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ECKM 2023



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ECKM Preface

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

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

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

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

We hope you enjoy the conference.

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

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Brazil; Walter Vesperi, Università degli Studi di Messina, Italy; Ass. Prof. Tone Vold, Inland Norway University of Applied Sciences, Business School, Norway; Vilma Vuori, Ramboll Finland, Finland; Dr Dariusz Wielgórka, Czestochowa University of Technology, Poland; 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; Prof Krzysztof Zieba, Gdansk University of Technology, Poland; Dr Inga Zilinskiene, Mykolas Romeris University, Lithuania; Dr Zbigniew Zontek, University of Bielsko-Biala, Poland; Dr Justyna Żywiołek, Czestochowa University of Technology, Poland;

BIOGRAPHIES

Conference and Programme Chairs



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



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

Keynote Speakers



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



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



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

Mini Track Chairs



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



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



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



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



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



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



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



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



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



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



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



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



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



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



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

Biographies of Contributing Authors

Zabeda Abdul Hamid is attached to the Department of Business Administration, Faculty of Economics and Management Sciences, International Islamic University Malaysia. She has a degree in Psychology and a Masters and Ph.D. in Human Resource Management. Zabeda teaches, supervises, and publishes in the areas of Knowledge Management, Organisational Behaviour, Management, and Talent Development.

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

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

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

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

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

Guilherme Agnolin. Master's student in the Graduate Program in Engineering and Management of the Knowledge of the Federal University of Santa Catarina. Graduated in Chemical Engineering and MBA in Project Management. Has a course in Innovation, Entrepreneurship, and Marketing. Acts as a project manager at the SESI Innovation Center in Health Technologies.

Geeta Albert is a consultant attached in MIDF, Malaysia. She received her PhD in knowledge management from the Taylor's University (Malaysia). She has been implementing knowledge management systems and services since 2007 and has been involved in organising KM Conferences since 2014. Her main research area is cultivating virtual knowledge sharing communities in organisations.

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.

Sawasn Jawad Al-Husseini assistant professor (Middle Technical University, Institute of Administration Rusafa, Baghdad, Iraq). Received her PhD degree in management information systems from Plymouth University, School of Management, Plymouth, UK. Publications are related to innovation, leadership style, knowledge management, knowledge sharing, and intellectual capital, she has many papers published at national and international journals and conferences.

Ali Mehanna Al-Naimi is a PhD student at Henley Business School, UK. He received his Master's in Human Resources Management and Training from University of Leicester in 2021. He received his Bachelor in Computer Hardware and Software engineering from Coventry University in 2016. His main research areas are tacit knowledge, Implicit knowledge and digital transformation

Huda Almutiari is a PhD candidate in Information Studies at the School of Humanities, University of Glasgow. Her research interests are in knowledge management and knowledge sharing.

Jorge Antunes obtained a bachelor's degree in modern and contemporary history, and a master's degree in science, innovation, and society, obtained at ISCTE-IUL. He also holds a postgraduate diploma in science and technology management and policies from NOVA University of Lisbon. Currently, Jorge Antunes is a R&D project director at COIN – Innovation Consulting.

Nekane Aramburu, D.Sc. (Econ. & Bus. Adm.). Associate Professor and the Head of the Departmental area of Strategy and Information Systems at Deusto Business School (DBS, University of Deusto, Spain). She specializes in Business Organization, Organizational Learning, Knowledge Management, and Innovation. She has been the Director of the Master's Degree in Competitiveness and Innovation at DBS.

Matheus Argôlo received his B.Sc. in Electronics and Computer Engineering from the Universidade Federal do Rio de Janeiro in 2021. He is an M.Sc. student in Systems Engineering and Computing at 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 2nd year PhD student at the University of Pardubice, Czech Republic. He received his master's in Business Administration and Leadership and management in Education from the KNUST, Ghana, and the University of Newcastle, Australia respectively both in 2014. His main research areas are knowledge production function and innovation.

Nuno Baptista received his Phd in Marketing and Strategy from Universidade da Beira Interior, Portugal. He is an Adjunct Professor at Escola Superior de Comunicação Social from the Instituto Politécnico de Lisboa, an Auxiliary Professor at Universidade Lusíada, and an integrated researcher at NECE-UBI. His research interests include business strategy and social marketing.

Michael Bell is the Chief Knowledge Officer (CKO) for the John F. Kennedy Space Center (KSC) and serves as the Program Manager for NASA's Lessons Learned Information System (LLIS) promoting and facilitating knowledge collection and knowledge sharing. He previously worked in the electronics manufacturing industry as an industrial engineer designing and managing factory layout projects.

Insaf Ben Ghanem: recently graduated as a doctor in management from the Higher School of Economics and Commerce, Tunisia.

Lamiae Benhayoun, PhD is Associate Professor in Management Information Systems at Rabat Business School - Morocco. She is head of the eLearning department and of the Master in Business Analytics. Her research focuses on emerging technologies, knowledge management, operational excellence, and innovation networks, and was published in highly recognized peer-reviewed journals in technology management.

Marco Berardi is a post-doc researcher at "G.d'Annunzio" University. 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.

Jorge Betancur has been a researcher and professor of administration at the IUE, Faculty of Business Sciences, since 2007. His work has focused especially on the productive fabric of the region, especially SMEs, on the study and design of management models and on the transfer of knowledge from the University to companies.

Dr. 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, Local project leader – EU Knowman project.

Manfred Bornemann is a management consultant and academic teacher. His work focuses on change management, organizational development, knowledge management, and intellectual capital reporting He is the author of two textbooks, numerous book chapters and reviewed articles, together more than 100. He serves as co-chair for KMGN, BVBW and GfWM.

Constantin Bratianu is professor of *Strategic Management* and *Knowledge Management*, Bucharest University of Economic Studies, Romania. He is the President of the International Association for Knowledge Management. He is founding editor of *Management Dynamics in the Knowledge Economy*. His academic interests are: knowledge dynamics, knowledge management, knowledge strategies, and strategic management.

Karl Joachim Breunig is a Full Professor of Strategic Management at the Oslo Business School– OsloMet, where he is heading the research group on Digital Innovation and Strategic Competence in Organizations (DISCO) and PhD program BIG (Business administration, Innovation and Governance). His research concentrates on the interception of strategy- and innovation theory.

Magdalena Bsoul-Kopowska, PhD in political science in the field of security, associate professor at the Częstochowa University of Technology. Her research and academic interests focus on the management of public institutions, security management, and human capital management. Magdalena Bsoul-Kopowska is an author of publications in the fields of management, security, and political science.

Felicjan Bylok is an Full Professor of sociology. He is the head of the Department of Sociology, Psychology and Communication of 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.

D.Sc. Sladjana Cabrilo is a Professor at I-Shou University in Taiwan. She holds a PhD degree in Industrial Engineering and Engineering Management from the University of Novi Sad, Serbia. Sladjana's research focuses on intellectual capital, knowledge management, innovation, business performance, and digital transformation.

Maria do Rosário Cabrita holds a PhD. in Business Administration. She is an Associate Professor and Senior Researcher at the Nova University, Lisbon. Mainly focused on intellectual capital and knowledge management, she has developed research with an impact on several scientific publications. She is a co-author of the book Entrepreneurial Excellence in the Knowledge Economy.

Delio Ignacio Castaneda *PhD. en Organizational Behavior, with an emphasis in Knowledge Management from Universidad Autonoma de Madrid, and Master in Education with emphasis in Organizations from Manchester University in UK. Now, Full Professor in the Business Department of Pontificia Universidad Javeriana in Bogota, Colombia, and invited professor in several universities.*

J**uan Gabriel Cegarra-Navarro** is currently a Full Professor with the Technical University of Cartagena, Cartagena, Spain. He also serves as an Associate Editor and Regional Editorial for several flagship journals, including Knowledge and Process Management and Journal of Knowledge Management. His research interests include knowledge management, technology transfer, innovation, and technology management.

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 (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). Primary area of research interest is information and personal data security management, recently application of Artificial Intelligence in this area.

Leszek Cichobłaziński: Assistant Professor (Human Resources Management and Negotiation, Management Faculty, 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. The educational background of Leszek Cichobłaziński is in Sociology.

Simone Cifolelli is a PhD student in "Accounting, Management and Business Economics", Department of Management and Business Administration, "G. d'Annunzio" University, 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.

Clara Cubillas-Para is a PhD student at the Technical University of Cartagena, Spain. Currently, she is working as a pre-doctoral researcher at this university with a contract funded by the Ministry of Universities of the Spanish Government in the Department of Business Economics within the areas of business organisation and marketing.

Carla Curado is an Associate Professor at ISEG, Universidade de Lisboa, Portugal. Her research addresses Knowledge Management, Human Resource Management and Organizational Behavior. Carla has been regularly presenting her work in leading international conferences and her research appears in numerous top journals. She is part of Stanford's List of World's Top 2% Scientists 2022.

Mónica D'Orey is a professor of accounting, at Polytechnic of Porto, Portugal. She is a PhD student in accounting, at Aveiro University, Portugal. She began her career in 1995 as an Auditor in a Big-4, is currently a Chartered Accountant. Her current areas of research interest are, international accounting, earnings management, and goodwill.

Yannick Dassen (M.Sc.) is research assistant at the Laboratory for Machine Tools and Production Engineering (WZL) at RWTH Aachen University in Germany. Since 2019 he is working in the group for automation and control and his main research areas are human-machine-interaction and worker assistance systems.

Jort de Vries (MSC) works as a PhD researcher at the University of Groningen, Netherlands and as a junior researcher at Deltares. He is trained in environmental planning and political sciences and his main research areas are Marine Spatial Planning and Knowledge Management in offshore wind farm policy and development.

Laura Di Chiacchio is a PhD researcher at Coventry University in cotutelle with the UPCT in Spain, in Data, information and knowledge management: driving effective environmental management practices. Recipient of the 2020 Ede and Ravenscroft Award for Academic Excellence at Coventry University.

Denys Dmytrenko: PhD student (Regional and Public Economics, University of Pardubice, Czech Republic). Received his master's diploma in Geoinformatics (University of Tartu, Estonia, 2020). Currently has one accepted

paper of his co-authorship (to Q1 journal), and two papers in review in other scientific journals. Main research areas are environmental economics, sustainable development and innovation ecosystems.

Senka Drobac is a postdoc researcher at Aalto University, Department of Computer Science. She earned her Ph.D. in 2020 at the University of Helsinki. Currently, she is working on transformations of raw data into Linked Open Data. Her interests are computational methods for cultural heritage, with methods including Natural Language Processing and Machine Learning.

Decebal Dumitrescu is second year PhD student, *Economics, Bucharest University of Economic Studies*. He has over 20 years of practical experience in finance, audit and business restructuring. He worked for a number of multinationals. His thesis focuses on restructuring Romanian SME's affected by the economic crisis, He works as a business consultant in transactional services.

Roberta Dutra de Andrade, PhD Student Management professor at Federal University of Ceará and Unicatólica de Quixadá, also lectures at University of Beira Interior. Junior researcher at NECE-UBI and FCT Portugal fellowship holder. PhD student at University of Beira Interior with interest in entrepreneurship and knowledge management in entrepreneurial ecosystems.

Anna Dvorakova graduated in 2021 with a Master's degree in Economics and Management from the Faculty of Economics and Administration at the University of Pardubice. Now she is studying for her PhD and her research areas are performance measurement and management system, corporate culture.

Robert Egel is a research associate at RIF e.V.. Before that, he worked as a quality engineer at a company in the automotive industry. His research interests are in the field of plant design, virtual commissioning and quality management.

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.

Monika Eisenbardt is an assistant professor at the University of Economics in Katowice, Poland. She is interested in information systems as well as the changes and challenges that modern consumers face. Currently, her research focuses on ICT applications, knowledge sharing, issues related to consumers, ICT, and knowledge, data visualization, and cryptocurrencies..

Celal Erdogdu is a PhD candidate in the Department of Business Administration at the ISMA University of Applied Sciences in Latvia. He is writing his PhD and works as a real estate valuer. His research focuses on the housing market, home price changes, affordibility, gas station valuation, and hotel valuation.

G. Scott Erickson. Scott 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.

Madeleine C. Fombad is a full Professor in the Department of Information Science at the University of South Africa (UNISA). She holds a PhD with specialisation knowledge management from the University of Pretoria South Africa. Her broad research interest lies in knowledge management for sustainable development and knowledge management education

Joanna Gajda: Doctor of humanities. Since 1995, she has been working at the Częstochowa University of Technology, actively participates in teaching activities – preparing for the teaching profession. Scientific and research interests focus on the issues of human resources management. In 2017, she was awarded the prestigious Award of the National Education Commission for outstanding achievements in the field of education.

Alexeis Garcia-Perez is a Professor of Management Information Systems at Coventry University (UK) and Visiting Research Scholar at Georgetown University (USA). His socio-technical understanding of Information Systems has enabled Alexeis's efforts to address the wider challenges of data, information, and knowledge management in business and society.

Ing. Mohammed Ibrahim Gariba is a third 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, Circular economy and as well as regional disparities and income inequality.

Dilyan Georgiev is a PhD student at Sofia University "St. Kliment Ohridski" with 6 years of experience in Software Engineering. With a Master's degree in Technologies for Knowledge and Innovations and a diverse professional background, Dilyan applies his expertise to offer a broader perspective on how KM methods and techniques can improve software processes.

Eduardo Giugliani. Full Professor at the Polytechnic School of the Pontifical Catholic University of Rio Grande do Sul, PUCRS, Brazil. Director of IDEIA – Support Center for Scientific and Technological Development, PUCRS. Postdoctoral and Distinguished Fellow at Fondazione Bruno Kessler (FBK), Trento, Italy. Ph.D. in Knowledge Management from the Federal University of Santa Catarina, Brazil.

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

Martyna Gonsiorowska is a Ph.D. candidate in Management and Quality Studies at the Gdansk University of Technology. Her research interests are in knowledge management, knowledge risk management, and employee well-being.

Magdalena Graczyk-Kucharska, PhD, Eng. took part in several domestic and international projects, including international internships at the University of California, Berkeley and Matej Bel University. Her scientific and research work area focuses on competence management for knowledge management and development of green organizations. Author of many foreign and domestic publications. Nr ORCID 0000-0002-4241-8216

Adriana Coutinho Gradim is a Business and Economics PhD Student at the University of Aveiro, in the specialization of management. Her research interests focus on knowledge management, human resource management, marketing and international mobility. Currently, she is funded by a doctoral scholarship granted by FCT.

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

Fernanda Guimarães is a doctoral student in Engineering and Knowledge Management at UFSC. She holds a degree in Law and Administration, a specialization in People Management, a specialization in Public Law and a Professional Master's Degree in University Administration from UFSC. She is currently participates in Sustainable Commons Co-Production and CEURS Program projects.

Alexandra Luciana Guță is teaching various disciplines of Management, including Knowledge Management; Organizational Strategy and Human Resources Management. She is passionate about the field of Knowledge Management, with a focus on research subjects such as: organizational learning; knowledge risks related to knowledge processes.

Stephen J. Hall is a PhD candidate at the Department of Computer Science at Middlesex University London and a lecturer in advanced data networks. Since 2004, his engagement with micro-enterprise has focused on increasing competitiveness through lean information systems. His research interests are Knowledge Engineering, Data Management, Artificial Intelligence, Organizational Learning and Micro Enterprise.

Rawâa Hammami Nationality: Tunisian. Institution: University of Sfax : Faculty of Economics and Management Academic level: Doctor on Management.

Irina-Emily Hansen is a researcher at the Norwegian University of Science and Technology. She holds a PhD in Knowledge Management of Industry-Academia Collaboration and a MSc in Product and System Design. Her research interests are knowledge management, industry-academia collaboration, innovation and entrepreneurship, Lean production, Industry 4.0 and Industry 5.0.

Ikramul Hasan: Assistant Professor of HRM (Independent University, Bangladesh). Received his PhD in Management (Concentration on Knowledge Management, University Brunei Darussalam, 2015). He is an editor of the Independent Business Review and has been involved in organizing international conferences. His main research areas are Knowledge Management, Organizational Effectiveness, and HRM.

Tareq Nael Hashem Assistant Professor at Petra University (1/2/2007- 31/8/2007) ,Assistant Professor in Philadelphia University (2/9/2007- 12/9/2012) ,Associate Professor in Philadelphia University (13/9/2012- 31/8/2014) ,Associate Professor in Isra University- Jordan (16/9/2014- 4/7/2022) and he was Head of Marketing Department in Isra University from(10/2019-10/2020), Full Professor in Isra University- Jordan (4/7/2022- up to now).

Ing. Nikola Hausmannová is a first year PhD student at the Faculty of Administrative and Economic Sciences, University of Pardubice. Her main area of research is the Role of Responsible Leadership in Innovative Management.

Paulo Lopes Henriques is a Professor of Organizational Behavior and Human Resources Management at the ISEG, School Economics & Management at Universidade de Lisboa. His research and forthcoming publication explores several themes of organizational behavior such as ethics, trust, mentoring, knowledge management and human resources practices.

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, including DX strategy, to various Japanese companies.

Ike Hlongwane is a senior lecturer in KM field from undergraduate to postgraduate levels in the Department of Information science at the University of South Africa (UNISA), Pretoria, South Africa. He is also a supervisor for masters and doctoral students specialising in KM projects. He has presented papers at several local and international conferences.

Chaima Hmida, 1st Year PhD student in Management Sciences and Business Administration at the University of Pannonia in Veszprém, Hungary. I have taught Human Resource Management course, meanwhile working of my research topic: Digital readiness in the era of industry 4.0 in Tunisia. Specialized in the fields of knowledge management, social media and digitalization.

Henri Hussinki, D.Sc. (Bus. Adm. & Economics), is an Assistant Professor of Business Analytics at the Business School, LUT University, Finland. His research and teaching focus on business analytics business value. His research has been published in journals such as the Journal of Business Models, Journal of Knowledge Management, and Journal of Intellectual Capital.

Eli Hustad is a Professor at the Department of Information Systems, University of Agder, Norway, with a research focus on knowledge management, agile system development, digital transformation, digital inclusion, and socio-technical aspects of large-scale information systems implementation. Her scholarly contributions have been disseminated at various esteemed international conferences and published in several reputable journals.

Nor Takrim Ibrahim has a Masters in Knowledge Management and a Degree in Library Management from University Teknologi MARA, Malaysia. She has vast experience in implementing knowledge management systems and facilitating workshops. Her focus in assessing organisational knowledge assets gives her significant strength in capturing, organising, and analysing digital content.

Michał Igielski is a research and teaching employee at Gdynia Maritime University. He received his PhD in management sciences from University of Gdańsk in 2011. He has been working at Pomeranian universities: specialization - entrepreneurship, project and HRM. Additionally, He is a coordinator of EU projects and an advisor in companies from the BSR.

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 professor in design management at BI. Ph.D. in design management from BI. Publications within art, innovation and design management.

William Miguel Jiménez Rivera has an economist from the National University Federico Villarreal, Peru, and a master's degree in economics with a mention in finance from the National University of San Marcos, Peru. A university professor, he has researched and published on the Peruvian financial system, industrial organization, and public economics issues.

Giedrius Jucevicius is Head of Research and Professor at the Faculty of Economics and Management, Vytautas Magnus University. Research interests: inter-organizational relations, comparative management, trust, innovation ecosystems. He was a visiting researcher at EUI (Italy), University of Lausanne (Switzerland), University of Cambridge (UK), is EU expert in the fields of innovation and entrepreneurship.

Jaime Miranda Junior. PhD student in the Engineering and Knowledge Management Program at UFSC, Brazil, holds a master's degree in Computer Science from the Federal University of Pernambuco, and a degree in Computer Engineering from the University of Vale do Itajaí. They have experience in software development processes, knowledge engineering tools, and programming languages.

Alexander Kaiser is professor at the Vienna University of Economics and Business and heads the Knowledge Management group. His research interests are knowledge-based management, systemic coaching and vision development and enhanced learning theories.

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 consumption, human capital management, and organizational behaviour.

Kathrin Kirchner is an Associate Professor at the Technical University of Denmark. Her research focuses on the influence of new digital technologies (e.g., Virtual Reality, Artificial Intelligence) on knowledge work and employees' well-being. She is co-editor of the International Journal of Workplace Health Management.

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.

Omar Khalil is a professor of information systems at Kuwait University. He has a PhD in information systems from the University of North Texas, USA. Held different academic and administrative appointments at Egyptian and American universities. Has been professionally active in several professional associations. Has more than a hundred publications, and his research interests include information systems effectiveness, knowledge management, and information ethics.

Neilya Khibina works as a senior researcher at the Center for Social and Gender Studies of the Kazakh National Women's Teacher Training University. Neilya Khibina started her professional career as a teacher in higher educational institutions of Kazakhstan. Her research interests include law, gender Studies, social and humanitarian studies, and research methodology.

Nasrullah Khilji is an Associate Professor, Portfolio Leader for Academic Partnerships and Course Director for MSc DTSS at the University of West London, School of Computing and Engineering. He has extensive knowledge of KM, MIS; project management; business operations, strategies and systems; technological innovations; leadership and team dynamics in a variety of settings.

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

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.

Paweł Kobis. Researcher and teacher(Department of Information Management Systems, Faculty of Management of the Częstochowa University of Technology in Poland. Author, co-author and scientific editor of over 100 papers published in scientific journals, monographs and conference materials. Interests: information security management, human factor in information security, management of enterprise information resources using IT.

Patrycja Kokot-Stępień is a graduate of the Częstochowa University of Technology and the University of Economics in Katowice (Poland). Her research interests focus on management processes with particular emphasis on innovative activities and business financing. She works at the Częstochowa University of Technology.

Edit Kővári: Professor of human resource management (University of Veszprém, Hungary). Received her PhD in emotional intelligence (University of Derby, UK). Edit the National Emotional Intelligence Coordinator for Hungary at the International Society for Emotional Intelligence .Secretary of the University Networks of European Capitals of Culture. She has outstanding publications, organized several international conferences.

Florian Kragulj is a senior scientist at the WU Vienna University of Economics and Business. His research is on organizational learning and KM, emphasizing its social nature and strategic future potential. He is particularly interested in an ethical perspective on knowledge management to illuminate its implications for doing well by doing good.

Patrycja Krawczyk graduated from the Częstochowa University of Technology 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.

Ali Krubally, a Gambian national, is currently pursuing a Ph.D. in Business Administration at Osaka University. He completed his Master's in Business Administration at the same university in 2021. In 2018, Ali came to Japan under the prestigious MEXT Scholarship. Prior to that, he obtained a Bachelor's in Business Administration from Institut Africain de Management (IAM) in Senegal.

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 62 peer-reviewed studies published with Wiley, Springer, Taylor & Francis, Emerald, Elsevier, IGI Global, and Routledge. She is a reviewer for international journals (54 confirmed by Publons), National Polish Science Center (NCN), and the US Fulbright Program. Wioleta Kucharska was recently involved in such topics as tacit knowledge, personal branding of knowledge workers, 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.

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, and 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.

Rosaria Lagrutta is a PhD student at the University of Basilicata, Italy. She is actually involved in a research project concerning the assessment and management of learning spaces supported by 4.0 technologies. Her research interests focus mainly on knowledge management, digital transformation, 4.0 industry, assessment and valorization of intangible resources and innovation management.

Harri Laihonen is a Professor of Health and Social Management at the University of Eastern Finland. He has specialized in knowledge management and performance management. Professor Laihonen is interested in improving understanding of organizational performance in different organizational settings and designing knowledge and performance management systems for public sector organizations, networks, and service systems.

Ophillia Ledimo has a PhD in Industrial and Organisational Psychology and is currently Full Professor and Head of Teaching and Learner Support at the University of South Africa. Her field of specialisation are Wellness, Assessments and Organisational Psychology. She has published in journals and presented papers at conferences within this field at national and international levels.

Małgorzata Łęgowik-Małolepsza defended her doctoral thesis on the topic: "Decision-making models of organisational and financial processes in cement industry companies".She has been working as an assistant professor at the Faculty of Management, Częstochowa University of Technology. Her scientific and research activity is contained in more than 50 publications published at home and abroad.

Sylwia Łęgowik-Świącik, prof. PCz is a researcher at the Faculty of Management at the Częstochowa University of Technology. She worked in units of the public finance sector and in enterprises. She focuses her scientific interests on the issues of intellectual capital and business models in enterprise management. Scientific and research activity is included in over one hundred published publications.

Anna Lemańska-Majdzik, PH.D. works at Faculty of Management, Czestochowa University of Technology, Poland. She is an author of over 160 scientific papers/monographs. She was a supervisor of over 130 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.

Ane Linden is a professor of Medicine and Nursing at UNISINOS University, Brazil. She received her PhD in Management from Universidade do Vale dos Sinos University, and Instituto Superior de Economia e Gestão from

Lisbon University, Portugal. Her main research areas are Knowledge management, Practice based learning and Healthcare management.

Ewa Lipianin-Zontek, Phd, lecturer, scientist at the University of Bielsko-Biala, working on research into tourism management, knowledge management and social organizations. She has conducted guest lectures in several countries: Turkey, Italy, Germany, the Czech Republic and Slovakia. Currently, she is working also as a business and NGOs consultant and member of the tourism promotional organization in Bielsko-Biala.

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.

Elaine C. Long is a business psychologist, wellness consultant, researcher, author, and adjunct faculty at The Chicago School of Professional Psychology. She earned a Ph.D. with distinction from TCSPP and an MBA from Northwestern University. She is a scholar-practitioner of organizational practices focusing on Faith-at-Work, workplace spirituality, and positive psychology that leads to human flourishing.

Joachim Lorenz is a Ph.D. student at the Universitat Politècnica de València. His main research area is knowledge management.

Stefania Mariano is an Associate Professor of Management at the American University of Sharjah, UAE. She received her PhD from the University of Molise (Italy) in 2006. Her main research areas are knowledge dynamics in organizations, knowledge management, organizational knowledge, and behavioral knowledge.

Antonieta Martínez-Velasco is a Research Professor in the School of Engineering at Universidad Panamericana, Mexico. She is a Mexican National System of Researchers (CONACYT) member. She has a Ph.D. in Engineering from the Universidad Panamericana. Her area of specialization is Artificial Intelligence applied to Engineering, Health Sciences, and Social Sciences.

Aurora Martínez-Martinez is an Associate Professor in the Department of Business Administration at the Universidad Politécnica de Cartagena. Originally a CFO, she joined academia after completing her Ph.D. in 2011. She is a member of the International Association for Knowledge Management (IAKM). Her research is focused on knowledge management, organizational learning, and sustainability.

Lucía Martín-Montes works at the University of Jaén, in the Department of Business Organization. She is pursuing her Phd, specializing in the non-profit sector. She has a degree in Law, a degree in Business Administration and Management, and a master's degree in teaching. She has worked in banking and as a political adviser.

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 Human Resources Management.

Ghorbani Maryam is a Master's student pursuing industrial engineering at Isfahan University of Technology (IUT) in Iran. She has already attained her bachelor's degree in the same field from IUT in the year 2022. Her research interests are focused on sustainability and its impact on knowledge management, business, energy consumption, and innovation.

Anastasiia Mikhlina (BBA) is an Education Coordinator at the School of Business at Jamk University of Applied Sciences in Jyväskylä, Finland. Mikhlina works in Global Education Export. Her main research areas are human resource management, human capital management, and future foresight.

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.

Edwin K. Morris is the president and founder of Pioneer Knowledge Services (PKS), a non-profit organization with a charitable knowledge management purpose. He earned the Thomas J. Froehlich Award from Kent State in 2013 recognizing academic excellence and promise for leadership in the field of information architecture and knowledge management.

Peter Mozelius is an Associate Professor and Researcher, working at Department of Communication, Quality Management and Information Systems at the Mid Sweden University in Östersund, Sweden. Research interests are in the areas of Technology enhanced learning, Lifelong learning, Game-based learning, and Programming education.

Justyna Maria Myszak, PhD, is Assistant Professor of the Institute of Management, University of Szczecin, Poland. Her main research interests are carried out in two areas. The first is related to business management and includes issues: knowledge management, knowledge sharing, knowledge transfer, organizational culture. The second revolves around logistics, smart industry, industry 4.0, Lean Manufacturing.

Donovan Nadison is management consultant, owner-manager of New Africa Consulting, worked for Oxford University and Deloitte Consulting. He is a master's degree graduate from the Wits University in South Africa, was a US Fulbright Scholar, now a Teesside University doctoral candidate in the UK. His research interest are in knowledge management and public sector reform.

John Natividad has served the Philippine Normal University for almost 19 years now in various capacities. He was assigned as Faculty of Information and Communications Technology and Educational Technology, Online Learning Facilitator, Director of the Management Information System, and Data Protection Officer. At present, he is the Director of Facilities Management and Sustainability Services.

Andrei Ștefan Neștian has published in the area of Knowledge management, Human Resource Management and Performance Management. As teacher, he lectures in Human Resource Management, Competency and talent management, Quality Management and Organizational performance. He also has 17 years of experience as a management consultant and trainer.

Carla Neves, PhD student in Management (University of Beira Interior). She has a master's degree in Human Resource Management. Additionally, she works full time in Consultua – Ensino e Formação Profissional, where she coordinates training projects. Besides, she teaches at IPB the Curricular Unit "Psychosociology of Organizations" of the bachelor's degree in Management and in Accounting. https://orcid.org/0000-0003-2527-799X

Anna-Maija Nisula, D.Sc. (Econ. & Bus. Admin.) is an Associate Professor in Knowledge Management at the LUT Business School, Finland. Her research interests are in knowledge management, creativity and knowledge work. Her research has been published, in the Int. Jour. of Project Management, Digital Creativity, CIM, Int. Jour. of Human Resource Management, and Journal of Business Research.

Nóra Obernater, PhD is a habil. associate professor, Head of Department of Management at the University of Pannonia in Veszprém, Hungary. She has taught a variety of management master courses, including Strategic Human Resource Management, Strategic Management, Intercultural Management, and Knowledge Management. Her research fields focus on knowledge management, social media, digitalisation, and national cultures.

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.

Johan Olaisen is professor in knowledge management at BI Norwegian Business School. Ph.D. in KM from School of I, UC Berkeley. Publications within KM, innovation, strategy, and leadership

Mírian Oliveira is a Professor and researcher at Business School, Pontifícia Universidade Católica do Rio Grande do Sul (PUCRS), Brazil, and invited professor and member of Advance/CSG at Lisbon School of Economics and

Management, Universidade de Lisboa, Portugal. She obtained her doctoral degree in 1999. Her research interests include Knowledge Management, Knowledge Sharing, and Knowledge Hiding.

Victoria Yousra Ourzik (M. Res.): Lecturer and doctoral candidate (University of Paris Dauphine PSL). Teaches Marketing Management and Market Research. Extensive experience in both academia and industry, has worked in marketing and sales roles, most recently as a Consultant for Expedia Group in the travel tech industry. Expertise in the areas of big data, digital marketing, and firm performance.

Edmund Pawlowski, Institute of Engineering Management, Poznan University of Technology.

Anne Pedersen is a Ph.D. Candidate at DTU Management at the Technical University of Denmark. She has a master's degree in Learning and innovative Change from Aalborg University. Her Ph.D. is about virtual collaboration in hybrid work, and is particularly interested in how organizations enhance capabilities for Knowledge Management and organizational learning.

Gandhirajan Periyaswamy (**Peru**) has 24 years of experience in delivering customer experience through IT solutions. Expert in Data and Knowledge management, Peru has delivered solutions for major BFSI customers across world. Product owner for multiple TCS IP solutions, Peru played key role in building AKB capabilities and rolling out to customers.

Gabriel Pestana is a professor at Polytechnic University of Setubal, and a senior researcher at UNIDCOM/IADE. Holds a PhD in Information Systems from the Technical University of Lisbon and specialises in knowledge management and collaborative decision-making platforms. His research focuses on data governance workflows and visual analytics models to support intelligent business process automation.

Adrian Petre is a PhD student at the Bucharest University of Economic Studies, Romania. His main research areas are related to business administration, new economic models, knowledge economy, green economy, sustainability and risk management.

Osvaldo Peuyadi is a PhD student, expected to end his thesis on Sustainable Banking in 2022 at Universidade Europeia, with my supervision. He has a long standing interest in Ethics. He made is graduation in Philosophy.

Malefetjane Phineas Phaladi, PhD in Information Science, is the Director of Library Services and affiliated to the Department of Information Systems in the Faculty of Accounting and Informatics at the Durban University of Technology in South Africa. His research interests cover knowledge management, human resource management, organisational culture and design, leadership, strategy and management.

Luiza Piersiala is a assistance professor of social sciences in the discipline of management and quality sciences at Częstochowa University of Technology, Poland. She received his PhD in social sciences from CUT in 2017. Her main research areas are international management and entrepreneurship, innovations, special economic zones.

Margarida Piteira is professor at Lisbon Accounting and Business School (ISCAL, Portugal) and has a Ph. D. in Economics and Organizational Sociology (ISEG/ University of Lisbon). Researcher at Socius (Research Centre in Economics and Organizational Sociology). Her research areas are innovation, creativity and human resources management.

RAQUEL PUENTES-POYATOS. PhD in Economics and Business Administration (UNED). Official Master's Degree in Sustainability and Corporate Social Responsibility (UNED). Professor of University, University of Jaén. My lines of research are focused on Corporate Social Responsibility, Human Resources Management and Social Economy Enterprises, with a special focus on the olive oil sector

Mahesh Chandra Puvvada (**Mahesh**) has 23+ years of IT experience across sales, consulting, solution architecture and implementation services. As the head of transformation for UK & Europe geographies, Mahesh has been instrumental in providing solutions that improved operational excellence and customer experience across different customers.

Mariza Motta Queiroz is an economist with more than 30 years of experience in a public transport operator. She has also a PhD in Transportation Systems (IST). She is an Invited Professor at ISCTE and a member of U-Shift Lab at IST. Certified in Project Management and in Product Owner.

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.

Marcin Relich is a researcher at the Faculty of Economics and Management, University of Zielona Góra. His research interests include knowledge management, knowledge acquisition, management information systems, decision support systems, business intelligence, and sustainability in the aspect of new product development, product design, and product innovation.

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.

Raysa Rocha (PhD) is NECE-UBI Research Center Vice-Coordinator for Personal Development. She received her Ph.D. with distinction from UBI. She is a guest editor for the SI on Practical Wisdom in the JMSR and section editor of the Springer Encyclopedia of Diversity, Equity, Inclusion (DEI) and Spirituality under the section Spirituality, DEI, and KM. https://orcid.org/0000-0002-6542-1397

Hamid Roham has been a PhD student in management at the University of Lisboa, Portugal, since 2020. He received his DBA from the same institution in 2020. Hamid's educational background includes an MSc in biomedical engineering from the University of Technology Amir-Kabir, Iran. His research interests revolve around knowledge management and sharing.

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, ICTO, Irpsm.

Bernadete Rosa is an undergraduate in Electrical/Electronic Engineering and worked in the industry for 20 years. She is a Master of Biomedical Engineering and a Ph.D. student in Biomedical Engineering at UTFPR. She has MBA in Information and Communication Technology Management, and she is a professor of Intellectual Capital Security.

Aleksandra Rudawska, PhD, is Assistant Professor of the Institute of Management, University of Szczecin, Poland. Her main research interests revolve around knowledge sharing behaviour, knowledge management, organisational learning, organisational behaviour, human resource management. She is a principal investigator and participant in several national research projects.

Consuelo Ruiz-Rodríguez is Professor in Financial Economy and Accounting Department, Faculty of Social and Juridical Sciences of the University of Jaén. She completed her PhD at the University of Jaén in 2016 with Cum Laude. Nowadays, her research interests are focused in Intellectual Capital, Disclosure of Intangibles, Social Responsibility and its integration in Higher Education, Non-financial Information and Cooperatives. All this research is complemented by attendance at numerous international conferences and the publication in high impact journals.

Linda Ryan is an associate professor and director of Postgraduate Studies in the Department of Design Innovation in Maynooth University. Her Ph.D. is in the area of Product Service Systems, transitioning organisational culture from product to service-orientated. Her research interests include user-centred design, service innovation, culture transition and public sector reform.

Anna Rybak, PhD, is Assistant Professor at the University of Technology, 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.

Aleksandra Rzepecka: Adjunct of Faculty of management and leadership, General Tadeusz Kościuszko Military University of Land Forces, Wrocław, Poland,. PhD in the field of Social Sciences in the discipline of Management and Quality Sciences. Research interests: organizational culture, professional career, organization image, CSR.

Agnieszka Rzepka is a Professor at Lublin University of Technology in the Faculty of Management in the Department of Economics and Economic Management. She specializes in inter-organizational management, intellectual capital, self-management, and SMEs. Her current research is focused on teal organizations. In addition to 140 papers, she has written seven proprietary and collective monographs.

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 (University of Deusto, Spain). She also chairs the Academic Committee of the Doctorate Program on Business and Territorial Competitiveness, Innovation and Sustainability. Her research focuses on intellectual capital, knowledge management, and innovation.

Robert Sałek BEng, PhD, is an assistant professor at the Faculty of Management of the Czestochowa University of Technology in Poland. In 2012 doctoral degree in economics. Member of the Program Council and acts as an Innovation Broker, for contacts with business. He specializes in management sciences, knowledge management and production as well as logistics.

Sebastian Saniuk, Assoc. Prof. Dr Eng., is employed as a professor at the University of Zielona Góra. Since 2015 he is a member of the Committee of Production Engineering of the Polish Academy of Sciences. His research focuses on production management, Industry 4.0. The results of his research have been presented in over 220 scientific publications: journals, monographs and conference.

Stefano Scaglioni is working at the European Space Agency in Darmstadt, Germany. He covers the role of Product Assurance and Safety Manager, within the quality office of the ESA Operations directorate. His job consists in ensuring the quality of the space operations services (e.g. flying JUICE and EUCLID satellites) delivered to the customers.

Yee Yee Sein, Phd student who is studying at the University of Pardubice, in the Czech Republic. I have participated in 21st and 22nd European Conference on Knowledge Management ECKM. My main research areas are knowledge, innovation policy and regional development.

Denilson Sell is professor of Knowledge Engineering and Management at the Universidade Federal de Santa Catarina and at the Universidade do Estado de Santa Catarina (Brazil). He has led several research and development projects with public and private organizations. His most recent work focuses on Knowledge Engineering, Analytics, Digital Platforms, and Digital Transformation.

Daniel Silva is a PhD student in Management at the University of Beira Interior (UBI) and a researcher at the Research Group on Enterprise Science (NECE), with some studies already published. His research focuses on organizational psychology with a major focus on the study of personality traits in organizational context.

Philip W. Sisson is a retired Lockheed Martin Senior Program Manager, KM cross-division coordinator, and KM best practices track leader. Phil has degrees in mathematics, ORSA and economics, and computer information systems.

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.

Tiffany Smith is the NASA Chief Knowledge Officer and Director of NASA's Academy of Program/Project & Engineering Leadership. She is responsible for ensuring that the agency's technical workforce maintains the critical knowledge needed for mission success by providing learning and development opportunities, strategic communications, and knowledge services in collaboration with all NASA Centers.

Robert Smith graduated with a BSc in 1969 and has undertaken postgraduate studies in Education, Engineering and Law. He holds a PhD in engineering and is currently a PhD candidate in law at the University of New England, Australia and an international development consultant working in Southeast and South Asia.

Cristina Sousa has a degree in Business Science and a master's degree in management. She works as a research fellow in the R&D project ETEIA (Energy Transition Entrepreneurs), in which she develops her research in Entrepreneurship, and an Assistant Professor in the Department of Economics, Sociology and Management of the School of Human and Social Sciences, University of Trás-os-Montes e Alto Douro.

Juha Saukkonen holds a position of a Senior lecturer of Management at JAMK University of Applied Sciences in Finland. He has published on topics of Futures Foresight, Knowledge Management, Entrepreneurial Learning, and Education. He is a guest lecturer on these topics in various universities and organizations in Finland and abroad.

Maria José Sousa (PhD in Management with Habilitation in Management and Public Management) is Pro-Rector for the Development of Distance Education and a professor and a research fellow at ISCTE. Is the former Portuguese President of the ISO/TC 260 – Human Resources Management. She was/is the coordinator of several European projects of innovation.

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 international scientific conferences on Business Competences, on Trade Marketing, on Business Environment.

Claudia Spilotro is a Research fellow at the University LUM Giuseppe Degennaro (Bari, Italy). The research project she is working on is: "Data-driven Marketing for Apulian Aerospace SMEs". Her main research interests include digital transformation, digital marketing, technological innovation and business model innovation.

Christian Spletter is research associate and PhD candidate at the University of St. Gallen (MCM-HSG). He studied social sciences and psychology. His research interests include higher education contexts (e.g., Decision-Making and Knowledge Visualization).

Małgorzata Spychała, PhD, Eng. is an Assistant Professor at Poznan University of Technology. She specializes in managing the competences of employees and managers. She conducts research on improving incentive systems and improving communication in employee teams. Author of many foreign and domestic publications. Member of many design teams in Poland and abroad. ORCID 0000-0003-1471-5536

SS Sreejith is an Assistant Professor at the School of Management Studies, National Institute of Technology Calicut, Kerala, India. He completed his PhD from the Indian Institute of Science in Human Resource Management. His research interest includes individual and group behaviour, organizational sustainability, performance enhancement and productivity.

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.

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 101 items. The mainstream interests covers the area of accounting and related elements of business management.

Constantin Stoenescu, professor, Faculty of Philosophy, UNESCO Chair, University of Bucharest. Books (KM): *Theory of Knowledge. Topics-Texts-Bibliography* (co-author, 1999), *Knowledge Management* (co-author, 2007), *An Epistemological Perspective on Knowledge Management* (2011), *Epistemology and Knowledge Management* (editor, 2011), *Knowledge Management. Current Topics.* (editor, 2011). He also has published about 20 papers on knowledge management topics.

André Sucena, PhD student in management at the University of Beira Interior (UBI), Portugal. I have 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.

Marta-Christina Suciu is full professor, PhD supervisor, Economics 1 Doctoral School, Bucharest University of Economic Studies. She is also senior associate researcher at National Institute of Economics*, Romanian Academy* and corresponding member of *Romanian Academy of Scientists, Commission for Economics, Law and Sociology*. Her main research areas are: creative economy, KM, education.

Aleksandra Sus, Associate Professor, General Tadeusz Kościuszko Military University of Land Forces. Ph.D. Eng.

Sharifah Nur Izma Syed Izaddin has 25 years of experience in talent development, strategic communications, and management. Sharifah's career kicked off in the insurance industry, where she was involved in Public Relations for five years followed by a combined 15-year stint in financial services where she was responsible for multiple award-winning Corporate Sustainability and Responsibility projects.

Maciej Szafrański, PhD, Eng. is the author of nearly a hundred scientific publications, including monographs. His main research areas include competence management, quality management, marketing. He possesses more than 6 years of experience in the industry. Head and member of teams in many national and international projects. ORCID 0000-0002-4281-9845

Malvin Rivera Tabajen is an Associate Professor II at the Philippine Normal University (PNU). He is a candidate for the degree in Doctor of Philosophy in Knowledge Management at Bangkok University, Bangkok, Thailand. He has published articles and published research papers on knowledge management and ICT application.

Antonia Terán-Bustamante is a Senior Researcher and Professor at the School of Economics and Business Administration at the Universidad Panamericana and is a member of the Mexican National System of Researchers by CONACYT. She has a Ph.D. in Administration Sciences from Universidad Nacional Autonoma de México (UNAM). Her research is focused on Human Capital, Competitiveness, Innovation, and Entrepreneurship

Ilkka Tikanmäki MBA (Information Systems) is a Project Specialist in Safety, Security and Risk Management at Laurea University of Applied Sciences and a doctoral student of Operational art and tactics at the Finnish Defence University.

Eduardo Tomé made his PhD in Economics in 2001 addressing the Portuguese Experience of Human Resource Development investment using the European Social Fund. Since than he has taught in the Portuguese Universities, published a number of papers in refereed journals, attended conferences, organized conferences, written book chapters in addition to teaching at under-graduate, masters and PhD levels.

Philip Toland is a Commercial Manager for ESB in Ireland. He has 20 years' experience in the Construction industry with 16 of these years spent in the Civil Engineering, Quarrying and Road Construction industry where he previously worked as a contracts manager. He has a keen interest in renewable energy, sustainability and lean construction.

Jowita Trzcielinska: researcher (Faculty of Engineering and Management, Poznan University of Technology, Poland), employed there since 2008. Main research areas are entrepreneurship and the identification of market

opportunities by SMEs. Author of several scientific papers in this area and was involved in the organization of three conferences. She is also actively involved in university teaching.

Stefan Trzcieliński works at the Poznan University of Technology. He heads the Department of Management Systems. He is the chairman of the Organization and Management Sciences Committee at the Poznan branch of the Polish Academy of Sciences. He conducts research combining the issues of an agile enterprise, opportunity recognition, Industry 4.0 and the use of AI.

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.

Michał Trziszka was born in 1987 in Poznań (Poland). Since 2007, he has been the CEO of cal.pl providing hosting and cloud services. Assistant at the Faculty of Engineering Management at the Poznan University of Technology. Author of publications in the field of agile management and the use of cloud computing by enterprises.

Rebecca Tumwebaze is a Doctoral researcher at the Kemmy Business School, University of Limerick. Her research in Agriculture Knowledge Management, explores integration of different knowledge types and forms held by the diverse agriculture actors and how this knowledge can be leveraged to achieve a sustainable agriculture sector.

Remigiusz Tunowski: Assistant Professor at WSB Merito University in Gdańsk, Poland. Ph.D. in Economy and Finance, University of Life Sciences, Warsaw, Poland, 2019. Scientific publications in area of Business Intelligence. The author has practical experience in the field of BI systems. Since 2011 he has participated in practical implementations of this system in the USA and Poland.

Lina Užienė is an Associate Professor at the School of Economics and Business, Kaunas University of Technology, Lithuania. Her main scientific interests lie in intellectual capital management and national policy based on the management of intellectual resources. She is an author of several academic publications and a research manager focused on the impact of digital transformation.

José Vale is a professor at the Porto Accounting and Business School, Portugal, where he teaches several courses related to management accounting. He has a PhD in Management -Accounting and Management Control - from the Faculty of Economics, University of Porto. He is a member of the Porto Polytechnic's Centre for Organisational and Social Studies.

Gregório Varvakis - Mechanical Engineer from the Federal University of Rio Grande do Sul, Ph.D. in Manufacturing Engineering - Loughborough University of Technology. Professor at the Federal University of Santa Catarina, Department of Knowledge Engineering. Experience in administration, process management, knowledge management and service organization management. Researcher: innovation, knowledge management, productivity, continuous improvement, technology and information flow.

Namosha Veerasamy is a computer scientist in the field cyber security research and governance for over 15 years. She received her PhD from the University of Johannesburg. She is currently employed as a senior researcher at the Council for Scientific and Industrial Research (CSIR) in Pretoria. She also holds CISSP and CISM certifications.

Sathiskumar Venkataramani (**Sathish**) has 28+ years of experience across Sales, Pre-Sales, Consulting and delivery with a focus on Banking, Financial Services and Insurance customers. As the Global Head of BFSI Business Operations Transformation with a focus on Business Transformation enabled by Cognitive solutions, Sathish has been instrumental in providing strategic solutions to power customer's Growth & Transformation agenda

Mary Viterouli: teaching experience of over twenty years and is now also working as a Deputy Director at the Vocational Institute (DYPA, Chalkida). Scientific interests revolve around Strategic Management, Human Resources Management, Adult Education, Sociology and English Literature. Holds two Bachelor's Degrees, two Master's Degrees and is a PhD Candidate at the University of Thessaly, Greece.

José M. VIedma Marti. Doctor of Industrial Engineering, Graduate in Economics, and Emeritus Professor at the U.P.C., Barcelona, Spain. His current field of research and interest is focused on the strategic perspective of Knowledge Management, Intellectual Capital, and knowledge Based-Development and he has consulted and developed management frameworks and systems worldwide on those matters.

Tiziano Villa is a trainer and consultant in project management. PMP®, PMI-ACP®, PMI-DASSM®, SAFe® 6 Agilist. Founder of "the Project Management Lab®". Past Director of PMI® - NIC Northern Italy Chapter. Experiences as project manager and PMO coordinator. Professional activities in different industries, focused on knowledge management in projects, navigating complexity, agile development, organizational change management, benefits realization management.

Stefan Voigt is a researcher at Fraunhofer Institute for Factory Automation and Operation IFF. He received his doctoral degree in engineering at Otto-von-Guericke University Magdeburg in 2017. His main research areas are knowledge and information management, agile project management and digital transformation.

Tone Vold lectures at The Inland Norway University of Applied Sciences, Norway, in courses within Digitalization of Workforms in Organization 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.

Carl-Magnus von Behr is a doctoral researcher at the Institute for Manufacturing (IfM), University of Cambridge, investigating how to improve knowledge sharing among NHS Estates and Facilities Management departments. He holds an M.Phil. in Industrial Systems, Manufacture and Management from Cambridge and a B.Sc. in Industrial Engineering and Management from the Technical University Berlin, Germany.

Heleen Vreugdenhil (PhD) works as a senior researcher at both Deltares and Delft University of Technology in the field of Policy Analysis and particularly in innovation management. She is experienced both academically and practically in pilot projects and living labs in which through innovative policy-research interactions new knowledge is developed to support policy processes.

Anthony Wensley is an Emeritus Associate Professor at the Management Department at the University of Toronto Mississauga and the Rotman School of Management, University of Toronto. Professor Wensley's work focuses on the development and implementation of major enterprise systems. Professor Wensley is an active member of IAKM.

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.

Andrzej Wodecki. Associate professor at the Warsaw University of Technology, artificial intelligence, machine learning model value management, CausalML and MLOps. With more than 20 years of experience in enterprise IT systems implementations, he shares his experience with managers on prestigous MBA Programs.

Adrian Xavier was born in Singapore, moved to Australia in 2006 before joining the Royal Australian Air Force (RAAF) in 2010 as a Director (Aeronautical Engineer). Mr Xavier has a BEng (Hons) from the University of Bristol (UK), an MSc in Aeronautical Science from USA and a Masters in Systems Engineering from UNSW.

Joseph Zernik, PhD, is Research Director at Human Rights Alert NGO. The NGO promotes government transparency, particularly in e-gov systems, and investigates the effect of e-gov on Human Rights and democratic institutions.

Saliha Ziam is an Associate Professor at TELUQ University of Quebec. His research interests focus knowledge transfer in health sector, health assessment tools for decision support and knowledge absorptive capacity strategies. His recent works on knowledge transfer have been published in Allergy, Asthma & Clinical Immunology Journal and Evidence & Policy.

Ali Imran Zakaraia has 7 years of experience in Library Management, Knowledge Management and Talent Development. He is currently responsible for driving the company's Knowledge Management's strategy, governance structure, and roadmap to transform the Group into a digitally connected knowledge-based organization. He is also a Certified Practitioner in Knowledge Management issued by International Professional Managers Association.

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.

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.

Zbigniew Zontek, lecturer, 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 several countries: Turkey, Germany, Italy, 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 Creation Among Managers and Supervisors in Palm oil Estates in Malaysia

Zabeda Abdul Hamid, Shangkar Ganesh Chandiram and Rodrigue Ancelot Harvey Fontaine
International Islamic University Malaysia, Kuala Lumpur, Malaysia

zabeda@iium.edu.my
shangkarg@gmail.com
ridhwan_fontaine@iium.edu.my

Abstract: Knowledge of planting and seeding is critical to ensure the healthy growth of palm oil trees, maintaining efficient harvesting systems, and achieving quality products. However, there is a lack of studies in the palm oil industry on how knowledge is created within the managerial and supervisory staff of palm oil plantations that can enhance the workflow and output. This research conceptualises four knowledge creation tools; Socialisation, Externalisation, Combination, and Internalisation (SECI) based on Nonaka's Knowledge Spiral Theory. It is hoped the research can discover the knowledge creation tools most utilised among the Managers and Supervisory teams in palm oil estates in Malaysia who were the samples of this research. The findings of this research revealed that Socialisation and Combination significantly contributed to knowledge creation. However, Internalisation and Externalisation were not positively related to knowledge creation. When the data was analysed with moderating variables such as job category, upper management preferred using Socialisation tools while senior assistant or assistant managerial levels preferred Socialisation, Combination, and Internalisation. Furthermore, field supervisors or field conductor levels preferred utilising all four tools. As a result, Socialisation was identified as one of the major tools where there was a relationship with the three levels of job category. Therefore, plantation companies can develop relevant training programmes based on tacit-to-tacit conversion activities. The research data can be applied by plantation companies in Malaysia to implement appropriate training programmes for Managers, Assistant Managers, and Field Supervisors.

Keywords: Socialisation, Externalisation, Combination, Internalisation, Knowledge creation, SECI model

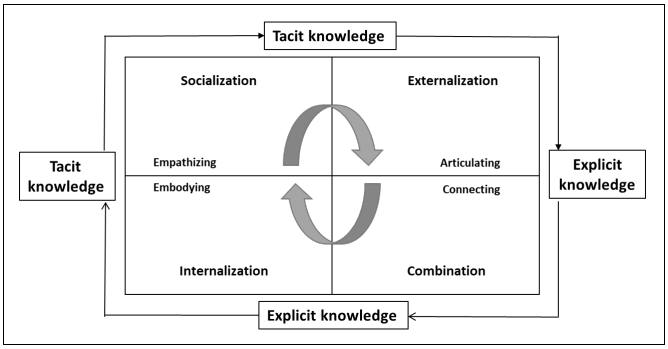
1. Introduction

Effective Knowledge Management (KM) needs a suitable combination of organisational and managerial initiatives and suitable information technologies. Malaysian palm oil plantations have been recognised as leaders in technology development and adoption. KM in the plantations started with the use of computerised inventory management systems. Subsequently, plantation companies applied KM to integrate various functions, including sourcing raw materials, production, and support activities (Kamarulzaman and Mohayidin, 2016). However, there is a gap in the Knowledge Creation process at palm oil plantations that need to be addressed. Therefore, this research focused on knowledge creation among Managers and Supervisors in palm oil estates in Malaysia as they are involved in managing the business.

1.1 Overview of Knowledge ManagemenT

Organisations are dynamic instead of static constructs (Nagpal, 2019) that change as people join and leave them over time. Furthermore, organisations also undergo diversification, merge with other organisations, and experience various changes. The dynamic nature of an organisation ensures that the knowledge accumulated or lost within an organisation is also dynamic (Botha et al., 2014). Hence, the people involved in KM must manage the knowledge created as staff continuously learn new knowledge. Additionally, they must identify new approaches to doing things and handle the loss of knowledge that gradually develops intellectual liabilities (Botha et al., 2014). As a field of study, KM has existed for more than 30 years and has moved to an essential component of organisational life from an academic theory (Girard and Girard, 2015).

The knowledge creation model was initiated by Nonaka in 1991. It is critical before a successful and effective knowledge transfer occurs. The model was then subsequently expanded in 1995 by Nonaka and Takeuchi (Li et al., 2018). The framework of the Socialisation, Externalisation, Combination, and Internalisation (SECI) knowledge creation model is shown in Figure 1. The model describes how tacit and explicit knowledge is created, transferred, and re-generated in an organisation.



(Source: Nonaka & Takeuchi, 1995; Nonaka & Teece, 2001)

Figure 1: The Framework of SECI Knowledge Creation

Tacit knowledge is also referred to as implicit knowledge and is defined as knowledge that is impossible to be conveyed in a written or spoken method. This form of knowledge explains an individual's skill, idea, or experience and is difficult to express in written form (Hadjimichael & Tsoukas, 2019). Conversely, explicit knowledge is a form of knowledge ready to be articulated, codified, documented, and accessible whenever needed. Therefore, explicit knowledge can be conveyed to one another in an organisation and can be stored in hard or soft copy forms (Hislop et al., 2018).

According to the SECI framework, knowledge is created through conversion and sharing. Four methods allow the processes of conversion and sharing. First, Socialisation is described as tacit knowledge sharing via observing, imitating, practicing, and participating among the members. The second knowledge-creation process is Externalisation, where tacit knowledge is articulated into explicit knowledge and is deeply internalised to knowledge-sharing creation. Third, Combination depicts the integration of concepts into the system of knowledge. Lastly, Internalisation, denotes expressing explicit knowledge into tacit knowledge (Bandera et al., 2017).

Ahmed and Mohamed (2017) stated that proper KM improves the performance of organisations whether it is public or private. They also emphasised that the retention and proper training of employees not only improve their skills but also build confidence. This paper, therefore, examined the importance of KM in modern organisations especially in the agricultural sector. Agriculture is an important sector in Malaysia for national growth and has been the backbone of the Malaysian economy. Palm oil is one of the largest agricultural products produced for the domestic and export market. As a palm oil producer, Malaysia is experiencing a robust development in new palm oil plantations and mills as this commodity plays a significant role in the economic growth of the country.

The palm oil industry including estates and millings, utilise considerable human resources and machinery. Thus, the industry aims to enhance KM and knowledgeable people for sustainability (Kamarulzaman & Mohayidin, 2016). Knowledge creation processes are very important for an organisation's success; hence, this research focuses on understanding SECI tools and how it helps in sharing and creating knowledge among Managers and Supervisory teams in palm oil estates in Malaysia. The findings could help companies in similar circumstances to improve their business processes and organise their knowledge flow between employees as management and supervisory teams are responsible for managing palm oil estates from planting seedlings until the harvest.

1.2 Malaysian Palm oil Industry

Agriculture has always been an important sector of the Malaysian economy as Malaysia is one of the largest producers and exporters of palm oil in the world. Planting palm oil for commercial purposes started in 1917 and grew rapidly in the early 1960s due to the government's agricultural diversification programme that was introduced to decrease the nation's economic dependence on tin and rubber (Samad et al., 2014) as well as land settlement schemes to plant palm oil to eradicate poverty among farmers and smallholders without lands. The industry's development has been centralised to increase prosperity and societal advancement nationwide, starting from the rural communities employed in plantations to the downstream industries and extending to cities and export zones (Kushairi & Ong-Abdullah, 2019).

As such, the Managerial and Supervisory team's knowledge of agricultural practices and land usage can reduce the ecological impact on the agroecosystem and mill supply (Bessou et al., 2017). They need to equip themselves with sufficient knowledge in these areas to produce Fresh Fruit Bunches (FFB) efficiently as poor process

management in palm oil estates impacts production. Lack of knowledge in the selection of plantation sites (i.e. soil depth, drainage, soil composition, and moisture availability) creates poor quality in the size and health of the trees (Hamdani & Musofa, 2015).

However, the performance of Malaysia's palm oil estates began to decline from 2019 onwards with a 11.06% drop in palm oil production after a steady increase until 2018. The last decline in production was recorded in 2014, but the percentage was much lower at 1.4%. Lower production, decreased prices, and weak demand reduced the country's palm oil export earnings from RM74.75 billion to RM65.12 billion (Shevade & Loboda, 2019).

In addition, palm oil production declined due to external factors such as unpredictable rainy seasons and internal factors such as process management of the plantations' operation (Seng & Ahmad, 2017). The impact from the internal factor is manageable with appropriate KM in the process, while the external factor is beyond the Managerial and Supervisory team's control (Kushairi & Ong-Abdullah, 2019).

1.3 Problem Statement

The Managerial and Supervisory team's knowledge in seeding and planting palm oil trees in the field can determine the yield's quality in future harvesting. Failure to use improvised planting materials reduces the profitability of palm oil production as absence of this knowledge causes the purchase of planting materials from the wrong channels. Adequate knowledge gives the Managerial and Supervisory teams access to the information and resources they need to do their jobs effectively. It also helps the business retain that knowledge for future use, which promotes efficiency, a better working experience, and less repetitive work.

Sufficient knowledge of palm oil plantation will enhance the Managerial and Supervisory team's skills in reasoning and problem-solving especially in planting patterns, planting palm seedlings, and planting density. The teams will become more efficient in applying knowledge and solving problems across different levels of the organisation. Unfortunately, currently, there is a gap in the knowledge of the Managerial and Supervisory teams in managing palm oil estates. Considering the situation, the research explored the knowledge-creation process using the SECI tools among Managerial and Supervisory teams to fill the research gap in KM practices, especially in palm oil estates in Malaysia.

1.4 Purpose of the Research

This research aims to investigate and identify the four knowledge-creation tools from the SECI Model: Socialisation, Combination, Externalisation, and Internalisation. Specifically, it seeks to determine the preferred tool (or tools) contributing to knowledge creation among the Managerial and Supervisory teams in Malaysian palm oil estates and to recommend appropriate training and development programmes accordingly.

1.5 Significance of the Research

From an academic point of view, this research benefits from the experiences of the Managerial and Supervisory team in managing knowledge in the workplace as the findings will encourage more individuals in the organisation to identify best practices in knowledge creation using SECI tools. In addition, the results could assist the human resource department in designing appropriate training programmes and equipping necessary mechanisms that can enhance knowledge sharing and creation among the managerial and supervisory teams using the SECI model.

2. Knowledge Management

As a critical process, KM is involved in every department regardless of its function in the organisation. However, the process of KM may differ to suit the department's function and be executed in diverse ways to improve organisational performance. Omotayo (2015) stated that KM addresses the crucial issues of organisational adoption, survival, and competence when facing progressively irregular environmental change. According to Nasimi et al. (2013), KM helps an organisation function by comprehending the data's relationship, determining and documenting rules to manage data, ensuring data accuracy, and maintaining data integrity. Furthermore, Yusof, Masrek and Noordin (2016) proved that KM application in an organisation is about mapping knowledge and information resources online and offline.

Studies have shown the various ways KM function helps organisations achieve and sustain performance. Widiatuti, Arachman, and Broto (2019) showed that KM is a measure to make the *know-how* residing in human brains gained through learning and performance initiatives accessible and beneficial to each person in the

organisation. The measure attempts to encapsulate or tap the organisation's collective experiences and wisdom and make it accessible to ensure everyone can utilise it to enhance performance.

2.1 The Development of Knowledge Management in Malaysia

Hegazy and Ghorab (2014) summarised that the fourth Malaysian Prime Minister, Tun Dr Mahathir Mohammad stimulated the KM agenda in 1991 to transform Malaysia's economy into a knowledge-based economy. Some organisations' initiatives in KM application emerged as an inspiration to many others to act similarly. Apriliadi (2019) stated that KM progressed in Malaysia when multinational firms such as Microsoft and Hewlett-Packard (HP), introduced their existing KM practices, processes, and applications.

According to Raudeliūnienė and Davidavičienė (2018), the Multimedia Development Corporation (MDC) was one of the first government-linked companies (GLCs) that practiced KM in the early 1990s. Malaysia started laying the way and placed the foundation for a knowledge-based economy (k-economy) in the early 1990s by assuming that continuous measures were required to enhance the country and the industries' competitive position. Contrastingly, a survey undertaken by Asrar-ul-Haq and Anwar (2016) discovered that Malaysia lagged behind leading nations such as Singapore and the USA concerning knowledge enablers. Malaysia was found to be nearly on par with developed countries only in technological cooperation. Several other efforts to assess KM directed researchers to report that KM was comparatively slow in Malaysia (Hashim, Talib, & Alamen, 2014). Previous studies discovered that the implementation level was not on par with the awareness level, although many organisations were aware of KM and the imminent advantages (Razi, Habibullah, & Hussin, 2019).

2.2 Research Hypotheses

This research was conducted among the Managerial and Supervisory teams in Malaysian palm oil estates to examine the relationships between:

- Independent variables (Socialisation, Externalisation, Combination, and Internalisation) and other moderator variables (Job Category and Years of Working Experiences).
- The dependent variable (Knowledge Creation) and moderator variables).
- The moderating effect on the relationship between the independent variables and dependent variables.

Relevant hypotheses were developed to test the relationships between the variables:

H1: Socialisation is positively related to individual knowledge creation.

H2: Externalisation is positively related to individual knowledge creation.

H3: Combination is positively related to individual knowledge creation.

H4: Internalisation is positively related to individual knowledge creation.

H5: The relationship between Socialisation, Externalisation, Combination and Internalisation, and knowledge creation is moderated by job category.

H6: The relationship between Socialisation, Externalisation, Combination and Internalisation, and knowledge creation is moderated by years of working experience.

3. Methodology

This research utilised a quantitative method and adopted existing questionnaires by Nasser (2012) and Huang and Wang (2002) to measure individual knowledge creation. The unit of analysis in this research was individuals and the samples for this research were selected from the Managerial and Supervisory teams in palm oil estates in Malaysia. In this study, the researcher used convenient sampling to obtain the sample. Etikan, Musa, and Alkassim (2016) defined convenience sampling as a type of nonprobability or non-random sampling where members of the target population that meet certain practical criteria, such as easy accessibility, geographical proximity, availability at a given time, or the willingness to participate are included for the purpose of the study. Managerial and Supervisory teams of various palm oil estates in Malaysia were contacted through personal networks and work groups and a link to the questionnaire was shared for data collection. A total of 325 useable responses were received and the data collected was analysed using SPSS version 27.

3.1 Research Framework

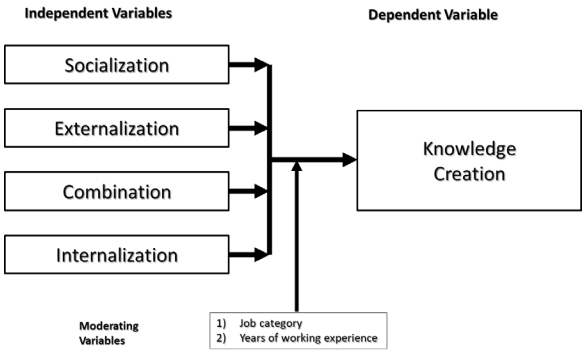


Figure 2: Research Framework

The SECI model by Nonaka and Takeuchi (1995) was reviewed as the research framework and foundation for this research. This model relates to the type of knowledge and its interaction with knowledge creation (Dalkir, 2017). Figure 2 exhibits the four knowledge-creation tools that are sequential. Therefore, knowledge evolves in a sequential pattern with differences. New quality of knowledge is created when the knowledge is converted from one tool to another. This study used these tools to develop the research hypotheses to examine the knowledge creation among the Managerial and Supervisory Teams in Malaysia (Syed et al., 2018).

4. Results and Conclusion

4.1 Linear Regression

Table 1 summarises the overall relationships among the variable. It was discovered that Socialisation and Combination had a positive relationship with Knowledge Creation if it is measured by simple linear regression with a group of Managerial and Supervisory teams with different levels of years of working experience.

Table 1: Summary of Linear Regression

Num	DV / IV	Knowledge Creation	F	R^2	p
1	Socialization	H1 Accepted	44.299	0.118	0.000
2	Externalization	H2 Rejected	3.078	0.006	0.080
3	Combination	H3 Accepted	48.177	0.127	0.000
4	Internalization	H4 Rejected	0.009	0.000	0.926

Therefore, it is concluded that Internalisation and Externalisation are not appropriate tools for generating Knowledge Creation for the group of Managerial and Supervisory teams with different years of working experience. Internalisation and Externalisation are related to learning from reading materials and Zulkifli et al. (2021) proved that issues of reading habits are still far behind due to a few factors such as lack of interest, motivation, previous knowledge, and vocabulary knowledge which could affect reading comprehension. Thus, H1 and H3 were accepted and H2 and H4 were rejected.

4.2 Linear Regression with Job Category

Table 2 shows the relationship between independent and dependent variables which are moderated by job category.

Table 2: Linear Regression with Job Category

No.	IV / Job Category	Socialization	Externalization	Combination	Internalization
1	Managerial or Above	Positive Relationship F = 7.040, R^2 = 0.079, p = 0.010	No Relationship F = 0.544, R^2 = 0.008, p = 0.463	No Relationship F = 1.675, R^2 = 0.010, p = 0.200	No Relationship F = 0.653 R^2 = 0.009, p = 0..422
2	Sr. Asst/Asst. Mgr	Positive Relationship F = 83.510, R^2 = 0.438, p = 0.000	No Relationship F = 0.002, R^2 = 0.000, p = 0.963	Positive Relationship F = 128.618, R^2 = 0.546, p = 0.000	Negative Relationship F = 12.864, R^2 = 0101, p = 0.001
3	Field Supervisor/ Conductor	Negative Relationship F = 48.453, R^2 = 0.245, p = 0.000	Negative Relationship F = 50.778, R^2 = 0.254, p = 0.000	Positive Relationship F = 8.648, R^2 = 0.050, p = 0.004	Negative Relationship F = 55.955, R^2 = 0.273, p = 0.000

From Table 2, it can be concluded that:

- For upper managerial levels, they preferred to create or exchange their knowledge through Socialisation but not with Externalisation, Combination, and Internalisation.
- For the Senior Assistant/Assistant Manager level, they preferred to create or exchange their knowledge through Socialisation, Combination, and Internalisation but not with Externalisation.
- For the Field Supervisor/Conductor level, they preferred to create or exchange their knowledge through these four tools: Socialisation, Externalisation, Combination, and Internalisation.
- Socialisation was identified as the most major tool where there is a relationship with all three levels of job category.

Based on the analysis 8 or 67% out of 12 tests showed $p \leq 0.05$, and Hypothesis 5 for this moderator was accepted. The job category moderates the relationship between Socialisation, Externalisation, Combination, and Internalisation and Knowledge Creation

4.3 Linear Regression with Years ff Working Experience

Table 3 shows the relationship between independent and dependent variables which are moderated by years of working experience.

Table 3: Summary of Linear Regression with Years of Working Experience as a Moderator

No.	IV / Experience	Socialization	Externalization	Combination	Internalization
1	< 5	No Relationship F = 2.511, R^2 = 0.044, p = 0.123	No Relationship F = 3.965, R^2 = 0.082, p = 0.055	Positive Relationship F = 7.047, R^2 = 0.155, p = 0.012	No Relationship F = 1.922, R^2 = 0.027, p = 0.175
2	6 – 10	No Relationship F = 0.260, R^2 = 0.012, p = 0.615	No Relationship F = 0.173, R^2 = 0.008, p = 0.682	No Relationship F = 0.176, R^2 = 0.008, p = 0.679	No Relationship F = 0.001, R^2 = 0.000, p = 0.975
3	11 – 15	No Relationship F = 0.087, R^2 = 0.001, p = 0.768	No Relationship F = 0.000 R^2 = 0.000, p = 0.992	Positive Relationship F = 6.792, R^2 = 0.083, p = 0.011	No Relationship F = 0.429, R^2 = 0.007, p = 0.515
4	16 – 20	No Relationship F = 1.476, R^2 = 0.009, p = 0.230	No Relationship F = 3.275, R^2 = 0.043, p = 0.076	No Relationship F = 0.053, R^2 = 0.001, p = 0.819	Positive Relationship F = 5.216, R^2 = 0.076, p = 0.027
5	21 – 25	No Relationship F = 2.604, R^2 = 0.032, p = 0.113	No Relationship F = 0.578, R^2 = 0.012, p = 0.451	No Relationship F = 0.129, R^2 = 0.003, p = 0.721	No Relationship F = 0.176, R^2 = 0.008, p = 0.051
6	> 25	Negative Relationship F = 8.540, R^2 = 0.071, p = 0.004	Negative Relationship F = 17.367, R^2 = 0.142, p = 0.000	No Relationship F = 0.048, R^2 = 0.000, p = 0.827	Positive Relationship F = 5.849, R^2 = 0.047, p = 0.017

From Table 3, it can be summarised that:

- For the category > 25 years of working experience, there are significant positive relationships with Internalisation but a negative relationship with Socialisation and Externalisation.
- For the category 16 – 20 years of working experience, there is a significant positive relationship with Internalisation.
- For the category < 5 years of working experience, there is a significant positive relationship with Combination.
- For the category 11 – 15 years of working experience, there is a significant positive relationship with Combination.
- There is no relationship between the categories 6 – 10 and 21 – 25 years of experience.
- Based on the analysis of years of working experience, 6 or 25% out of 24 tests showed $p \leq 0.05$, and Hypothesis 6 for this moderator was rejected. The years of working experience category does not moderate the relationship between Socialisation, Externalisation, Combination, Internalisation and Knowledge Creation. Therefore, years of working experience were omitted from further discussion.

4.4 Recommendations

The overall amount of Knowledge Creation outcomes posed by the Managerial and Supervisory team in palm oil estates in Malaysia may influence the outcomes and result in FFB production. Each level in the job category preferred a different level of Knowledge Creation tools. Upper managerial levels preferred Socialisation while Senior Assistant/Assistant Manager levels preferred Socialisation, Combination, and Internalisation to generate or share their knowledge before being upgraded to the Managerial level. While the lower rank of Field Supervisor/Conductor category chose all four tools: Socialisation, Externalisation, Combination, and Internalisation for their knowledge creation. Based on the research findings, it is recommended to any plantation company organise training programmes based on the SECI Model. Since Socialisation fits all types of job categories, the plantation company can develop its training programmes based on tacit-to-tacit conversion programmes such as presentations, talks, mentoring programmes, informal and formal gatherings, and case studies. Workplace collaboration with the right software, digital platforms, social media, and messengers could also help develop and capture tacit knowledge.

4.5 Implications of this Research

Two implications can be drawn from this research:

- The Knowledge Creation tools contributed to Knowledge Creation among Managerial and Supervisory teams in palm oil estates in Malaysia; and
- The mediating factors influenced the Managerial and Supervisory teams in palm oil estates in Malaysia in creating their knowledge.

The findings of the research identified that Knowledge Creation tools such as Socialisation, Externalisation, Combination, and Internalisation significantly contributed to generating knowledge among Managers, Senior Assistants/Assistant Managers, and Field Supervisors/Conductors. This is because these tools have the following attractive attributes; it is relatively simple to apply, take little time away from day-to-day organisational activities, generate results for the organisation, combine Knowledge Creation and Knowledge Sharing, enable a caring and sharing culture in the organisation, continuously builds relationships and dynamic communities of practice, is a possible tool for multi-project management, and reforms knowledge society (Carvalho & Ferreira, 2001). Most organisations spend vast sums of money for training and development. Some organisations have achieved their targeted goals by creating, generating, and sharing knowledge among their subordinates while others fail due to uncertainty on the proper way to create knowledge among their subordinates. The findings of this research can provide guidance for any plantation's HR Department by determining which tools can be applied to generate knowledge among Managerial and Supervisory teams.

This research implies that Socialisation is a favourable tool and positively affects Knowledge Creation among Managers, Assistant Managers, and Field Supervisors of palm oil estates in Malaysia. This is supported by Zabeda (2008) who discovered that organisations benefit further in terms of knowledge sharing and creation through personal networking, basic communication practices, and discussions between managers and employees, rather than on technology. In addition, a study by Raid et al. (2012) examined the impact of the knowledge-creation process including Socialisation, Externalisation, Combination, and Internalisation on implementing a learning organisation (LO) strategy in an Algerian international oil company. Raid et al (2012)'s research revealed that Socialisation, Internalisation, and Combination have a significant impact on the success of a LO strategy. Socialisation is the major influential factor, having the strongest impact on LO but Externalisation was found to have no statistical influence on LO. These findings also showed that there is no relationship between Externalisation at the Managerial and Senior Assistant/Assistant Manager levels.

4.6 Limitations of the Research

Due to limited internet coverage in the estate, not all Managerial or Supervisory teams could access the questionnaire. One of the major disadvantages of an online questionnaire system surfaces in remote locations where access to electricity, stable internet connection, and other basic system requirements are difficult to meet. Such barriers impede the respondents from responding to the online questionnaire.

4.7 Suggestions for Future Research

Achieving a knowledgeable society is not an easy task. Clear understanding and proper tools should be applied to create or generate knowledge among the Managerial and Supervisory teams in palm oil estates because different employees have different types of skills, attitudes, and behaviours. The findings from this research may assist human resource departments in palm oil plantation companies to design training programmes according

to specific job categories. This research is deemed one of the pioneer studies of KM in palm oil estates in Malaysia.

The current research only focused on how the Knowledge Creation tools affect the Knowledge Creation process and how they were moderated by job category and years of working experience. However, organisational culture aspects were not tested in this research.

Further studies need to strengthen the theory's adaption to the current scenarios and culture. Future research can also examine whether organisational culture such as innovation, technology, transparency, values and beliefs, and other moderating variables such as education, race, and age have an impact on the Knowledge Creation process and Knowledge Creation tools.

4.8 Conclusion

Most industrial countries have gradually changed from industrialised economies to information or knowledge-based economies, where human beings become the most valued asset due to the tacit knowledge embedded which is difficult to access. Therefore, we have a KM system that was developed to discover, capture, apply, and share knowledge. Unfortunately, KM is rather new in palm oil estates in Malaysia.

Based on the findings of this study, it can be concluded that KM is an effective way for Malaysian plantation companies to build competencies in the market not only to compete with our neighbouring countries but also to gain a reputation in the eyes of the world. More importantly, the training programmes based on the SECI Model could be used as a guideline for any palm oil plantation company to develop their training programmes for their subordinates.

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R&D Cooperation and Innovation Networks: Lessons From SME Participation in H2020

Ricardo Abreu[1], Jorge Antunes[2], Mafalda Escada[1], Muriela Pádua[2] and Maria Teresa Patrício[1]

[1]Centre for Research and Studies in Sociology, ISCTE - University Institute of Lisbon, Portugal
[2]Conhecimento Intensivo, Lda., Portugal

ricardo_joao_abreu@iscte-iul.pt
geral@conhecimento-intensivo.pt
mafalda.escada@iscte-iul.pt
muriela.padua@conhecimento-intensivo.pt
teresa.patricio@iscte-iul.pt

Abstract: Portuguese SMEs are 'catching-up' to the European Commission's goal of 20% for SME participation in H2020, representing16,7% of allocated funds.. Previous R&D experience, and especially R&D cooperation, have been identified as key determinants of participation in Framework Programmes, such as H2020. Thus, it is important to know SMEs that engage in these experiences and the drivers that lead them to it. This paper seeks to identify why and how SMEs gain collaborative experience with HEIs; what are the organizational characteristics that foster collaboration; the types of experiences in which SMEs are engaged with HEIs; the obstacles they face when applying for FP funding, and how these can be overcome. Lastly, we aim to draw lessons that foster SMEs' participation in Framework Programmes. To achieve these goals, we conducted a survey with SMEs that collaborate with HEIs (N = 26), including SMEs that participated in H2020 and SMEs that didn't. We then complemented the survey with six in-depth qualitative interviews with both FP participants and non-participants.

Keywords: Small and medium enterprises, Higher education institutions, Framework programme, Collaborative R&D

1. Introduction

European Union Framework Programmes (FPs), such as Horizon 2020 (H2020) can create and strengthen research and development (R&D) networks and cooperation between higher education institutions (HEIs) and small and medium enterprises (SMEs), given the collaborative nature of participant consortiums. FPs thus contribute to innovation networks. For HEIs, FP funding can work as a strategy to tackle reduced national research budgets (Enger, 2018). Particularly for SMEs, FP funding can counter usually faced barriers relating to R&D, such as lack of financial resources for investment in technology and qualified human resources (Barajas and Huergo, 2010; Lesáková, 2009).

SMEs are a key element of the European economy accounting for 99% of the companies operating in the non-financial business sector (European Court of Auditors, 2020). In 2019, 64,5% of enterprise workers were employed by SMEs (Eurostat, 2023). The importance of SMEs and their tendency for low participation in the FP has led the European Commission to work towards increasing their participation, having set a goal of 20% for H2020 allocated funds to SMEs. Although the goal has been met (24%) (European Commission, 2020), this is not the case for every Member-State. For example, SMEs account for 16,7% of H2020 allocated funds in Portugal (Agência Nacional de Inovação, 2020).

Discrepancies in participation come as no surprise taken the literature on European funding for R&D points to a 'Matthew Effect' (Merton, 1968 as cited in Enger and Castellacci, 2016; Enger, 2018). When looking at FP participants, it is possible to identify 'oligarchic networks' that prevent newcomers through cumulative advantages, such as more resources for R&D and/or central network positions that reinforce themselves overtime (Enger, 2018). This 'Matthew Effect' also translates geographically. Some instruments in previous FPs, such as Networks of Excellence and Integrated Projects, have increased the bias towards large consortia located in North-West Europe thus accentuating inter-regional differences (Amoroso et al., 2018; Marimon, 2004). Although this literature points to plausible arguments explaining low participation of small entities and particularly small firms in peripheral Member-States such as Portugal, it doesn't focus on the specificities of such organizations. Most literature on FP participation focuses on HEIs. To address this gap, we turned to literature on corporate R&D, including focusing on SMEs' participation in FP, asking what determines SMEs' participation in European funding for R&D. Participation usually entails a successful application or project submission. Yet, participation can also be thought of as applying for funding, regardless of the application's success. Since a successful application depends on the decision to apply, we are interested in what drives SMEs to apply. Thus,

we ask what drives SMEs to be interested and apply for funding and not necessarily what determines application success which we nevertheless briefly address.

2. Research Questions and Literature Review

SMEs' decision to participate in the FP is based on trade-offs between expected benefits of cost sharing and expected short-term costs of participation (Faber et al., 2016). The FP's administrative requirements are complex and demanding, often leading SMEs not to apply (Barajas and Huergo, 2010). This decision may be the result of an objective cost-benefit calculus, but it can also result from misconceptions about the FP, such as 'loss of control' of the company, a perceived inadequacy of the FP for the firm's needs, or simply a lack of information (Romero-Martínez et al., 2010).

Apart from the H2020's SME Instrument, FP projects entail R&D cooperation which turns R&D partners, partnerships, and respective perceptions into important variables to consider. Different entities may pursue different goals, preferring specific kinds of R&D outputs over others. Commercial products as R&D outputs are more valued by SMEs (Luukkonen, 2002) than HEIs (Grimpe et al., 2022). SMEs are more market-driven than research-driven (Hervás-Oliver et al., 2021). A perceived incompatibility of goals may then result in SMEs deciding not to form partnerships. Conversely, it doesn't come as a surprise that SMEs with prior experience of R&D cooperation are more likely to apply for the FP (Barajas and Huergo, 2010). Previous experience gives firms more confidence for future cooperation (Mora-Valentin et al., 2004 as cited in Catarino and Teixeira, 2009). This, of course, points to previous R&D experience in general as a key factor for FP participation. Additionally, previous collaborative experience fosters networking which makes it easier to find adequate partners for future participation (Barajas and Huergo, 2010).

Although the FP can in principle create research networks, previous R&D experience and, especially, collaborative R&D experience appear to be an important factor determining participation in the FP. This resonates with the 'Matthew Effect' pointed by Enger (2018) when researching about HEIs' participation in H2020. Hence, it is important to ask: how and why do SMEs gain collaborative R&D experience with HEIs? What are the characteristics of SMEs that engage in these experiences? What obstacles do these experiences help overcome when applying for European funding? What can we learn from SMEs that participate in the FP?

Most literature regarding the relation between organizational characteristics and participation in the FPs focuses on HEIs. We thus sought to combine the literature on corporate R&D, especially regarding SMEs, with some important characteristics that help predict involvement in collaborative R&D. This, however, requires further research to which we pretend to contribute with this paper. Additionally, to better grasp the reality of SMEs that are more engaged in R&D, we borrow the concept of 'academic firms' (Campbell et al., 2013; Campbell and Carayannis, 2016). The 'academic firm' is an ideal type of firm focusing on knowledge application but also on knowledge production, balancing profit generation with a goal of knowledge production. These firms encourage research work, value education and life-long learning for their employees, have cross-employment experiences, such as hosting PhD researchers in collaboration with HEIs, and value 'traditional' academic R&D outputs such as scientific publications. We thus analyze Portuguese SMEs engaged in collaborations with HEIs with this ideal type in mind, contributing to its empirical verification.

Organizational size, as measured by the number of researchers, is a determinant of HEIs' participation in FP (Enger and Castellacci, 2016). Similarly, Kelly and Arora (1996) as cited by Catarino and Teixeira (2009) refer that SMEs only engage in collaborative R&D when they have enough human resources to do so, suggesting a relationship between size and collaborative R&D. However, in their study of Spanish SMEs, Barajas and Huergo (2010) found a negative relation between firm size as measured by the number of employees and propensity to apply for FP funding, highlighting that this may be explained by specific Spanish policies towards increasing SMEs' participation in FP, and thus pointing to policy as an important factor. Besides enough human resources, another important factor is their stability. Work force turnover negatively impacts SMEs' engagement in R&D (Grego-Planer and Kus, 2020). On another note, internationalized SMEs, such as exporters, are more likely to engage in collaborative R&D (Lesáková, 2009) and apply for FP funding (Barajas and Huergo, 2010).

Still regarding human resources, professional qualification is a key factor for R&D activity (Aschhoff, 2010; Lepori et al., 2015). Education and professionalism increase 'boundary-spanning activity' (Damanpour, 1991). However, it is important that firms have specific employees dedicated to R&D (Wang et al., 2010). A R&D formal organization, such as a R&D department or manager, is an important factor for R&D and innovation (Damanpour, 1991; Terziovski, 2010). Additionally, 'academic firms' usually engage in cross-employment, such

as the employment of PhD students, which suggests partnerships with doctoral programs and thus with HEIs as an important factor (Campbell and Carayannis, 2016).

Based on this literature review, focusing on SME-HEI relations, SMEs' organizational characteristics that may determine their engagement in collaborative R&D and, hence, their participation in FP funding, we intend to answer the already outlined research questions, hoping to draw lessons from Portuguese SMEs.

3. Methodology

To answer these questions, we conducted a survey with 'Leader' Portuguese SMEs that engage in collaborative R&D with HEIs (N = 26). Amongst these, 15,4% haven't participated (N = 4) in H2020 and 84,6% have participated (N = 22). All surveyed SMEs share the 'Leader' 'seal of approval' of the Portuguese Agency for Competitiveness and Innovation for high performance SMEs, indicating that both groups constitute highly competitive SMEs. Additionally, when gathering the data base for the survey, we 'matched' H2020 participant SMEs' activity sector and district with non-participant SMEs to make sure both groups were as similar as possible. We then complemented the survey with in-depth semi-structured qualitative interviews with three H2020 participant SMEs and three non-participants. The interviews allowed us to explore more deeply the answers provided in the survey. The interviews were transcribed, categorized, and analyzed through a common analysis grid.

4. Data Analysis

This section is divided into four major themes that will shed light on the elements that influence, enable or hinder R&D cooperation involving SMEs and HEIs. First, we examine the key organizational characteristics of SMEs engaging in R&D, exploring their structure and priorities. Second, we examine the importance of human resources in the context of R&D in SMEs, highlighting the critical role of skilled individuals in driving innovation and, thus, participation in R&D programs such as FPs. Third, borrowing from the concept of 'academic firms' which, among other factors, entail a balance between profit goals and knowledge production (Campbell and Carayannis, 2016), we discuss different preferences of R&D outputs and R&D strategies of SMEs, providing a deeper understanding of their approach to collaborative R&D, and exploring the empirical relevance of this concept. Finally, we identify the obstacles that SMEs with partnerships with HEIs find when applying for European funding. By examining these challenges, we aim to provide recommendations for policymakers and stakeholders to improve the environment for successful collaborations between SMEs and HEIs within FP.

4.1 Organizational Characteristics of SMEs Engaging in R&D

Table 1: Organizational Characteristics of SMEs for R&D

	Yes	No
Hiring PhD students	46,2%	53,8%
Partnerships with doctoral programs	38,5%	61,5%
Department, section, or R&D group	96,2%	3,8%
R&D manager or person in charge	80,8%	7,7%

Source: Author's survey

Table 1 suggests that nearly half of the organizations recognize the value of having highly educated researchers on their teams, since 46,2% hire PhD students. However, only 38,5% of SMEs have partnerships with doctoral programs, indicating that on the one hand, SMEs that hire PhD students do not necessarily have a formal ongoing partnership with HEIs, and that on the other hand, most SMEs are not currently involved in such partnerships. In the qualitative semi-structured interviews, when asked about hiring PhD students and partnerships with PhD programs, most SMEs' representatives recognized the importance of having PhD researchers on their companies. Yet, only one of the interviewed SMEs has a formal PhD protocol to host researchers. Interestingly, this protocol is held with the HEI where the SME itself was created as a spin-off. Others claim not to have an organized or big enough structure to formally host researchers themselves nor availability to do so given their workflow. However, the interviews allowed us to explore the relation between human resources and HEIs established through internships. Some of these SMEs host bachelor and/or master level interns. When asked about the origin of these partnerships, most stated that these arose from personal connections to HEIs, such as being alumni.

In terms of R&D organization, Table 1 highlights that a vast majority (96,2%) of SMEs have a R&D dedicated department, section, or group, with 80,8% stating to have a R&D manager or a person in charge. This indicates a strong commitment to research activities and the importance of leadership and management in driving R&D efforts. Amongst the interviewees, the spin-off SME - closer to the ideal-type of 'academic firm' given the centrality of R&D in the company – who regards FP participation as a key activity of the firm, not only has an R&D department and R&D manager, but also a person in charge of FP projects within the department. Contrastingly, three interviewees do not have an R&D formal organization, but two of them engage in R&D, nonetheless. Interestingly, both are in the agricultural sector and claim to have been approached by HEIs to engage in collaborative R&D. This points to at least an R&D dedicated person as a driver for collaborative R&D initiative and, hence, FP participation.

Regarding other characteristics of SMEs, our sample of SMEs engaged in collaborations with HEIs also revealed that 76.9% of SMEs are exporters; 65.4% participate or have participated in FPs; 34.6% have 10-49 workers, 23.1% have 50-99 workers, and 30.8% have 100-249 workers. These results point to SMEs that engage in R&D partnerships with HEIs as having certain characteristics in common. Most of them have an R&D department, group or section, and a R&D manager; invest up to 9% of their turnover in R&D; have up to 100 workers; and are exporters. Furthermore, most of these SMEs are or have been participants of FPs, have official partnerships with doctoral programmes, and hire PhD candidates. Therefore, these SMEs may represent embryo examples of 'academic firms' driven by supporting and advancing knowledge production (Campbell & Carayannis, 2016). However, the below target allocation of H2020 funding to Portuguese SMEs suggests we look at other possible explanatory variables.

4.2 Human Resources in SMEs and R&D

Table 2: Importance of Human Resources in SMEs for R&D

	N	Minimum	Maximum	Mean	Std. Deviation
It is difficult to recruit qualified human resources for R&D	23	1	5	3,57	1,237
R&D activities are performed by human resources that are already in the company	23	2	5	4,13	0,694
For R&D activities, it is important to have stable human resources in the company	23	4	5	4,70	0,470

Source: Author's survey

Table 2 focuses on the role of human resources in R&D. The data shows a moderate level of difficulty in recruiting qualified R&D personnel, with a mean score of 3,57 (1,24). This finding suggests that SMEs face challenges in attracting and hiring the right talent for their R&D initiatives. The data also reveals that most SMEs (4,13 (0,69)) rely on their existing workforce for R&D activities, potentially due to the difficulties in recruiting new talent or a desire to leverage in-house expertise. Finally, the high mean score of 4,70 (0,47) for the statement 'for R&D activities, it is important to have stable human resources in the company' emphasizes the need for a stable workforce in R&D endeavours. In the interviews, all SME representatives stated to value human resources stability, especially in highly skilled functions, namely due to the long 'on the job training'/integration time in the company's activities. However, most of them admitted to struggling to find and maintain appropriate human resources for different perceived reasons: a younger and more willing to rotate generation of skilled workers; competing for human resources with other sectors or foreign companies offering better conditions – the latter enhanced with the possibility of remote work; but also, an increasing demand and scarce supply of highly trained professionals, especially in the IT sector. Regarding qualifications, most of the interviewees privilege at least a bachelor's degree, except for the spin-off SME that demands a master's degree for the R&D department. This was also the only interviewed SME that currently employs workers with a PhD.

Drawing a connection between Table 1 and Table 2, SMEs that have a dedicated R&D department or group and an R&D manager might be more likely to invest in stable human resources and engage in collaborations, such as hiring PhD students or partnering with doctoral programs. Encouraging firms to pursue this kind of organization can eventually create more potential FP participants. Additionally, encouraging organizations that already

present these characteristics to actively participate in the FP can contribute to the creation and strengthening of research networks, fostering collaboration between SMEs and HEIs.

4.3 SMEs Engaged in HEIs Collaborations as 'Academic Firms'

Table 3: Importance of R&D Outputs for SMEs as Characteristics of "Academic Firms"

	N	Minimum	Maximum	Mean	Std. Deviation
Publication of scientific articles	26	1	5	3,35	1,06
Submission of patents	26	1	5	3,35	1,13
Trademark registration	26	1	5	3,31	1,29
Creation of new products	26	3	5	4,58	0,76
Collaboration with partners	26	2	5	4,42	0,86
Skills acquisition and development	26	3	5	4,65	0,63

Source: Author's survey

Table 3 provides some support to the concept of 'academic firms', highlighting different activities commonly associated with the concept, such as the publication of scientific articles, submissions of patents, trademark registration, creation of new products, collaboration with partners, and skills acquisition and development. The surveyed organizations place a strong emphasis on the creation of new products, with a high mean score of 4,58 (0,76). This suggests that SMEs and HEIs working together are focused on driving innovation and delivering tangible results. Furthermore, SMEs also prioritize collaboration with partners and skills acquisition and development, with mean scores of 4,42 (0,86) and 4,65 (0,63), respectively. These high scores indicate the importance of effective partnerships and the continuous development of expertise within these firms. Conversely, the data also shows that activities such as publication of scientific articles, submission of patents, and trademark registration have lower mean scores of 3,35 (1,06), 3,35 (1,13) and 3,31 (1,29), respectively. While these activities are pursued by academic firms, their lower scores suggest that they may be of secondary importance when compared to more practical aspects of innovation and collaboration in the case of the surveyed SMEs. This resonates with statements made during the interviews. Most interviewees regard R&D activities as depending on their clients' needs and/or aim at improving processes or products. Only the spin-off SME is responsible for 'all its technology' and engages in R&D activities that are not necessarily client-oriented, namely FP projects that they use as a strategy to explore new possibilities aiming at technology transfers and enhancing their networks for future partnerships, providing an example of an embryonic 'academic firm'.

In conclusion, data from Table 3 only partially supports the notion of academic firms. Despite showing a strong focus on the creation of new products, collaboration with partners, and skills acquisition and development, more traditional academic activities, such as publications of scientific articles, submission of patents, and trademark registration appear to be less emphasized. This may be a sign that the 'traditional' valued outputs of HEIs do not echo SMEs', eventually hindering potential partnerships. For example, an interviewed representative whose SME has not participated in H2020, but nonetheless has worked with HEIs, expressed that HEIs apply for FP to fund their current expenses and that their research has 'no interest' since it's not close enough to the market. On the other hand, other interviewees regard their relations with HEIs as *quid pro quo*, or as complementary. This points to the need of policymakers and stakeholders to better understand the priorities and needs of SMEs, enabling them to tailor support mechanisms and strategies to foster successful collaborations between SMEs and HEIs, aiming at increasing SMEs' participation in the FP.

Table 4: Importance of R&D Strategies for SMEs

	N	Minimum	Maximum	Mean	Std. Deviation
Developing R&D through internal resources	26	2	5	4,65	0,745
Develop R&D through the contracting of external resources	26	2	5	3,81	0,939
Developing R&D continuously	26	3	5	4,73	0,533
Open new lines of research	26	3	5	4,58	0,703

Source: Author's survey

Table 4 shows that SMEs value the importance of developing R&D through internal resources (4,65 (0,75)), continuously developing R&D (4,73 (0,53)) and opening new lines of research (4,58 (0,75)). However, they acknowledge the need to contracting external resources (3,81 (0,94)) to reach R&D goals. These results indicate that SMEs are engaging in R&D partnerships with HEI to create new products, but also to develop internal skills, reflecting an interest in their employee's training – distinctive of 'academic firms'. From the interviews, we were able to conclude that while some SMEs mainly resort to HEIs to compensate their lack of internal resources, others – like the spin-off SME - regard partnerships with HEIs as a strategy to be up to date on the state of the art within their sector and, thus, be more innovative and competitive. As in the case of R&D outputs, Table 4 also only partially supports the notion of 'academic firms'. On one hand, SMEs seem interested in contributing to knowledge production by recognizing the importance of continuously developing R&D, valuing opening new lines of research, and wanting to develop internal skills. However, especially given their internal resources limitations, these firms seem more focused on commercial goals than balancing profit goals with knowledge production.

Overall, these findings contribute to understanding the motivations of SME-HEI collaborations and point the need of policies that can help inform and support/facilitate them, for example, instigating doctoral partnerships between SMEs and HEIs that allow SMEs to overcome their difficulties in acquiring human resources for R&D, enabling them to pursue a more balanced 'academic/commercial' R&D strategy. Thus, to inform these policies, it is especially relevant to also look at the obstacles SMEs perceive regarding collaborations with HEIs which, once overcome, may significantly increase FP participation.

4.4 Obstacles for SME-HEI Collaborations

Table 5: Obstacles of SMEs with HEI partnerships in applying for European Funding

	N	Minimum	Maximum	Mean	Std. Deviation
Different perceptions of cost, time and/or productivity among partners	15	3	5	3,93	,46
Difficulty in obtaining immediate results	15	2	5	3,67	,90
Sharing of information on intellectual property	15	2	5	3,47	,92
Lack of stability of R&D public policies	15	2	5	4,00	1,00
Difficulty in obtaining R&D funding	15	2	5	4,00	1,00
Difficulty in finding R&D partners	15	1	4	2,80	1,15
Abstract academic research topics	15	2	5	3,53	,99

Source: Author's survey

According to our data, difficulty in obtaining partners for R&D projects (2,80 (1,15)) and different perceptions of cost, time and/or productivity among partners (3,93 (0,46)) are two relevant obstacles. This indicates that partners may struggle to align priorities and expectations when working together, which could hinder the success of collaborative projects. This is especially relevant for FP participation in that previous experience is a key determinant of participation. Other obstacles include the difficulty in obtaining immediate results (3,67 (0,90)), sharing information on intellectual property (3,47 (0,92)) and abstract academic research topics (3,53 (0,99)). This suggests that organizations face some difficulties in achieving quick outcomes, dealing with intellectual property issues, and bridging the gap between academic research and practical applications. However, regarding confidentiality, the interviewed representatives stated that even though it poses problems, such as managing who can access the information inside the company, it doesn't refrain them from engaging in collaborative R&D. Interestingly, the two representatives from the agricultural sector claimed that there is no confidentiality in their collaborative experiences and perceive it as a positive factor, since the sector is volatile to collective problems such as pests. This indicates that exploring inter-sector differences may be important for future research. Additionally, these findings also highlight the importance of stable public policies and adequate

funding to support R&D collaboration, as well as the need for effective networking to identify suitable partners. For example, one of the interviewees perceives publicly funded R&D projects as sporadic and poorly funded, not taking into consideration a long-term business strategy for SMEs. On another note, H2020 participants stated that being connected to big organizations, such as prestigious HEIs is key to finding new partners. When asked about the origin of relations with HEIs, SMEs' representatives usually referred to personal connections. This, once again, points the need for other networking mechanisms that do not leave SMEs dependent on individuals' social background and path which can contribute to the already mentioned 'Matthew Effect'.

Interviewing SMEs' representatives allowed us to further develop the topic of obstacles and directly enquire them about possible improvements to be made through policy. Regarding FPs, but also other R&D funding schemes, SMEs' representatives complained about the administrative burden they represent. While some view partnering up with HEIs and other organizations, such as bigger firms, as a strategy to deal with this burden, since these tend to have more resources and experience, others point the need for available adequate human resources to manage these projects. For example, one of the interviewees suggested that business and entrepreneurial associations could play a central role if they provided these administrative services and that the State should facilitate this role.

5. Discussion and Conclusion

If policies are to be more effective in promoting collaboration between SMEs and HEIs, thus enhancing the propensity of SMEs to apply for FPs, it is important to understand the different aspects of collaborative practices between firms and HEIs. This means also better knowing the SMEs that engage in these practices.

Our findings underline the importance of specific organizational characteristics of SMEs to assume collaborative R&D activities. Most of the surveyed SMEs are exporters, pointing to internationalization as an important factor driving R&D cooperation; most invest up to 9% of their turnover in R&D, and most participate in the FP – confirming that previous experience in R&D and cooperation in R&D is a driver of FP participation. A formal R&D organization also seems like an important driver of collaborative R&D and, thus, FP participation: a specific department, or at least a R&D manager is key. Regarding size, the number of overall employees doesn't seem to make a difference in collaborative R&D, unlike the case of HEIs.

However, for SMEs to engage in R&D, it is important that they have qualified and stable human resources, which is difficult to attain. Engaging in partnerships with HEIs appears to be a strategy to compensate for the lack of internal resources. Hiring or hosting PhD researchers can reflect this strategy, but it is important to address the difficulties signaled in the interviews, such as an insufficient structure and heavy workflow that hinder availability to monitor PhD researchers. Even though a significant percentage of SMEs stated to hire PhD researchers, most SMEs do not have official partnerships with doctoral programs. Thus, the 'academic firm' cross-employment practice seems only embryonic in our sample of SMEs. Additionally, SMEs' connections to HEIs are mostly based on personal connections. Creating different networking platforms or strategies may instigate partnerships which, in turn, can help SMEs counter their lack of resources and instigate R&D cooperation and FP participation. Yet, our survey shows that SMEs value R&D activities performed through internal resources. These findings point the need for further research about SMEs' R&D strategies and concerns regarding human resources for R&D activity.

Furthermore, our findings indicate that SMEs and HEIs tend to prioritize different types of outputs. SMEs are more market-driven than research-driven (Hervás-Olivier et al. 2021) and therefore focus more on the creation of new products, collaboration with partners, and skills acquisition and development. HEIs, however, tend to emphasize traditional academic activities, such as publications of scientific articles. Nevertheless, spin-off SMEs or 'academic firms' reveal a tendency for more diverse R&D outputs, such as joint co-publications, coordinated and mutually supportive activities and a balance between profit goals and knowledge production Yet, the difficulties of establishing collaborative partnerships between SMEs and HEIs remain significant. Our findings reveal difficulties between partners regarding different perceptions on cost, time, and productivity; difficulties regarding sharing information, obtaining funding and results. These difficulties need to be identified and faced so that the obstacles to collaboration and networking can be surpassed. However, to enhance SME-HEI collaborations, future research should also address this subject focusing on the perspective of HEIs.

Regarding the concept of 'academic firms', even though it proved to be a theoretically useful tool, guiding our analysis of SMEs, it doesn't translate empirically in the case of our sample of SMEs. In the case of the interviewed SMEs, the spin-off SME seems to fit into this ideal-type of firm. In general, the characteristics of 'academic firms' can only be observed as an embryonic tendency within our sample of SMEs. Future research aiming to explore

this concept should resort to a bigger sample of SMEs, whether for surveys or interviews. Future research could also draw on this concept in order to explore possible policy initiatives that bring SMEs closer to this ideal-type of firm, fostering corporate R&D and motivating SMEs to participate in the FP.

Lastly, the importance of participating, of learning by doing, of promoting learning behavior of SMEs concentrated on learning and network formation can help address the 'Mathew Effect' observed in FPs by promoting short-term exchanges that can lead to more long-term innovative capabilities of SMEs, and motivate them to participate in competitive research projects such as the FP.

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Empowering Rural Public Library Users Towards Sustainable Community Development Goals

Roziya Abu[1], Siti Khadijah Mohd Rafie[2] and Haziah Sha'ari[3]

[1]School of Information Science, Universiti Teknologi MARA Shah Alam Malaysia

[2]School of Information Science, Universiti Teknologi MARA, Kedah, Malaysia

[3]School of Information Management, School of Business and Government, Victoria University of Wellington, New Zealand

roziya307@uitm.edu.my
khadijahrafie@uitm.edu.my
haziah095@uitm.edu.my

Abstract: The Sustainable Development Goals (SDGs) are a set of international targets that were developed in 2015 by the United Nations. These goals aim to end poverty, protect the planet and ensure prosperity among human kind for all by the year 2030. They are divided into 17 goals and 169 targets that cover all aspects of life – including education, health care, housing, food, energy and climate, peace and justice, governance and sustainable economic growth. Plus, to ensure peace and prosperity. Empowerment is very important element for a community to become developed and to sustain the development. To be able to have self-empowerment, one must first have a sense of self-help and self-determination. Self-help and self-determination are related to the idea that helping one's self will create collaboration and improve one's quality of life (Christenson, 1989). Power in community development refers to the ability to influence change rather than the power to exploit or dominate others, it is an action of choice. This paper introduces Rural Community Learning Network (RCLN) Traits Model which offers a helpful insight for rural communities to value and support rural public library as community sustainable development center. This model was develop using qualitative approach through interviews with the rural public libraries' staffs, users and non-users, observations, and examinations of documents. Thematic analysis has been used to identify the empowerment sustainability characters for the traits model. This study concluded that rural public libraries in Malaysia had not fully implemented the empowerment elements which is identified as an important element in rural libraries and community development.

Keywords: Rural public libraries, Sustainable development, Community empowerment, Rural community development

1. Introduction

Sustainability development seems to be identified as an important area to be highlighted by governments, universities, business leaders and non-governmental organizations (NGO) (Annan-diab & Molinari, 2017). There are seventeen (17) elements of sustainable development goals (see in Figure 1), developed by United Nations set in 2000 which has been adapted by 193 countries all over the world.



Figure 1: The Sustainable Development Goals (United Nations, 2015)

The seventeen (17) development goals as can be seen in the figure above are; 1) ending poverty in any forms anywhere in the world, 2) ending hunger, improving nutrition and promoting sustainable agriculture, 3) ensuring healthy lives and promote well-being regardless of ages, 4) ensuring quality education to all especially children

at rural areas, 5) promoting gender equality and empower women and girls, 6) ensuring access to clean water and sanitation, 7) ensuring affordable and clean energy to all, 8) promoting the decent work and economic development, 9) building robust infrastructure, promoting inclusive and sustainable industrial development and foster invention, 10) reducing inequalities (among mental impairments or psychosocial disabilities) within and among countries, 11) promoting inclusive, safe, resistant and sustainable cities and human inhabitants, 12) ensuring sustainable depletion and manufacture designs, 13) promoting quick responds towards combating climate change and its impacts, 14) preserving, conserving and sustainably using the oceans, seas and marine resources for sustainable consumption, 15) protecting, restoring and promoting sustainable use of native ecosystems, periodically managing forests, avoiding desertification, and halting and reducing land deprivation and stop biodiversity loss, 16) ensuring peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels, and 17) empowering the means of employment and invigorating the global partnership for sustainable development. Hence, sustainability can be defined as the capacity to bear with certain situation, so that it will be maintained and is long lasting. There are more than 200 definitions of sustainable development can be found (Parkin, Sommer, & Uren, 2003). However, the concept of sustainability is promoting the well-being of current community without neglecting the future is the best definition of sustainability.

Nonetheless, empowering rural public library users towards sustainable community development is important to ensure that these essential public service institutions can play an effective role in facilitating community development and social cohesion in rural areas of developing countries (Public Libraries Association, 2015). These rural communities are often faced with numerous socio-economic challenges including inadequate infrastructure, lack of employment opportunities, inadequate access to basic services such as health care and education, limited access to technology, and other socio-economic disadvantages. Hence, rural public libraries provide multiple source of information, activities and programs that offers healthy and balanced lifestyle. The renewable energy in rural public libraries available in green library practice, reduce the consumption of energy and waste as well as supporting the ecosystem. Providing good jobs and economic growth closely related with the no poverty point which rural public libraries will help in local economic activities. The environmental sustainability is also about responsible consumption of the resources used for the rural libraries.

The library in general should have sustainability element incorporated into their organization's procedures, ensure the library can sustain its existence and service (Karioja, 2009), and not just to preserving the information for the patrons. Nowadays, change is essential to the world we live in whether in social, economic or environment. Community should put effort to follow international recommendations of specific field, so that sustainability issue is not just a simple ideology. Libraries should not be an exception to this effort (Dias, 2017). This study proved that library is more than just preserving the information, eventually as time goes by, library needs the sustainability elements to remain relevant in the community.

2. Malaysia Rural Public Library Sustainability Plan

In Malaysia, sustainability plan was included in 7th, 8th, 9th and 10th Malaysia plan. It started in 7th Malaysia Plan (1996-2000) (Yiing, Yaacob, & Hussein, 2013). The 8th Malaysia Plan (2001-2005) highlighted the sustainable development of energy resources and renewable, while the 9th Malaysia Plan (2006-2010) stressed on environment, economic and social aspects. In addition, improving the standard and sustainability of better life quality through public transport, electricity, water and healthcare were included in 10th Malaysia Plan (2011-2015).

There are four (4) common goals to ensure the sustainability of libraries based on Cottrill, et.al. in 2015; 1) ensuring that libraries have sufficient financial resources, 2) ensuring that community realize the importance of libraries and prioritize libraries more in budgetary as well as in political agenda, 3) developing policies to extend coverage of wireless network so that library have access, and 4) established policies that control library administration, facilities, services and staffing.

On the other hand, there are few challenges that will obstruct the library's sustainability which are insufficient funding for library services and library staff, losing of job among the library staff, lack of leadership among librarians, and outdated computer and poor Internet connection in libraries.

Library sustainability refers to the placement of a library's core values and resources such as staff time, facilities, collections, services and technology to endure the challenges in order to bring new and energetic life in all aspects of library operation and outreach (New York Library Association, 2017). Currently many Malaysian public libraries (including rural public libraries) ensure their sustainability by cooperating and engaging with non-

government organization (NGO), local industries and local higher learning institution. Building partnerships with other organization or agency at local, regional, national and international and also with the government organizations, non-government agencies, cultural organizations, etc. would help the rural libraries to achieve long-term sustainability and also introduces empowerment elements to local rural community.

A workshop on the contributions of Malaysia libraries to Sustainability Development Goals (SDG) 2030 Agenda was organized by National Library of Malaysia as part of supported the SDG Agenda. There are 41 librarians all over the country participated in this workshop held at Kuala Lumpur with the cooperation of Petronas Resource Centre. An International Federation Library Associations (IFLA) representative was invited to talk about IFLA and IFLA's contributions toward SDG Agenda 2030. The importance of Malaysian and Malaysian libraries as well as librarians to contribute toward SDG Agenda were highlighted. This study is the part of the contribution of the SDG agenda in the aspect of rural libraries specifically, as for currently there is no SDG stories from Malaysia (Akmal Ahmat, 2020).

In the context of Malaysia, rural libraries need to be sustained in the community due to its role of providing information to the rural community, fulfil lifelong learning efforts, social and cultural role among the community (Omar et al., 2014). Many related studies conducted by multiple researchers (Roziya et al., 2011; Omar et al., 2014; Shaifuddin, Ahmad, & Mokhtar, 2011), have proven that rural libraries have great potential to continuously enhance the knowledge of rural community. For rural community, sustainability is bigger than just environmental issues and support, in fact it is about empowerment – economically, socially and personally. A sustainable rural public library must also work toward empowering economic prosperity and social righteousness for the library staff, their users and the local rural community (Abu, 2012). Hence towards sustainability development of rural libraries in Malaysia, Malaysian rural public libraries have consistently sought to enhance their rural public library services, programs, and activities to satisfy the information needs of the local rural population and promote self-empowerment.

3. Research Methodology

A qualitative approach using structured interviews and group observation was used to investigate the local community engagement practices in Malaysian rural public libraries managed by Malaysia National Library and rural public libraries in the state of Victoria, Australia. In total three (3) prominent and engaging rural public library in the State of Victoria Australia and nine (9) rural public library in Malaysia from variety of different states were selected. The focus was to understand and compare rural libraries' empowerment programs and practices that lead to sustainability. In doing so, a multiple case study approach and cross case analysis method were used.

The respondents use to collect data, were rural public library's staff members, users, and non-users. Each of them was interviewed. Depending on their feedback, the interview session lasted between 30 and 60 minutes. The data was analyzed using ATLAS.ti version 7. Hundreds of codes were generated as a result of data analysis, which led to thematic classification. Hundreds of coding were generated as a result of data analysis, which led to thematic analysis of this study. The Rural Community Learning Network (RCLN) Traits Model was constructed by taking into account all respondents' responses, group observation discussions, and data analysis results.

Meanwhile group observation was used to provide rich and nuanced data about rural public library users' social interactions and behavior. This method complements interviews data, plus it provides a more comprehensive understanding of a research topic. Group observation is a common research method used in various fields such as anthropology, sociology, psychology, education, and management. It involves observing a group of people in a natural or controlled setting and recording their behavior, interactions, and communication patterns. Within this study a total of nine (9) group observation was done and the finding supports the results of the study objectives and question.

4. Results: The Rural Community Learning Network (Rcln) Traits Model

A traits model is a method for the prediction of human behavior. RCLN traits model provides a basis type of learning network behavioral approach using and based on local resources, material and knowledge, for instance, using local industries through partnership programs, local associations through affiliation activities, and government and non-government organizations through collaboration events and campaigns.

The Rural Community Learning Network (RCLN) Traits Model (Figure 2) provides useful insight for rural communities to value and support the rural public library as a community empowerment development center. The strategy identifies and emphasizes the significance of improving the four aspects of rural community

development for rural communities. Furthermore, the study helps to raise community members' awareness of the following community empowerment development components: 1) participation, 2) self-help and determination, 3) decision-making, and 4) leadership.

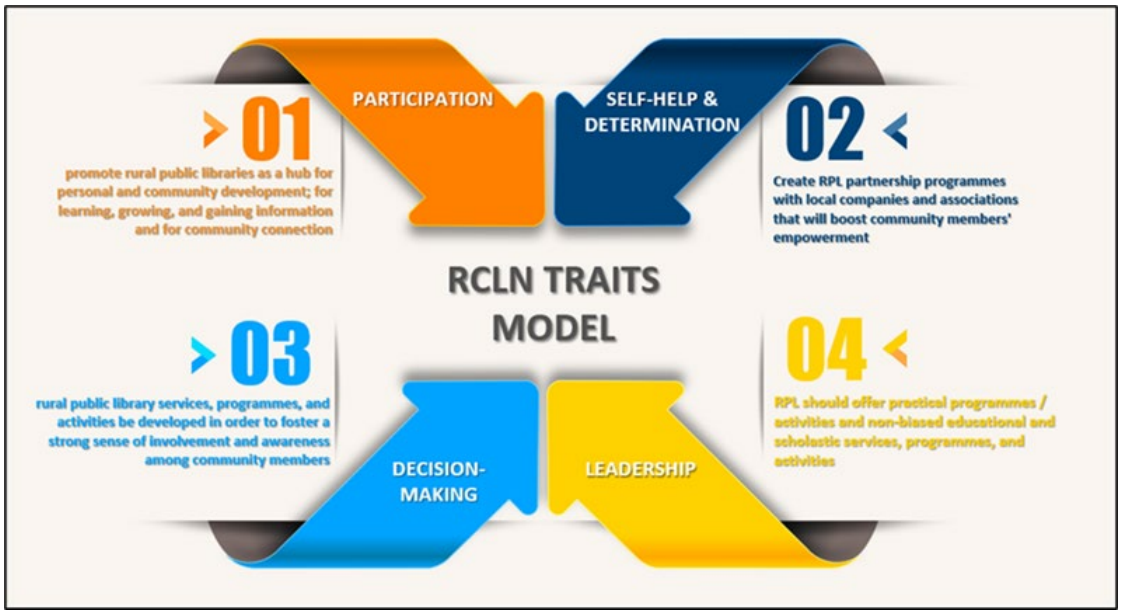


Figure 2: The Sustainable Development Goals (United Nations, 2015)

When developing services, activities, and programs for their communities, Malaysian rural public libraries incorporate elements of community empowerment development principles. Community development elements should be combined and fused so that local community members can strengthen their local, individual, and group self-empowerment. The model identifies and emphasizes the importance of improving rural community development characteristics for rural communities. Furthermore, the research contributes to raising community members' awareness of the following aspects of community development: 1) participation, 2) self-help and determination, 3) decision making, and 4) leadership. The RCLN Traits Model will be useful for current and future research in the development of rural community learning networks, which will involve major changes. The following are the elements:

- Participation: promote rural public libraries as a personal and community sustainable development hub for empowering, learning, growing, and gaining information (both formally and informally); and as a community connection and communication location.
- Self-help and Determination: Create rural public library partnership programs with local companies and associations to deliver library services, programs, and activities that will increase community members' empowerment.
- Making a Decision: It is recommended that rural public library services, programs, and activities be developed to foster a strong sense of involvement and awareness among community members. Allowing the local community to make decisions and make choices will assist them in solving problems and achieving their future goals, so rural public libraries will remain relevant to local community development.
- Leadership: It is advised that rural public libraries offer interactive, hands-on programs and activities, such as workshops on communication, management, and delegation skills, as well as impartial educational and scholastic services, programs, and activities. These engagement strategies will strengthen the local community's sense of leadership and empowerment.

The Rural Community Learning Network (RCLN) is created to provide rural communities with the opportunity to share and learn from each other. One unique aspect of the RLCN is that it allows members to helping individuals to find and learn from other community-minded individuals in their area. Through the use of the RLCN approach rural public library can help each member of local rural community to easily engage with their local community by participating in different discussion platform and sharing information and resources with one another. Individuals can also join various interest groups and create their profiles to connect with other like-minded individuals in their community. Malaysia's rural public libraries incorporate elements of community

development ideas into their services, events, and programs for their communities. Community development elements were integrated and fused to allow local residents to increase their local, individual, and group self-empowerment. Improve Malaysia's rural public libraries' programs, services, and activities by leveraging information and technology to strengthen the RCLN Traits Model.

4.1 RCLN Supporting Rural Community Consultation Effort

The Rural Community Learning Network (RCLN) works as rural community consultation as they are related in supporting community engagement and participation in rural areas.

The Rural Community Learning Network (RCLN) is a platform for sharing knowledge and resources among rural communities. It provides a way for individuals and organizations in rural areas to connect, share best practices, and learn from each other. The RCLN focuses on capacity building, skills development, and knowledge transfer, and seeks to improve the economic, social, and environmental well-being of rural communities.

On the other hand, Rural Community Consultation is a process of seeking input from rural communities on issues that affect them. It involves engaging with community members to gather their perspectives, needs, and ideas, and using this feedback to inform decision-making. Rural Community Consultation can take many forms, including public meetings, surveys, focus groups, and interviews.

Therefore, the RCLN can be seen as a tool for facilitating rural community consultation by providing a platform for sharing information and fostering dialogue between community members and stakeholders. The RCLN can also help to identify areas where consultation is needed and provide guidance on how to effectively engage with rural communities. Overall, the RCLN and rural community consultation are complementary approaches that can support the development of sustainable and resilient rural communities.

5. Conclusion

Public libraries have long been regarded as a pillar of democracy. The rural public library is no different. In fact, rural public libraries are more important than ever in empowering local communities. Furthermore, in order to achieve the Sustainable Development Goal of promoting inclusive and sustainable societies, rural public libraries must do more than just provide physical access to library resources and services in rural and remote areas; they must also ensure equitable digital access and digital literacy for all citizens, as well as provide training to rural public library staff members in information management, technology, and leadership skills. Most importantly, rural public libraries must strengthen partnerships among local libraries, local governments, and community groups in order to develop services that meet community needs and promote empowerment for long-term rural development.

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Factors Influencing Professional Virtual Communities Towards Public Service Efficiency

Geeta Albert[1], Goh See Kwong[2] and Nor Takrim Ibrahim[3]
[1]Knowledge Connections Inc., Petaling Jaya, Malaysia
[2]School of Business, Monash University, Subang, Malaysia
[3]Knowledge Management Unit, Venture Nucleus Inc., Malaysia

geeta@kconnections.com.my
goh.seekwong@monash.edu
nortakrim@vn.net.my

Abstract: Communities of practice, which are often a central component of KM, are considered to be used to facilitate information sharing, resolve internal obstacles, and enhance mutual learning. The extensive use of ICT has enabled their transformation into a virtual environment – Professional Virtual Communities of Practice (VCoPs) – which is creating ideal conditions for collaborative information sharing and learning. This research examined factors predicting usage of the VCoP and how Malaysian public sector organisations, through their adoption, can influence their service efficiency. Based on the synthesis of the UTAUT2 and the DeLone & McLean Model of IS Success, a quantitative approach was adopted for this research. 313 valid respondent data was collected using a questionnaire from public sector organisations that had adopted a VCoP as a knowledge sharing tool. A logical sequence of methods, encompassing descriptive and inferential analysis, followed by using Structured Equation Modelling (SEM), and the SmartPLS software was conducted to determine relevant statistical tests. The findings suggest that the Malaysian Public Sector will benefit from improving their knowledge sharing environment with a VCoP system. Establishing appropriate facilitating conditions, quality knowledge and an enjoyable and up-to-date digital tool will ensure continuous usage.

Keywords: Public sector KM, Virtual communities of practice, UTAUT, DeLone & McLean

1. Introduction

Knowledge is widely regarded as crucial, particularly because it is the most valuable asset in any organisation. At all levels, new knowledge is created not just by individuals, but by teams and communities of people sharing their knowledge and experience throughout the enterprise. More recent interests have tended to introduce communities of practice as structures – tools to be deliberately created by policymakers and organisations for the instrumental purpose of targeted knowledge dissemination. Public organisations have begun to support professional virtual communities of practice (VCoPs), which have evolved into an effective knowledge sharing vehicle, where knowledge workers can voluntarily engage, share opinions, make informed decisions, and eventually enhance their performance. The aim of this research is to examine factors predicting usage of the VCoP and how Malaysian public sector organisations, through their adoption, can influence their service efficiency. The study is based on the integrated perspective of popular UTAUT2, and the DeLone & McLean Model IS Success models. Findings from the VCoP usage are highlighted and discussed, with the purpose to examine implications for research on KM in public services, and for the management of these social collaborative tools in Malaysian public organisations.

2. Literature Review and Hypotheses

2.1 Professional Virtual Communities (VCoP)

Alavi (2013), defines the VCoP as "social network of individuals, who interact through social media, potentially crossing geographical, political and psychological boundaries in order to pursue mutual interest or goals". It has been observed that employees in a VCoP collectively learn to achieve their knowledge seeking objectives (Frank et al. 2017). More recent interest has tended to introduce the VCoP as structures – tools to be deliberately created by policymakers and organisations for the instrumental purpose of targeted knowledge dissemination (de Carvalho-Filho et al., 2020; Zamboni et al., 2020). A recent review concerning papers about CoPs published in major KM Journals, testified the growing interest of scholars: 25% of empirical papers were devoted to Communities of Practice in the public domain (Bolisani & Scarso, 2014).

However, empirical evidence in the public sector about KM in general, and VCoPs in particular, are still lacking, particularly when compared to the private sector (Scarso et al., 2016). The shortage of studies undertaken to predict the use in adopting the VCoP in public sector organisations, has propelled research to mitigate this gap.

Organisations like the Malaysian Public Works Department, Ministry of Trade, and the International Islamic University Malaysia have become pioneers in cultivating the VCoP amongst their professional staff. The question addressed in this article assesses factors that predict use of the VCoP system towards efficiency in public sector organisations.

2.2 Predicting Usage of the VCoP in Public Sector Organisations

Quigley et al. (2007) stressed that "no single theoretical viewpoint can provide clarification of the information sharing and transition process" from the perspective of knowledge sharing. Hence, to explain user acceptance on a particular technology, researchers apply theories and models with different variables, which have been proven successful in determining usage of a system (Venkatesh et al., 2012). There is an inclination of using a combination of theories as the UTAUT2 and DeLone & McLean IS Success models in predicting the usage of IS systems (Tarhini, A. et al., 2019). Consistent with the exponential growth of VCoPs during the last decade, this study combines these two models to predict VCoP usage for the Malaysian public sector organisations.

2.3 The DeLone & McLean Model

The DeLone & McLean Information System (IS) Success Model has been acknowledged as one of most widely used technology assessment frameworks and had contributed towards an improved understanding of IS management (Stefanovic et al. 2016). After a comprehensive review of the literature in 180 empirical studies, the researchers DeLone & Mclean (1992) grouped the IS success dimensions into six main categories of which are multidimensional and closely related: 1.system quality, 2.information quality, 3.use, 4. user satisfaction, 5.individual impact, 6. organisational impact. DeLone & McLean revised the IS performance model ten years later, adding service quality as a new dimension of assessing IS success and combining organisational and individual impacts into a single impact measure called "net value" (Stefanovic et al., 2016). The emphasis of the DeLone & McLean, (2003) updated model is on the importance of measuring the success of information systems.

2.4 The Unified Theory on the Acceptance and Use of Technology (UTAUT2)

Numerous empirical studies provide support for UTAUT2 being a robust and parsimonious model that can be adopted to explain users' acceptance of new information technology as a tool, for performing an activity (Venkatesh et al., 2012). UTAUT2 with seven constructs that affect behavioural intention and use behavior include facilitating condition, performance expectancy, effort expectancy, social influence, hedonic motivation, price value, and habit, has been applied to explain the acceptance in various industries such as Internet Banking (Arenas et al., 2013), Mobile Applications (Wong et al., 2014) and Social Media applications (Baptisa et al., 2015). As price value is not significant in organisational contexts, studies in this research setting can exclude it (Venkatesh et al., 2012).

Having examined the existing VCoP studies, the researchers construed the VCoP will require factors from both models to better predict VCoP usage. With similarity of variables, the service dimension of the DeLone & McLean model has been merged with UTAUT's facilitating conditions. Existing VCoP studies (presented in Table 1) below, examine factors that influence its usage.

Table 1: Existing VCoP Studies That Examines Factors Predicting its use

No	Research Studies that affect VCoP usage	Variables: DeLone & McLean model		Variables: UTAUT2 Model	
		Knowledge Quality	System Quality	Behavioural variables	Facilitating Conditions
1	Andrew et al. (2008) The research focussed on the VCoP, with its potential application in nursing.	Access to reified and tested best practice statements.	Simple to use online systems	Ease of use, Social influence amongst practitioners and academics	A vibrant learning environment.

No	Research Studies that affect VCoP usage	Variables: DeLone & McLean model		Variables: UTAUT2 Model	
		Knowledge Quality	**System Quality**	**Behavioural variables**	**Facilitating Conditions**
2	Meeuwesen, B. & Berends, H. (2007) Research of four CoPs within Rolls-Royce.	Knowledge quality	Social networking system with easy-to-use functions	Performance expectancy	A knowledge sharing environment
3	Yamklin, S. & Igel, B. (2012) Research based on in-depth interviews with staff in 3 CoP field sites in Thailand.	Access to new ideas and best practices	24x7 system access	Service efficacy and problem solving Ease of use	Governance – Formally integrating CoPs into the organisational structures
4	Scarso et.al (2016) Research on VCoP development and usage in corporate and public sector organisations.	Technical but shared reviews amongst experts and line professionals	Social Networking Platform with a 24x7 access to the content	Peer influence with performance expectancy	Dedicated team at every level, with top management support. Governance to manage the CoPs.
5	Haas et al. (2020) Research on VCoP Engagement	Access to best practices	Adequate technology to support and sustain the VCoP	Performance expectancy	CoP governance to develop best practices. Regular communication programs to promote benefits.
6	Wolf P., Spath, S., & Haefliger, S. (2011). An automotive case study to explore what incentivizes employees to share knowledge in intra-firm CoPs.		Infrastructure to share experiences with ease.	Performance expectancy Social influence	Support from Management
7	Othman, R., Albert, G., and Kwong, G.S. (2015). An Engineering case study to determine VCoP usage.	Problem solving forums and link to subject- matter experts.	Wikis with cloud tags for easy search terms. Online chats linking to lessons learned.	Peer influence, 'fun' environment with allocation of points for top views, queries, and feedbacks. Cultivating a habit of using the VCoP	Dedicated team with on-going awareness programs, publishing reified knowledge for easier viewing.
8	Lai and Chen (2014). Research to investigate the knowledge-sharing behaviour.	Quality knowledge		Enjoyment in helping others, Knowledge self-efficacy Reciprocity and enjoyability	Offline activities, Effective CoP Task Force and Moderators
9	Hung, Lai & Chou (2015). Study on Use intention in VCoP		Technology adoption, Resource availability		Interpersonal trust

2.5 The Research Model and Hypotheses

The research model posits that if the VCoP members have significant use intention, then this will result in increased VCoP System use and greater efficiency in public sector service delivery. The two notable models, UTAUT2 and DeLone & McLean IS Success model, was incorporated for the purpose of predicting use related to VCoP technology, based on theoretical evidence provided in the previous two sections and existing literature. The integrated research model presented in Figure 1 aimed to combine quality dimensions from the IS Success model with constructs of the UTAUT2 model, as independent variables, to predict VCoP usage. The research hypotheses and measures/items used to develop the constructs have been suggested below:

#	Research Hypotheses
H1	A higher level of a VCoP's system quality will produce a higher level of user satisfaction
H2	A higher level of a VCoP's knowledge quality will produce a higher level of user satisfaction
H3	Social influence will positively influence the use intention in the VCoP
H4	Effort expectancy will positively influence the use intention in the VCoP
H5	Performance expectancy will positively influence the use intention in the VCoP
H6	Hedonic motivation will positively influence the use intention in the VCoP
H7a	Habit will positively influence the use intention in the VCoP
H7b	Habit will positively influence the use behaviour in the VCoP
H8a	Facilities conditions will positively influence the use intention in the VCoP
H8b	Facilities conditions will positively influence the use behaviour in the VCoP
H9	User satisfaction will positively influence the use intention in the VCoP
H10	Use intention will positively influence the use behaviour in the VCoP
H11	Use behaviour will positively influence the efficiency in public service delivery

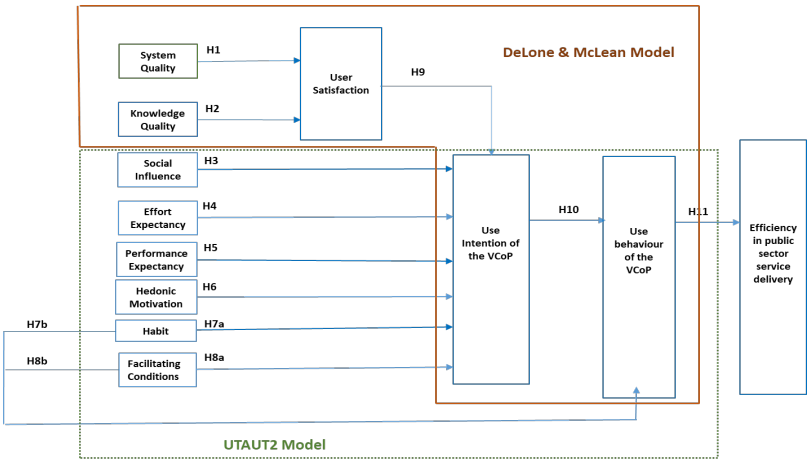


Figure 1: The Research Model

3. The Research Methodology

3.1 Design and Procedure

This study utilised a cross-sectional, questionnaire-based design. Using convenience sampling technique, 313 samples were analysed from employees adopting the VCoP in public organisations in the Klang Valley area of Malaysia in 2020. The results of power analysis following Cohen et al. (2013) and Hair et al. (2017) approach using G.Power 3.1, indicated that the sample size is big enough to achieve an alpha less than or equal to 0.05 (two-tailed) and a power greater than or equal to 80%. A link to the study's questionnaire was sent to employees to fill up. The questionnaire consisted of two sections including respondents' socio-demographic

attributes such as gender, age, academic qualification, frequency of VCoP usage, and job position, as well as the items prepared to measure the variables in the research model. Furthermore, the quantitative stand of this study, utilised the survey items originally derived by Venkatesh et al. (2003; 2012) from the UTAUT2 and the DeLone & McLean IS measurement models (2003); which supported these same items.

3.2 Participants

The sample consisted of 161 males (51.4%) and 152 females (48.6%). 74.2% of the respondents were young adults with an age range between 25-40 years of age. Majority of the participants (94%) were degree holders with 72.8% being officers. 86.3% of the respondents indicated that they have been accessing the VCoP for more than a year (34.5 % between 1-2 years, 28.8% between 2-3 years and 23% more than 3 years). Based on these responses, it is appropriate to assume that these respondents are experienced in using the VCoP and will be knowledgeable enough to provide their opinions on key success factors they feel will ensure sustenance of the VCoP.

3.3 Measures

User satisfaction was measured using two items adapted from DeLone & McLean (2003) (e.g., "The functionality and performance of VCoP website has met my expectations"). Behavioural intention was measured using three items adapted from Davis (1989) (e.g., "I intend to continue using the VCoP in the future"). To measure VCoP usage, respondents were asked to indicate if they use the seek problem solutions at work, learn about new knowledge or exchange of knowledge with other members. Systems quality was measured using four items adapted from DeLone & McLean (2003) (e.g., "It is easy to navigate within VCoP system"). To measure knowledge quality, respondents were asked to indicate if the information stored in the VCoP is relevant for their job, easy to understand, accurate, complete, and reliable (DeLone & McLean, 2003).

The items used to measure social influence (five items, e.g., "people who are important to me think that I should use VCoP") were adapted from Venkatesh et al. (2012). Also, the items to measure effort expectancy (four items, e.g. "Learning how to use the VCoP is easy for me") drawn from Venkatesh et. al (2003). Items to measure Peformance Expectancy (four items, e.g., "Using the VCoP helps me accomplish things more quickly"). Hedonic motivation was measure using three items adapted from Venkatesh et al. (2012) (e.g., "I find using the VCoP to be enjoyable") and habit (four items, e.g., "The use of VCoP has become a habit for me"). To measure facilitating conditions, respondents were asked to indicate if they have the resources, knowledge, and adequate training to use the VCoP (Venkatesh et al. (2012)). All items were measured on a 5-point likert scale.

3.4 Data Analysis

Categorical variables were presented as frequency and percentages. The measurement model and structural models were assessed using partial least squares structural equation modelling (PL-SEM) and SmartPLS 2.0 software. Data analysis revealed all missing values were addressed. Using SmartPLS, the data was analysed in several separate, but sequentially related steps. The implementation of these parameters in a systematic manner is a two-step method (presented in Figure 2). The first criterion was to evaluate the outer model (measurement model), which will include the reflective constructs' reliability and validity, followed by the Inner model (structured model).

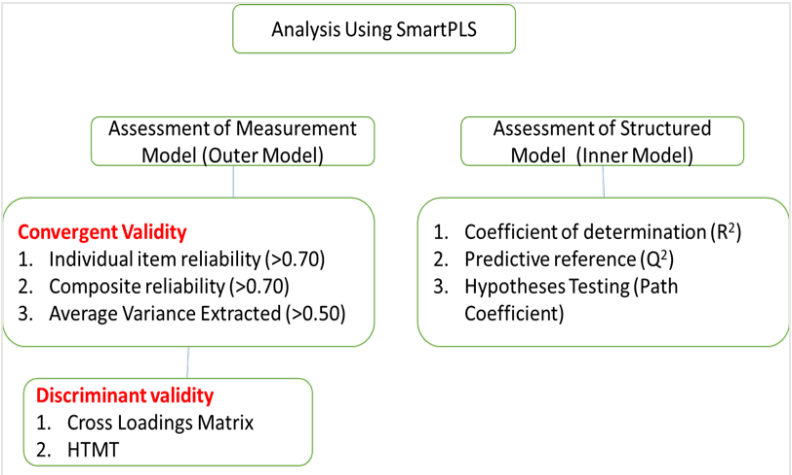


Figure 2: Model Validation Process

4. Results

The results supported construct reliability as well as convergent validity of all constructs. Cronbach's alpha (ranged from 0.754 to 0.929) indicated good internal consistency of the items of the constructs and composite reliability of the constructs (ranged from 0.754 to 0.912) support the construct validity. Convergent validity assessed average variance extracted of the constructs (ranged from 0.670 to 0.851), achieving discriminant validity. Factor loadings ranged from 0.730 to 0.929 and were significant at 0.001. As advised by Hair et al.(2017), Heterotrait-monotrait (HTMT) ratio was assessed and the value was less than 0.9, also fulfilling the requirements of discriminant validity.

4.1 Structural model assessment

While there were significant positive associations between habit (H7b), facilitating conditions (H8) and use intention (H10) towards use behaviour, this study could not support H3, H5 and H7a on the relationships between social influence, performance expectancy and habit towards use intention. There were significant positive associations between the two (2) factors of DeLone and McLean model, including systems quality and knowledge quality towards user satisfaction, supporting H1 and H2 respectively.

Also, the results supported H9 that positively associated user satisfaction to use intention. Finally, the results displayed a strong relationship between use behaviour (H11) and efficiency in public service delivery (presented in Figure 3).

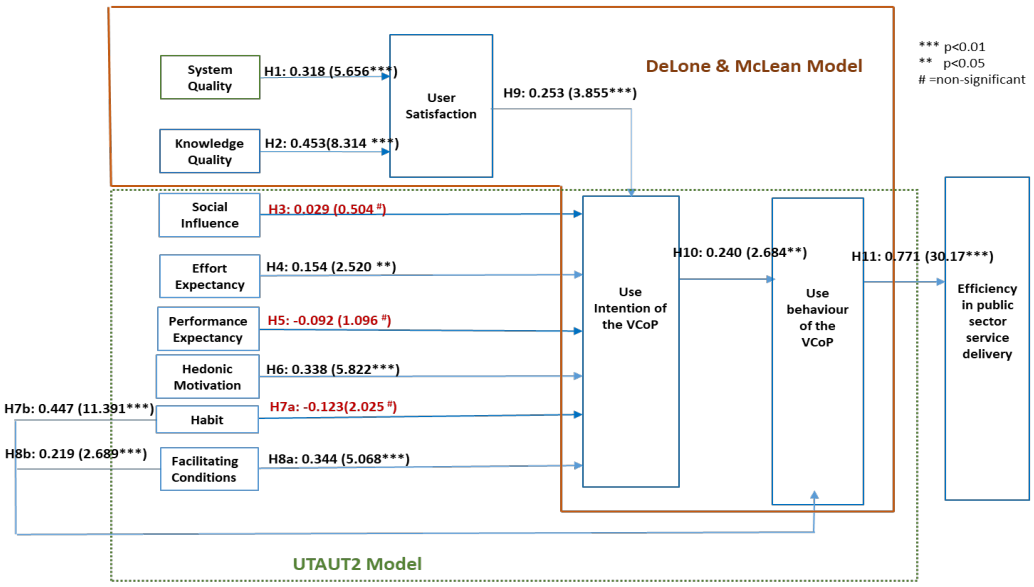


Figure 3: Research Model Assessment

4.2 Hypotheses Testing

Standard regression weights or path coefficients between constructs relevant to the proposed hypotheses were calculated to test the hypotheses. The statistical significance test was used to assess the intensity and existence of the relationships (which was either positive or negative). A t-test was used to determine the significance of the path coefficients, and hypotheses with t-statistics greater than 1.96 were found to be supported, as shown in table 3.

Table 3: Summary of Hypotheses Testing of the Research Model

#	Beta	T-stat value	Findings		#	Beta	T-stat value	Findings
H1	0.318***	5.656	Supported		H7a	-0.123#	2.025	Not supported
H2	0.481***	8.314	Supported		H7b	0.447***	11.391	Supported
H3	0.029#	0.505	Not supported		H8a	0.344***	5.068	Supported
H4	0.154**	2.520	Supported		H8b	0.219***	2.689	Supported

#	Beta	T-stat value	Findings		#	Beta	T-stat value	Findings
H5	-0.092#	1.096	Not supported		H9	0.253***	3.855	Supported
H6	0.338***	5.822	Supported		H10	0.240**	2.684	Supported
					H11	0.771***	30.170	Supported

(#p< .1, * p<.05, **p<.01, *** p < .001, two-tailed test, # - not supported)

5. Discussion

This research contained 13 hypotheses in all, with 10 of them being supported. This study proved that that people seek the VCoP knowledge base to solve work related problems or seek for expertise (Wolf, P., 2011; Scarso, et al. 2016). Based on the integrated framework, this research clarified factors that can predict engagement in VCoPs for public sector organisations. As a result, this research adds to the theory on communities of practice and laid out options for the VCoP Administrators to strategise and put in place policies and procedures, to boost member participation in the virtual communities of practice. In particular, this research will be able to highlight individual user satisfaction and technological factors that are critical to motivate the VCoP members in adopting the VCoP for their knowledge sharing and learning initiatives.

As the VCoP is a source of knowledge for information seekers, there is a belief that the quality of the technology, being an integral component in the VCoP, was posited as a potential influence in impacting user satisfaction. The H1 hypothesis was supported by these findings, which indicated that the System Quality in a VCoP had a substantial positive direct impact on user satisfaction (β=0.318, t-statistic =5.656). Similarly, the results of the study revealed that Knowledge Quality had a positive direct impact on VCoP System User Satisfaction (β = 0.453, t-statistic = 8.314).

These findings were not unexpected, as they corroborated with previous De Lone and McLean studies (Chen (2007); Gauzdal (2008); Hew (2009) and Borzillo (2017). As a result, H2: A higher level of VCoP Knowledge Quality leads to higher levels of user satisfaction, was proven to be significant. The factor, Effort Expectancy (EE) had also a positive influence (β = 0.154, t-statistics = 2.520) on use intention of the VCoP, which is consistent with UTAUT findings (Venkatesh et al., 2003) and several previous studies (Al-Shafi et al. 2009; Gupta et al., 2008). Hence H4 – Effort Expectancy has a significant positive effect on use intention of the VCoP. Consistent with findings from several studies (Venkatesh et al., 2012; Moorthy et al., 2019), there is strong indication, that fun and enjoyment can predict technology adoption. Hedonic Motivation (HM) was found to have a significant positive direct effect on use intention (β = 0.338, t-statistic = 5.822). This indicates that the more users think of answering questions in the VCoP forums (Lai & Chen, 2015), as a pleasant and competitive environment, the more likely they are to use the virtual knowledge sharing platform. Limayem et al. (2007), with their findings had stated that "an operationalization of habit was seen have direct effect on technology use over and above the effect of intention" which can be a reason as why findings from this research followed a similar path. Hypothesis (H7a) was not significant (β = - 0.123, t-statistics = 2.025) in predicting users' intention, whilst H7b posits that Habit is positively associated with the use of the VCoP (β = 0.447, t-statistics = 11.391). Facilitating Conditions in Hypothesis H8a had a significant positive direct effect (β = 0.344, t-statistic = 5.068) on use intention. Similarly, hypothesis H8b analysed the influence of facilitating conditions on use of the VCoP, and findings indicate a positive relationship (β = 0.219, t-statistic =2.689). This was in line with previous research results (e.g., Neufeld et al., 2007; Im et al, (2011)). A deeper discussion on the non-significant relationships between Performance Efficiency and Social Influence with intention to use the VCoP, indicated that these results aligned with previous research findings (Al-Shafi, 2009; Cimperman et al., 2016; Ladan et al., 2018).

Theoretical contributions of this research are threefold, one being combining two models (UTAUT 2 and DeLone & McLean) to better predict VCoP usage for public sector organisations. Second, predicting the factors that will be required to adopt VCoP usage has been studied and the findings of the research can be used to develop a VCoP framework and adopted for KM in public sector organisations. Finally, this research is explored further by determining the impact or net benefits in adopting the VCoP in organisations. By implementing the VCoP successfully, the model can determine if the VCoP users enhance employees' decision-making skills, improve their work processes or service efficacy by acquiring new knowledge "captured" in the VCoP.

The findings of this research discovered several main factors that can influence users' adoption of a web based VCoP system and can improve service effectiveness in the Malaysian public sector. The quality of knowledge,

the stability and functionality of the system, cultivating a 'fun' environment and developing a habit of using the VCoP will be key constructs to consider in ensuring the success of VCoP adoption. Investing in quality infrastructure and initiating regular change management programs throughout the organisation via regular brainstorming sessions should be advocated to develop the VCoP facilitating infrastructure. The role of the VCoP policy makers entails developing a structured implementation approach, determining functional requirements of the VCoP Knowledge Portal and content reification processes in developing quality knowledge.

Several limitations of the present study include using self-report questionnaire that may induce several response biases (Podsakoff et al., 2012). Moreover, this study collected samples only at one point. It is proposed for further studies to examine adoption of VCoP systems from pre-implementation to later stage of implementation via a longitudinal study. A robust phased-based VCoP implementation strategy is proposed, hinged on significant factors in predicting usage, paving the way in constructing a VCoP maturity framework (Albert, G., et al., 2019), in assessing gaps and building strategies in enhancing its usage.

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Learning Problems in a Remote Working Situation: A Generation Z Perspective

Anna Albrychiewicz-Słocińska
Department of Applied Sociology and Human Resource Management, Faculty of Management, Częstochowa University of Technology, Poland

a.albrychiewicz-slocinska@pcz.pl

Abstract: The transformations on the labour market related to the work modes, but also to the fact of new pension arrangements allowing early retirement, as well as the massive entry of the youngest generation of workers, known as generation Z, into the labour market, create numerous risks related to the irreversible loss of organisational knowledge, which cannot be replaced by external knowledge. New challenges that appear in modern companies are also connected with the massive implementation of remote work as a result of COVID pandemic. In these circumstances knowledge management and particularly knowledge transfer from employee to employee faced with new obstacles. In the context of the outlined econo-socio-demographic changes, the author of this paper focuses her analysis on answering the question of how remote working influences selected aspects of learning processes in organisations as experienced by Generation Z. The research was conducted in December 2022 on a sample of the Generation Z representatives with the aim to identify their experiences and opinions about the remote type of work. For the research purposes, the Likert scale-based questionnaire technique was applied. The data was analysed in the STATISTICA program using Kruskal-Wallis ANOVA on ranks test, Mann-Whitney test, and the Pearson's chi-square test. The results of the research reveal interesting dependencies between the respondents' opinions and variables such as gender, the industry in which the remote work was conducted, size of the organisation, experience in remote working and the preferred form of work in the future.

Keywords: Learning, Knowledge exchange, Remote work, generation Z

1. Introduction

The knowledge management is based on a principle that all knowledge, both explicit and latent, accumulated by the organisation is readily available to each of its members. This has an impact on decision-making processes and allows the organisation to become more agile (González-Ramos, Guadamillas, and Donate 2023). Knowledge management provides access to knowledge and information, allowing rapid development for those who are able to make good use of it (Schaefer and Makatsaria 2021). Knowledge management is often associated with modern information technology. Thanks to the latter, data streams flow from a variety of sources and can be processed and analysed in many different ways (Duque, Silva, and Godinho 2023). However, some experts on the subject argue that more attention should be paid to the human aspect of knowledge management rather than technological one (Evans, 2005, p. 23; Miković et al. 2020).

Modern technology means that work can also be geographically dispersed to a significant degree. This was demonstrated by the COVID-19 pandemic situation, when employees were redeployed to work remotely (and thus off-site) whenever possible. When we talk about the geographical dispersion of work today, we are more and more often referring to its provision not only from another city, but also from a different country or a continent. Remote working, much like outsourcing, has also become an element of operational cost control (Mueller-Langer and Gómez-Herrera 2022). Re-evaluations are taking place regarding expectations towards work and professional careers (Green 2022). The theme of work-life balance is resonating more and more strongly (Robak, 2017). The transformations on the labour market related to the work modes, but also to the fact of new pension arrangements allowing early retirement, as well as the massive entry of the youngest generation of workers, known as generation Z (Rodriguez et al, 2019; Bencsik et al, 2016;), into the labour market, create numerous risks related to the irreversible loss of organisational knowledge, which cannot be replaced by external knowledge. Part of knowledge 'leaks' out of the organisation, and some knowledge is additionally undervalued (Ritala et al. 2015). The latter specifically relates to the core tasks, that are easy to learn, but cannot be learned in the absence of teachers. In the workplaces, the generations do not work together as before. The master-apprentice relations ceased to exist. In addition, the division between the two latter groups is being blurred. Who is the master and who is the apprentice? Age or position is no longer a dividing line between these groups. The need to recruit staff with slightly different competences, such as exceptional intelligence, communication skills, the ability to solve problems and interpret information, is coming to the fore. At the same time, the demand for knowledge, that sometimes gets invalidated with time, is changing at a significant rate. Employees need to continually update their skills, so the continuous learning is becoming the norm.

In the context of the outlined econo-socio-demographic changes, the author of this paper focuses her analysis on answering the question of how remote working influences selected aspects of learning processes in organisations as experienced by Generation Z.

2. Learning as Part of Knowledge Management

Today, the importance of knowledge, both for organisations and for individual employees, is evident in the redefinition of many management terms. Among other things, the notion of career, hitherto understood as a sequence of positions of increasing hierarchical importance, is changing to a process of accumulation of information and knowledge in the form of qualifications, experience and contacts developed in the course of successive professional roles (Akkermans et al. 2021). Thus, the essence of a career lies in the lessons learnt from one's experiences - in the information, knowledge and views that one acquires and revises in the activities performed throughout one's life (Evans, 2005, p. 29). Such perception of career seems more typical for Generation Z, for whom rigid hierarchical organisational frameworks seem outdated, ossified and stifling to their own development (Dolot 2018; Duffy 2018; Hijzen and Menyhert, 2016; Lazanyi and Bilan 2017; O'Boyle et al, 2017; OECD 2014; Singh and Dangmei 2016; Zwart and Baker 2018).

Knowledge itself is also an increasingly difficult term to grasp, going far beyond what is collected in books. Its definition is now being pondered by philosophers, psychologists, management or IT specialists (Dreesens et al. 2020). As an intangible resource, it is difficult to assess. And its value is only revealed when we know what we want to know and only when we need to know it. New knowledge can emerge unexpectedly in our minds through the association of other seemingly incongruous types of knowledge or information. However, we often have no control over the process of such revelation.

Boydell (Evans, 2005, p. 30) distinguishes four types of knowledge: 'what it is', 'how to do it', 'how to become yourself', and 'how to achieve goals in collaboration with others', as well as three levels of knowledge: 'how to put it into practice', 'how to improve it', and 'how to combine it.' In contrast, Davenport and Prusak (2000) define knowledge as a fluid composition of focused experience, values, useful information and expert insight, providing a basis for evaluation and assimilation of new experiences and information. They emphasise that knowledge is born and proliferates in people's minds. In organisations, it is often recorded not only in documents and databases, but also in customs, norms and procedures. Furthermore, the aforementioned authors emphasise the distinction between information and knowledge (Liew 2007). Information only becomes knowledge by doing one of the following types of analysis: comparison (how does the information about a situation compare to other information?), corollary (how does the information affect decisions and actions), correlation (how does the information relate to the rest of the information you have), dialogue (what do other people think about the information). The views on knowledge cited are only an example of the view present in the literature that emphasizes the importance of human contact in generation and transfer of knowledge (Hau et al. 2013). At the organisational level, an interesting division of knowledge (maintaining, however, a socio-psychological perspective of knowledge) is represented by Evans (2005, pp. 31-33). It divides knowledge into four types:

- I know what - an operational knowledge (the basis for conducted normal day-to-day work);
- I know how - also an operational knowledge, but this time the body of knowledge is hidden in people's minds and consists of our experience of how something works and how to do something;
- I know why - a knowledge defining one's work, its meaning in the context of your strategic objectives;
- I know who - the lion's share of knowledge is in the minds of employees, it is crucial to have a good idea of who is who and what knowledge they have - both inside and outside the organisation).

From a personalisation perspective, knowledge management emphasises the need to build a dynamic working and learning environment that fosters the continuous generation, accumulation and application of individual and collective knowledge in order to discover new values for the company (Dagenais et al. 2020; Evans, 2005, p. 33). Thus, through a socio-psychological view of knowledge as such, knowledge management also focuses on the learning process, including mutual learning. Indeed, this process is a prerequisite for knowledge transfer between employees (Kamei and Ashworth 2023).

Discussions concerning the codifying or personalising approach to the knowledge are not just meaningless musings (Bermell-Garcia et al. 2012). The two approaches give rise to different knowledge management strategies. In the codifying approach, typical for enginnering, organisations focus on explicit knowledge. In contrast, in the psycho-social approach, managers focus on tacit knowledge. Its externalisation requires the creation of a conducive environment for the exchange of knowledge because you cannot force a person to share knowledge, nor can you force a person to accept knowledge (Akhmadi and Tsakalerou 2022). Full disclosure of

existing knowledge and acceptance of new knowledge must be guided by one's own volition and readiness lest it will be incomplete or ineffective. In today's reality, the competence to learn effectively and to teach others effectively is increasingly coming to the fore. With this in mind, management practitioners are increasingly often faced with the questions: How to create an environment conducive to learning in a remote working situation? How do you guide the development of the youngest Generation Z employees using the knowledge held by senior colleagues? Or What factors influence young employees' willingness to learn in a remote working situation. The problems and the attempt to address them are also part of this study.

3. Methodology

The research results presented in this paper are part of a quantitative survey entitled: 'Managerial aspects of managing remote working', conducted among young people working remotely, representing Generation Z. The survey was conducted in December 2022. The study presents an excerpt from the results of the research on respondents' opinions regarding the impact of remote working on learning processes. Among other things, the study posed the following problem: how does remote working affect employee learning, which is part of knowledge exchange processes.

The study was conducted with the use of quantitative research methods which utilizes the survey technique. The study included young people from Generation Z with a remote working experience including at minimum the year 2022. The most popular division in the literature assumes that Generation Z includes people born after 1995, although some researchers sometimes include those born in 1990, while others tend to include only those born in 2000 and later (Goh and Lee 2018; Kirchmayer and Fratricova 2018, Lazanyi and Bilan 2017; Bejtkovsky 2016; Hejnova 2015). Due to the fact that there are no statistics concerning the number of people aged 15-34 who perform remote work in Poland, the author focused on the group of young, economically active people representing the aforementioned category. Using the Labour Statistical Yearbook 2021 as a reference, the size of the working population in Poland in the age bracket relevant to this study was estimated to be 4,802,000 people. Table 1 presents the structure of the study population by gender and age. For the population estimated in such a manner, with the following statistical assumptions: fraction size: 0.5; confidence level: 95%; maximum error: 5% the study sample size was set at 384 persons. The study was conducted by a specialist market research agency - Fieldstat Ltd. The survey used quantitative research methods utilizing CATI (Computer Assisted Telephone Interview - 50% of respondnets) and CAWI (Computer-Assisted Web Interview - 50% of respondnets). The mixed technique was chosen because it allowed to increase the direct contact with the respondent. Contact was made with 2,783 persons working remotely. Some of the contacted people declined to participate, some could not participate due to the survey criteria (e.g., no experience of remote working in 2022), or saturation of the sample in terms of age or gender. The requirement of remote working experience in 2022 was introduced to eliminate the group of workers whose work was organised remotely only due to the COVID-19 outbreak. This is because these workers most often performed their duties and tasks in an extraordinary mode, significantly deviating from the conditions for remote work defined in the literature (Bareket-Bojmel, Chernyak-Hai, and Margalit 2023), with the most basic condition being the freedom to choose this particular form of work (Wiatr and Skowron-Mielnik 2023). The opinions of respondents who were forced to perform their work remotely due to external circumstances could therefore lead to false conclusions about their attitudes and beliefs. In the end, 388 correctly completed survey questionnaires were obtained (redundant surveys do not disrupt the planned structure of the study group). The research tool used was a standardised questionnaire consisting of 57 closed statements and 8 questions on the socio-demographic characteristics of the respondents. A Likert scale (the so-called Likert scaling technique) was used for the responses, making it possible to determine the relative intensity of the various responses (Babbie, 2004, p. 192). This form allows for a reliable and quick analysis of the collected material, as well as uniformity and ease of elaboration (Churchill, 2002, p. 309). The research tool (questionnaire) is proprietary and was prepared by members of the research team - employees of the Department of Applied Sociology and Human Resource Management, Faculty of Management, Częstochowa University of Technology.

The STATISTICA software was used in the process of compiling the research results. To assess the significance of differences in the analyzed variables, non-parametric tests were used: Mann-Whitney U test (UMW), Kruskal-Wallis ANOVA (AKW) test, Chi-square test. The obtained statistics were analysed using the publication by A. Stanisz (2006, pp.369-391). Four questionnaire validity procedures have been used: content (Rossiter 2008), face (Czakon 2014), construct (Cronbach and Meehl 1955) and nomological (Czakon 2014) ones. The scale reliability was validated using Cronbach's alpha that is a measure of internal consistency (α = ,970019).

4. Results of the Research

This paper focuses on an excerpt from the aforementioned research on employee learning issues in remote working situations. The analysis covered five indicators, for which the Cronbach's Alpha reliability coefficient was α = 0,863672 and which include the following statements:

- remote work necessitates learning new technical solutions;
- remote work involves solving problems on your own;
- remote work promotes learning from colleagues;
- remote work allows one to learn new things more effectively
- remote work allows one to learn from senior staff.

With regard to the analysis of indicators related to learning processes, the following distribution of respondents' answers was noted (Table 1).

Table 1: Percentage Distributions of Responses In Relation to Individual Indicators

Responses	%					
	1	2	3	4	5	Total
A	3.62	12.14	18.35	34.88	31.01	100
B	5.69	15,50	18.35	39.79	20.67	100
C	10.59	28.94	30.23	23.78	6.46	100
D	5.43	17.57	35.92	28.68	12.40	100
E	6.72	15.76	37.73	29.71	10.08	100

1:I completely disagree; 2: I rather disagree; 3: neither agree nor disagree; 4:I rather agree; 5:I completely agree.

Source: Research results

According to the results presented, it can be concluded that the vast majority of respondents, almost 66%, agree with the statement that remote working necessitates learning new technical solutions. A similar, but not as strong distribution of responses is presented by respondents with regard to the fact that remote working involves solving problems by oneself (60% agree or completely agree with this statement). With regard to the statement that remote working promotes learning from colleagues, the distribution of responses is more pessimistic. More than 39% disagree or completely disagree with this statement, while 30% express the opposite opinion. When it comes to the statement that working remotely allows one to learn new things more efficiently, almost 40% of respondents agree with this opinion and 23% hold the opposite view. However, the percentage of respondents without a clear attitude towards this issue is relatively high (35.92%). Similarly, with regard to the statement that remote working allows for learning from senior employees, as many as 37.73% presented an ambiguous attitude, more than 22% disagree with such a statement and almost 40% thinks this statement is true.

In relation to the indicators listed, the extent to which respondents differed in their answers has been analyzed, taking into account independent variables such as:

- gender,
- age (for the purposes of the study, it was assumed that the sample group of Generation Z representatives would be divided into three subgroups: 15-24 years old, 25-29 years old, 30-34 years old, in order to ascertain whether there are differences in opinion between the youngest and oldest generation representatives)
- the industry in which the remote work was conducted (the classification of industries adopted in the study is in line with the Polish Classification of Activities (https://stat.gov.pl/Klasyfikacje/doc/pkd_07/pkd_07.htm),
- size of the organisation (taking into account the number of employees: micro (1-9 employees); small (10-49); medium (50-249); large (more than 250)),
- experience in remote working (up to 6 months; 6 - 12 months; 1 - 3 years; more than 3 years),
- position (managerial, production)
- and the preferred form of work in the future (stationary, hybrid, remote).

Non-parametric tests were used to assess the significance of differences in the analysed variables. The distribution of results is presented in Table 2 - the table only shows statistically significant differences, which allows us to reject the null hypothesis H0 that there are no differences due to the independent variable, which allows us to accept the alternative hypothesis H1 that there are such differences.

Table 2: Kruskal-Wallis ANOVA and Mann-Whitney U tests for independent variables and selected indicators

Independent variables **AKW/UMW test at the assumed significance level (α = 0.05)**	**Analysed indicators**				
	A	B	C	D	E
Gender (UMW)	-	-	p = 0.0059	p = 0.0276	p = 0.0056
Age	-	-	-	-	-
Industry	-	-	p = 0	P = 0006	p = 0
Size of the organisation	-	-	p = 0	p = 0	p = 0
Remote working experience	p = 0.0025	p = 0.003	-	p = 0	p = 0.0004
Position (UMW)	-	-	-	-	-
Preferred form of work	p = 0.0498	p = 0.0002	p = 0	p = 0	p = 0

Source: Research results

In the light of the results presented for the significance tests, it must be concluded that the internal structure of the respondent sample in reference to age or position did not differentiate the responses on the issues in question.

Gender influenced respondents' opinions related to learning from colleagues, learning new things more efficiently and learning from senior staff. Men (35% of men surveyed) are more likely than women (23% of women surveyed) to recognise that remote working allows them to learn from their colleagues. The divide is even more pronounced with regard to learning new things, with almost 46% of men agreeing with this statement, as compared to 35% of female respondents. Similarly, when it comes to learning from senior staff, men have a much more positive outlook (34%) than women (25%).

The responses to questions on learning from colleagues and learning from senior employees were differentiated by the industry in which the remote workers were surveyed. Due to the extensive classification of industries (survey covered employees representing 19 different industries), the analysis of the significance of differences focused on the industries with the highest representation:

- Wholesale and retail trade; repair of vehicles - 26 respondents,
- Information and communication - 84,
- Manufacturing - 77,
- Water supply; sewage and waste management and recultivation activities - 33,
- Financial and insurance activities - 16,
- Real estate activities – 24,
- Professional, scientific and technical activities – 45,
- Health care and social assistance – 21.

A detailed analysis of the bivariate tables on the distribution of respondents' answers indicating statistically significant differences reveals interesting regularities. The elements of learning in the context of remote working are assessed most favourably by employees working in industries not traditionally associated with remote working, i.e., manufacturing, water supply, sewage and waste management, recultivation, and real estate activities. In industries where, according to the Polish Classification of Activities (https://stat.gov.pl/Klasyfikacje/doc/pkd_07/pdf/rozp_24_XII_2007.pdf), a significant share of remote working can be expected, such as financial activities, the IT sector or commerce, opinions on learning are moderately unfavourable, while in industries identified as highly specialised, such as professional, scientific and technical activities or health care, respondents had a strongly negative attitude towards the possibility of individual or mutual learning during remote work.

Difference significance indicators also demonstrate the impact of the size of the employing organisation on opinions related to learning during remote work. The least favourable statements were expressed by employees working in micro-organisations while the most favourable ones are found in small organisations. In medium and large organisations, positive feedback was also noted, but not as pronounced as in the case of small organisations.

Another variable conditioning respondents' statements was the experience of remote working. The issue of learning new technical solutions has been assessed negatively to a significant extent, regardless of the experience of remote working. Similar assessments were presented by respondents with regard to the statement that working remotely allows one to learn new things more efficiently. At the same time, the critical attitude was to a large extent proportional to the remote working experience. With regard to the statement that remote working involves solving problems as work by oneself, respondents showed the more optimistic outlook the higher their professional experience was. Among all groups, the respondents with shortest experience reported that they need to deal with work problems alone most often. And those with the longest experience of working remotely strongly disagree with the statement that remote working involves solving problems on one's own.

The most interesting distributions of responses to the questions, confirmed by indicators of significance of differences, were recorded in relation to the preferred form of work in the future. The distribution of indications is interesting because among the respondents who have been working remotely in 2022, only 68 of them would like to continue working in this mode, while 109 respondents preferred hybrid mode, and as many as 210 opted for stationary mode. The following patterns were observed in relation to selected learning indicators. Employees choosing remote working as their preferred mode of work in the future most often responded that remote working does not force them to learn new technical solutions (76% of the answers given, 6% were of the opposite opinion), does not involve independent problem solving (76%, 5% thought otherwise), but at the same time does not facilitate learning from colleagues (75%, 10% expressed the opposite view), does not allow them to learn new things more efficiently (69%, 10% thought otherwise) and does not allow them to learn from senior employees (50%, 15% were of the opposite view). With regard to employees choosing to work in stationary form, the distribution of responses looked slightly different. Although also in this group 60% of the respondents confirmed that remote working does not force one to learn new technical solutions (20% thought otherwise), 53% do not think that this type of work involves solving problems on one's own (29% have the opposite opinion), and 55% states that it does not facilitate learning from colleagues (28% have a contrary opinion), but only 25% do not think that remote working allows them to learn new things more efficiently (32% have opposite opinion) and 18% report that remote working does not allow them to learn from senior employees (50% have opposite opinion).

5. Discussion

There is a limitation that needs to be pointed out when considering the research results presented hereby. At the time of results analysis, no published studies on a similar issue could have been found, especially in the context of Polish labour market. This is somewhat of an obstacle, as the lack of comparative material does not allow the correctness of the research assumptions and conclusions made by the researchers to be fully verified. It should be emphasised that the survey design team made a deliberate research assumption that the remote working experience must include the year 2022, in order to eliminate the subgroup of employees who were transferred to remote working due to the COVID-19 pandemic from the group of employees with a short experience of remote working. This was done, because members of such subgroup very often performed their duties without proper preparation for remote working. In 2022, the epidemiological situation was already under control in Poland and workers doing remote work did so on their own volition or as a result of a planned organisation of work in the workplace and not as a result of external circumstances.

The first basic conclusion emerging from the picture of the survey results is that age was not a differiating factor as far as the answers to the questions are concerned. This means that, contrary to expectations, the age group defined as Generation Z, although quite stretched in the survey (15-34 years), is relatively homogeneous. Much more relevant to the issue of learning is the remote working experience. As the latter increases, the pressure to learn new technical solutions decreases, the ability to use technology for collaborative problem solving increases, but at the same time there is a growing awareness that this form of working is not conducive to learning new things more efficiently and learning from senior staff.

Women express much more critical attitudes towards remote working than men when it comes to issues of learning. Perhaps this is a result of the greater importance of interpersonal relationships in the workplace, and more social expectations of work in case of women.

It also seems that the more specialised the work the respondents did, the more learning constraints they recognised in performing their work remotely. In industries dominated by knowledge that is operational, explicit, and easy to codify and share, opinions on the impact of remote working on learning were much more favourable.

Also interesting is the observation indicating the impact of the size of the organisation on opinions about learning in remote working situations. In this case, of note are employees who believe that remote working does not promote independent problem solving learning from employees and learning from senior employees. The larger the organisation, the more favourable the opinions on the issues mentioned are, with the most optimistic statements being found among employees working in small organisations. It seems that micro-organisations lack sufficient intra-organisational stock of knowledge - a critical mass of knowledge. Learning in such organisations relies on the search for external sources of knowledge, which arguably poses difficulties that also include additional spending. As organisations grow, their structural capacity to organise work and the flow of information and knowledge also increases. At the same time, in small organisations there is the added benefit of a small number of employees who may know each other personally, facilitating direct contact. The superimposition of social relationships on structural networks for knowledge exchange and learning is a significant facilitator in this case.

Of the employees surveyed, more than half would prefer to work in a stationary mode in the future, but among those who declared to work remotely, it seems that the employees are fully aware of all the benefits and disadvantages this mode of work entails (Krzyżanowska 2020; Ewers and Kangmennaang 2023), also in terms of learning.

6. Conclusions

First and foremost, the conclusions of the research reveal that, when analysing the various aspects of the impact of remote working on elements of knowledge management, particular attention should be paid to the industry in which the organisation operates and the size of the organization itself. Any organisational knowledge is important and contributes to a company's competitiveness, but some organisations operate with highly specialised knowledge and in such cases special attention should be paid to creating an environment conducive to learning - knowledge transfer (in technical, structural and social terms). With regard to the socio-demographic factors of knowledge sharing, i.e., learning in the context of remote working, it is important to note the issues of the different needs expressed by women and men in this respect, as well as the importance of experience in working in such mode. This is because remote working requires the development of a different set of competences (from both the employee and the organisation), enabling the creation of a kind of 'prosthesis' of the classic forms of building and maintaining employment relationships that condition mutual learning. The issues analysed seem extremely interesting in the context of the ever-increasing popularity of remote working and the increased participation of Generation Z in the labour market. The study should be developed with use of qualitative methods.

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Knowledge Management and HRM Innovation Through Expatriates

Bruno Alexandre[1] and Dora Martins[2]
[1]CEOS.PP, ISCAP, Polytechnic of Porto, Portugal
[2]Research Unit in Governance, Competitiveness and Public Policies (GOVCOPP) and CEOS.PP, ISCAP, Polytechnic of Porto, Portugal

brunommalexandre@gmail.com
doramartins@iscap.ipp.pt

Abstract: In this study, the main objective is to understand how the international assignment is related to the acquisition and transfer of knowledge. As specific objectives, we intend to understand the international assignments motivations and to explore how the international assignment can impact the employee's career development. Through an exploratory case study approach, a qualitative research methodology was used to collect data, using a semi-structured interview with a group of stakeholders from an international company (five expatriates and two organisational representatives of expatriations process) in order to answer to the following research questions *which factors contribute to the acquisition and transfer of knowledge of expatriates in companies?* and *how does the acquisition and transfer of knowledge of expatriates in companies take place?* The interviews were verbatim transcript and data analysed according to thematic analysis procedures. Our findings show that expatriates are simultaneously agents of knowledge acquisition and knowledge transferring. In addition, expatriates have many high expectations about the useful of their knowledge transferring to home company, specifically in their organisational career evolution and for business innovation and competitiveness. Using the findings, on the one hand international companies can improve human resources system to fit their support practices to needs and expectations of their expatriates after return to home company. On the other hand, the knowledge brought from expatriation, helps organisations at the strategic level through market knowledge and enables the implementation of international innovation human resources policies and practices, contributing to the globalisation of the company. Some conclusions to the contributes to the knowledge management will be highlighted in the last part of the paper.

Keywords*:* Expatriates, International assignment, Knowledge management, International HRM, International career

1. Introduction

The number of expatriates on international assignments continues to grow (Renshaw, Parry & Dickmann, 2021) and during COVID-19 pandemic, expatriates became more than just people who work abroad. They became a strategic element to enhance business strategy and opportunities, and to foster knowledge transfer (Marques, Miska, Crespo & Branco, 2021). Furthermore, in context of international organisations, expatriates can serve as agents of knowledge transfer and knowledge sharing (Wu et al., 2023). Given their importance, they are seen as more than just a set of employees. However, knowledge management related to expatriation process remains limited (Canestrino, 2010; Osland et al., 2020). Among this concern, Mockaitis, Zander and Cieri (2018) suggest that there are radical changes in the way organisations are operating, underlining whether traditional models of organisations and the HR function in international organisations need new perspectives. One of them is the benefits of global teams for international firms which can contribute positively to the performance of organisational units, and people.

The expatriation process comprises a set of strategies aimed at internationalising the company's management, increasing the repertoire of knowledge for the development of a specific project or unit. Training new leaders, raising the level of coordination of geographically dispersed units, increasing the strategic diversity of human resources (HR) in the face of global markets, and exemplifying important aspects of the culture of the parent company (Bertolini & Larentis, 2019) generate that expatriates assume great importance in the implementation of these strategies inside of international organisations. Diverse international human resource management (HRM) literature (e.g., Elahi et al., 2019; Martins, 2013; Renshaw et al., 2021) attributes to expatriation the purpose of transferring organisational knowledge between different organisational units, even if they are more geographically dispersed, while the hiring of new employees to operate in the international market aims at transferring the knowledge held by these employees during the international assignment.

Knowledge management is increasingly recognised as an essential aspect of management and international business (Shao & Ariss, 2020) and expatriates function as key agents for sharing this knowledge (Martins, 2013). In this regard, the study made by Martins and Tomé (2015) shows that the knowledge acquired, and the knowledge transferred by Portuguese expatriates have directly contributed to their career development after returning from the international assignment. In addition, the research conducted by Mohammed (2015)

suggests that knowledge management contributes to the resolution of organisational issues through the application of thoughts and practices with a view to a better orientation. As referred by Nisula and Kianto (2016, p. 1920), "the success of all types of organisations increasingly depends on how the individuals' specialised knowledge is employed and integrated into organisational capabilities". It is important to understand (1) how acquisition and transfer of knowledge of expatriates in companies take place as well as (2) to explore how the international assignment can impact the employee's career development.

This research intends to contribute to the theory and practice of knowledge management, namely at the level of the implications that the international assignment of employees may bring in the improvement of organisational performance and personal motivation, through the knowledge acquired and shared during the international assignment, and the purpose of this study is to help us fill this gap.

The following sections present the literature review related to Knowledge Management and HRM Innovation through expatriates (section 2), followed by the description of the methodology (section 3). Section 4 presents the main results of the study, and section 5 underlines main conclusions.

2. Literature Review

In the literature there is no consensual definition regarding the concept of expatriation. Some authors (e.g., Briscoe & Schuler, 2011; Dasari et al., 2012) present a generalised definition of expatriation, considering that an expatriate is an employee of an organisation who performs functions in a foreign subsidiary of that organisation, in order to achieve their professional, economic and financial goals.

On the other hand, there are definitions that present more specific requirements. For example, Martins (2013) postulates that expatriation consists of a means by which companies place employees to live and work in another country, which requires the following conditions, namely: 1) placement abroad for an increased time interval, usually 3 years, renewable for similar or extraordinary periods, if there is an agreement between the parties; 2) retaining the labour link to the parent company (Home Country); 3) the hierarchical relationship, as well as the expatriate's duty to pay retribution, presenting transfer benefits to the destination organisation (Host country); 4) having the right to reintegration in the home company to a compatible position, counting for their seniority the time of expatriation. Caliaguri (2000) also presents a more specific definition, arguing that the expatriate is an employee sent by the home company to live and work in another country, for a time interval between two and several years. According to Gallon et al. (2014), expatriation should be thought of as strategic for the HR area, involving three moments: the preparation for the international assignment; the international assignment itself; the return from the international assignment (repatriation). In the literature, repatriation is characterized as the return to the Home Country, that is, when individuals return to their country, the expatriates are referred as repatriates (Gallon, 2011). This phase of the international assignment is characterized by being a complex process, which involves renegotiation, readaptation, rebuilding professional networks, and anchoring the career in the company (Gallon et al, 2017).

The experience that the repatriate had as an expatriate assumes great importance, both for him and for the organisation (Gallon et al., 2014). Often, the primary purpose of expatriation is to bring knowledge to subsidiaries, and consequently, the focus of expatriation is the international assignment itself, making repatriation the end of a cycle (Gallon et al., 2014). In this regard, Wu and colleagues (2023, p. 708) remind us that "Knowledge sharing is especially important in expatriation, because one of the main Knowledge sharing for expatriates' purposes of expatriation is to develop talents and strengthen the flow of cultural knowledge between headquarters and offices in different countries". The same authors consider that through Knowledge sharing, expatriates can learn and improve internal processes, which can result on positive influence on financial performance of organisation. This argument makes sense specially when expatriates can effectively share knowledge, they are able to exchange their ideas, which leads to collective learning and motivate them to be more innovative (Wu et al., 2021). From this perspective, it is important to do an effective knowledge management. By knowledge management is meant the interaction and communication of implicit knowledge, the former must be evidenced, that is, codified, transformed into words or numbers so that any individual can access, understand and transfer (Martins, 2010).

In this sequence, any company that intends to have a knowledge management, will need to correctly perform the organisational knowledge transfer, considered as one of the elementary agents of the overall knowledge management process (Martins, 2010). According to Serrano and Fialho (2005), the success of a company is based on its ability to originate and transfer knowledge more effectively than its competitors.

Through several transfer procedures, knowledge must be spread quickly and effectively throughout the company, because ideas have greater repercussion when they are widely shared (Martins, 2010). The knowledge brought from a repatriation, helps organisations at the strategic level through market knowledge and enables the implementation of international HR policies and practices, contributing to the globalisation of the company (Gallon, 2014; Wu et al., 2021). Prior research (e.g. Barba-Aragón & Jiménez-Jiménez, 2020; Krammer, 2022) suggests that innovation allows the development of valuable and scarce resources in the organisation, namely, HRM has also extensively linked to innovation performance (Easa & Orra, 2020; Wikhamn et al, 2022).

Although the literature highlights that knowledge transfer is one of the most critical activities within organisations (Joshi et al., 2004; Osland et al., 2020; Shao & Ariss, 2020), multinationals rarely systematically collect and use expatriate knowledge, despite the competitive advantage it represents in a global knowledge economy (Osland et al., 2020). In this regard, Nisula and Kianto (2016) argue that organisations have been paying increasing attention to knowledge management, because they are becoming aware of the importance that the collective knowledge of an organisation can contribute in creating value to help an organisation to compete, stressing that knowledge management "is typically seen to consist of knowledge processes (such as knowledge creation, sharing, acquisition, transfer and application) and infrastructures or management activities that support and enhance the knowledge processes" (Nisula & Kianto, 2016, p. 1923).

The literature suggests that there are several factors that contribute to the acquisition and transfer of knowledge within organisations. Oddou et al. (2013) show that expatriates after an international assignment acquire new perspectives, highly relevant global knowledge, a more globalised mindset, new networks as sources of information and personal growth, and improved managerial and global communication skills. It is therefore important that organisations are able to: (a) create an organisational culture that promotes knowledge sharing, (b) incorporate expatriate knowledge in decision-making or (c) create mentoring programmes that enable expatriates to share their knowledge transfer skills with future expatriates. In line with this perspective, Doherty & Cormican (2017) and Elahi et al. (2019) reinforce that verbal communication should be considered as a knowledge transfer tool used between expatriates and local workers for the diffusion of organisational knowledge, while Burmeister and Deller (2016) highlight the promotion of seven high-performance work practices (selecting and hiring staff, training, career development, job design, performance appraisal, compensation and rewards and internal communication) throughout the international assignment period as the factors that could positively facilitate knowledge transfer. Przytuła et al. (2018) conducted a study whose objective was to develop a model of knowledge transfer between the company's headquarters and the local subsidiary and to empirically evaluate the knowledge transfer process in five foreign subsidiaries based in Poland. The results showed that local employees recognised the usefulness of expatriates' knowledge and highlighted their knowledge transfer skills, motivation for learning and knowledge acquisition (Przytuła et al., 2018). Other studies (e.g. Bucher et al., 2019; Doherty & Cormican, 2017; Wu et al., 2021) mention the role of leadership in the knowledge transfer process. On the one hand, Bucher et al. (2019) found that leadership facilitates knowledge transfer through the perceived trustworthiness of expatriates' co-workers. On the other hand, Doherty and Cormican (2017), report that one of the factors related to effective knowledge transfer in a multinational technology organisation is leadership. In turn, Suutari (2019) highlights that the ability of expatriates to engage in knowledge transfer is closely associated with their position or function in the organisation.

3. Methodology

Through an exploratory case study approach (Yin, 2014), a qualitative research methodology was used to collect data, using a semi-structured interview with a group of stakeholders from an international company (expatriates and organisational representatives of expatriations process). This semi-structured interview had three groups of questions, one related to interviewees characterisation, another related to the international assignment motivations, and the last related to the exploration of how the international assignment can impact the employee's career development. Two interview guides are developed based on general themes (e.g. motivations to transferring/sharing/acquisition of knowledge and contribution of expatriation for career advancement) which include 13 questions, namely about function, duration of international assignment, motives (individual and organisational) for carrying out the international assignment, expectations related to international assignment, contribution of international assignment to transferring/sharing/acquisition of knowledge, contribution of international assignment to career advancement or future perspectives about professional career in the organisation. In the case of expatriates, two criteria are identified to select the

participants: i) to be currently expatriates and to be in an international assignment, at least, 6 months. To select the organisational representatives, it is just necessary they have expatriates on their team and hierarchy report. Five expatriates and two organisational representatives were invited to participate in this exploratory research, between February and March 2023. Their personal contact (email and mobile phone) was obtained from the HMR Head. An informed consent document was also developed and sent to all the study participants to be signed. The average duration of each interview was 20 minutes. Confidentiality was granted to interviewees and to the organisation, as well. The interviews were recorded. The next phase involved the treatment and analysis of the information collected according to the content analysis method. The data analysis was supported in a detailed description of the theme categories (Braun & Clarke, 2006), each one including interview quotes. This analysis was carried out manually and it followed a cross-case synthesis analytical technique (Buchanan, 2013). In each of the empirical data collection phases, a pre-coding framework was developed, created from a set of thematic categories arising from the reviewed literature (Braun & Clarke, 2006). To ensure validity, the analysis of the empirical data was conducted separately by two researchers (King, 2013).

3.1 Case Description

The Alpha company is a subsidiary of a German multinational dedicated to the manufacture of semiconductors for renewable energy and has been present in the Portuguese market since 2007. In the Portuguese subsidiary it has around 2000 employees. Currently, Alpha has 200 expatriates. To preserve anonymity, we do not provide more demographic characteristics of company.

3.2 Participants Description

Five expatriates were interviewed (all males; aged 40 in average). All expatriates had a technical position (installation, assembly, maintenance functions), and they are within the company for 1 year at least (minimum 13 months and maximum 14 years) with an average of 4,5 years of international assignment. The research also includes two organisational representatives with responsibilities on expatriation process (1 male and 1 female, aged 44 in average). Both organisational representatives are management positions (expatriates team leaders). Their seniority in the organisation is 12 years.

4. Results

4.1 The Motivation to Transferring, Sharing and Acquisition of Knowledge

International assignments are predominantly for sharing and transferring, although the acquisition of knowledge is also valued:

> *"They will transmit more than acquire because as a rule they already know what they are going to do when they are going to work abroad, but I would say that they always acquire some knowledge as well." (Interviewee 6, organisational representative)*

> *"They acquire more cultural knowledge, but they mainly transmit technical knowledge to the teams. If this transfer did not exist it would not be positive at all for the company, so it is very important that these expatriates are trained to transmit, because if they refuse it will have negative consequences on the company's results and when they share it we have other colleagues from other plants of the group asking for help from our expatriates, given the experience and technical knowledge they hold" (Interviewee 7, organisational representative)*

> *"... seeing a project from start to end, a person learns and acquires a lot of knowledge. And for new colleagues who also join the company, a person can also pass on that knowledge to those colleagues." (Interviewee 5, expatriate)*

While, from the expatriate's point of view, the international assignment may have both monetary and technical enrichment motivations for the expatriate himself, the organisational representatives emphasise the benefits of expatriation in terms of greater productivity for the organisation, greater speed in carrying out the work and the ability to transfer knowledge to other colleagues, freeing these expatriates from the workload that they end up having to take on while other colleagues do not master the knowledge that they are sharing. For this reason, expatriates are encouraged to share knowledge in order to be more efficient and, inherently, to make the company more productive, as the following accounts clarify:

> *"It's not only the monetary factor, it's also because renewable energies are the future for me. From my point of view that will be the future, hence also investing in that area (...) if I know that my colleague*

does not know, if I do not transmit them the knowledge I have, the work will be all for me, because the colleague does not know how to do it." (Interviewee 4, expatriate)

"For the company it has benefits because it allows greater productivity, greater speed and efficiency in the execution of work. The company wins because it becomes more efficient in the execution of the work, so we encourage our expatriates to acquire knowledge in order to have more knowledge and to be more efficient, and therefore being more efficient the company will also be more efficient. We also encourage the sharing of knowledge to free the more experienced in knowledge so as not to overload them and also because if there is no sharing of knowledge, this decreases the efficiency both of the worker who has more knowledge and the one who has less knowledge and also the one from the company. The more knowledge they pass on to the less experienced the easier the day-to-day life of the more experienced becomes." (Interviewee 6, organisational representative)

"They acquire knowledge to transmit to other colleagues later, (...) for example we had technicians that went to Germany to acquire knowledge in a new type of machine and then these technicians were assigned to a project in the Netherlands to transmit the acquired knowledge to new colleagues that were in that team in the Netherlands (...) having that knowledge makes them perform well and, obviously, this makes our organisation achieve better global results and to be chosen to take on new international projects since organisation's work is recognized for having new knowledge and new international experience." (Interviewee 7, organisational representative)

4.2 Contribution of Expatriation for Career Advanced

Both expatriates and organisational representatives admit that the effects on career development may be more related to their career as expatriates than to management positions in the home company. One of the expatriates (expatriate 2) states that "since I joined the company, I feel that I grew as a worker and even as a person, in all the places I went I always learned something, no matter how small it was, but I was always able to learn something and I was able to grow a lot, yes. This idea is reinforced by the account of one of the organisational representatives interviewed (organisational representative 6) who assumes that "international assignments do not help in internal career progression because it doesn´t take place where they are needed, so we cannot consider international experience as a differentiating factor for internal career progression."

However, some expatriates expect the international assignment to have positive effects on the development of their career in the home company: "I usually say that I am giving up my family and social life for the sake of something and that something is to enrich an area where they may give me a good financial return immediately, yes, but that may open doors for me in the future as well. Without any doubt, that may help me to have greater opportunities for growth and continuity in the organisation" (Interviewee 4). This expectation is confirmed by one of the organisational representatives who was once an expatriate and today has a project team coordination role testifying that: "we have examples of technicians who were in the international and who were chosen to take on project Management coordination roles as a result of the knowledge they acquired over the years. They were expatriates and if they had not been expatriates, they would never have acquired this knowledge." (Interviewee 7, organisational representative)

5. Discussions and Conclusions

The results show that motivation can influence knowledge sharing, transferring and acquisition by expatriates of this case-study company. These results are in line with previous studies by Wu et al. (2023) because: (1) these expatriates were recruited based on their expertise and skills; (2) they may be not afraid of losing personal value if they transferred their knowledge with local colleagues and; (3) the rewards obtained in the future within the home company are attractive, such as salary increase, bonuses, career promotions, better learning and growth. Furthermore, the results obtained denote that expatriates who are sharing more knowledge, gathering more information and knowledge are enabled to manage global processes (cost reduction, low prices, reduction of delivery times and promotion innovative ideas) as underline Wu et al. (2023). Recent researchers (Li et al., 2022; Wu et al., 2023) also add that organisational support represents an important factor on knowledge sharing, considering crucial to promote more willing to share knowledge with their team colleagues (Wu et al, 2023) as well as will strengthen the influence of trust, commitment on knowledge sharing (Osland et al., 2020).

Regarding this organisational case study, expatriation is considered a strategy to meet the main organisational objectives through expatriates (e.g., new organisational techniques and processes). Taking into account the results presented here, it is suggested that for a better management and transfer of knowledge, companies

should provide adequate organisational support to their expatriate employees, and it is important that they perceive this support; they should motivate them so that the transfer of knowledge occurs, not only from the employee himself; they should invest in frequent and informal communication, improving the internal organisational communication mechanisms, as referred to Li et al., (2022).

Some conclusions can be obtained from this study. First, the effectiveness of knowledge transfer is a crucial issue for the successful operation of a business unit. Secondly, the study results show that, through expatriates, the home company can promote knowledge sharing to facilitate knowledge acquiring and consequently to increase the effectiveness of knowledge transferring. Third, our study shows that HRM and team leaders support in a home company could play an important role in employees knowledge acquiring, transferring and sharing, namely through promoting performance assessment, training opportunities and career advance within the home company. These conclusions are in line with previous literature (Li et al., 2022; Wu et al., 2023) which refer that organisational support can increase favourable employees' outcomes, including willingness to share knowledge. Furthermore, our results show that knowledge sharing can help expatriates collaborate with then colleagues and develop new ideas to facilitate organisational innovativeness and competitiveness as well as to improve the productivity and performance of MNE (headquarter and their subsidiaries) as recently also concluded Li et al. (2022).

Although the results of this research have provided several conclusions with implications to the managers and specifically to the HRM function, this study presents some limitations, which encourage future research directions. One limitation is related to research design centred on qualitative methodology and a specific time. We propose that future research can carry out longitudinal study. Therefore, the number of participants of this study are limited to expatriates involved on the same project at the same time, this number of participants may be small to represent all expatriates from the study company. Finally, this study adopts the semi-structured interview approach to acquire the perceptions from expatriates and organisational representatives. Future research studies should carry out quantitative study to investigate the correlations between some hypothesis involved with the phenomenon of expatriate's knowledge sharing, transferring and acquiring. For instance, to compare the different antecedents' mediators and moderators' factors to enhance expatriate performance related to knowledge sharing.

More studies in this area are desirable, namely in Portugal, to better understand this knowledge transfer process through expatriates. Future studies could replicate and extend our study in different subsidiaries within this MNE as well as different industries. However, given the current context of internationalisation of Portuguese companies, as well as the high costs inherent in an expatriation process, the development of further studies is urgent to contribute to scientific knowledge that can be applied in practice in Portuguese organisations, to optimize and maximize the benefits of an expatriation process, both from the employee and the organisation point of view. Such studies would help to expand theoretical understanding related to knowledge management and expatriation management, such as job attitudes and behaviours on knowledge sharing, transferring, and acquiring.

This study helped us to clarify that knowledge acquisition/sharing/transfer through expatriation is motivated differently by organisational representatives and expatriates. On the one hand, organisational representatives want the acquisition/sharing/transfer of knowledge to enable them to increase organisational productivity, on the other hand, expatriates consider that the acquisition/sharing/transfer of knowledge could be financially beneficial for them in the short term along with the opportunities for enriching technical skills. Expatriates perceive that the opportunity of acquiring/sharing/transferring knowledge may have repercussions on their professional growth in terms of their organisational career, either as expatriates or as supervisors of international teams.

Finally, the results of this study allow us to extract some managerial implications. Specifically, how expatriation can be an organisational strategy for the acquisition/sharing/transfer of knowledge between different subsidiaries and provides hints on how those responsible for expatriate management. It can guide activities related to the recruitment and selection of expatriates as well as the importance of investing in attractive short-term reward systems in order to ensure the retention of expatriates. In other words, those responsible for expatriate management should be prepared to manage two interlinked human resources management processes: the attraction and retention of expatriates. Therefore, this research may help managers to reflect carefully on how they manage expatriates to satisfy opposite motivations, and not always easy to align, especially when the organisation wants efficiency and effectiveness gains and expatriates want more money and internal career development.

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Knowledge Sharing for Contextual Performance: An Empirical Study in the Ministry of Culture, Tourism and Antiquities in Iraq

Sawasn Al-husseini[1] and Rana Diaa Abdel Baqi[2]
[1]Institute of Administration - Rusafa, Middle Technical University, Baghdad, Iraq
[2]Technical College of Management- Baghdad, Middle Technical University, Iraq

Sawasn.alhusseini@mtu.edu.iq
dcc0006@mtu.edu.iq

Abstract: Knowledge and knowledge sharing are the main drivers of economic development and the main key to enhancing performance. This research aims to examine the impact of the knowledge sharing (donating and collecting) on the contextual performance at Ministry of Culture, Tourism and Antiquities in Iraq. To achieve the objectives of the research, the descriptive and analytical approach was used through the distribution of (278) questionnaires to the employees at the Ministry. Structural equation modeling with AMOS v.28 was used to build the model and analyse the relationships between variables. The research found that knowledge sharing can create a performance culture for the Ministry employees by building and encouraging knowledge collecting and donating inside and outside their departments, which in turn, increase their skills and experience in developing the performance of their tasks and duties. The implications of the findings and suggestions for future research are discussed.

Keywords: Knowledge sharing, Contextual performance, Service sector

1. Introduction

Today, service organizations operate in a complex environment and facing global challenges such as intense competition and rapid changes in IT, market instability, in addition to increasing demand for quality of services (Mathew 2010). These external pressures are forcing this sector to be not only efficient and effective but also innovative. Knowledge and knowledge sharing plays a vital role in increasing the effectiveness and creativity of the organisation by converting the tacit knowledge embedded in individuals into explicit knowledge through interaction (Hislop et al. 2018). It's can increase the ability of organisational members to solve complex problems at work, reduce errors and increase their organisational learning, and accordingly improving their job performance (Abbas and Sağsan 2019).

In developing countries like Iraq, cultural institutions such as the Ministry of Culture, Tourism and Antiquities play a vital role in the economic development of the country by creating a cultural environment stimulating creativity and prosperous tourism. This Ministry faced significant challenges, represented in how to improve its cultural, artistic and tourism activities. It needs to promote the cognitive interaction between its employees to be able to achieve its objectives and perform its work at a high level.

Previous studies have looked at the relationship between knowledge management and performance (Alghaila et al. 2017; Ali et al. 2018). However, few studies dealt with knowledge sharing (donating and collecting) and their impact on the contextual performance of the employees of service organisations in developing countries such as Iraq. Given the importance of the role played by this sector on the economic level, this study seeks to examine the impact of knowledge sharing on the contextual performance at the Ministry of Culture, Tourism and Antiquities, and to provide suggestions and recommendations to the decision makers in light of the results that will be realized.

The structure of the paper is as follows: In the next section the researchers will presents an overview of the literature as the basis for the main and sub-hypotheses. Then, the method used to analyse empirically the hypotheses. After that the findings will be presented. This will be followed by discussions of results of the research, and then, the implications of the research. Finally, outline the main conclusions and points out some of the recommendations for future research and limitation of it.

2. Knowledge Sharing and Contextual Performance

Knowledge is a dynamic humanitarian process to justify personal belief in reality (Hislop et al. 2018). It is one of the intangible assets that helps the organisation to continue and grow along with other resources such as capital, land and human resources (Abbas and Sağsan 2019). It consists of data including primary numbers, facts, and images based on observation, not analysis, and information that summarizes the data (Chen and Nonaka 2022).

Previous literature categorised knowledge into tacit knowledge and explicit knowledge: Tacit Knowledge reflects the skills and knowledge that exists within the mind, heart and behavior of each individual which is difficult to share or transfer to others (Akhavan and Hosseini 2016). It's subjective and intangible assets and rooted in the minds of individuals accumulated through study, learning and experiences and developed through talks, workshops, job training, and social interaction (Massingham 2019). While explicit knowledge refers to knowledge that can be easily transferred from an individual to another through written or oral messages and found in the books, databases, forms, procedures and policies, or, stored in the archives of the organisation (Abbas and Sağsan 2019).

Hislop et al.(2018) indicated that knowledge management is the process of creating, publishing and implementing organisational knowledge and exploiting new opportunities to improve the performance of the organisation. It's argued that the improving of the performance and creativity is achieved in knowledge management when knowledge sharing is considered (Chen and Nonaka 2022). Knowledge sharing refers to the transfer, interaction, understanding and creation of new knowledge that occurs between individuals. It is a two-dimensional process through which employees share their tacit and explicit knowledge and among themselves. Their daily interaction creates new knowledge through the process of sharing knowledge, which is donation and collection (Hooff and Weenen 2004). Donating knowledge process refers to the communication of individuals with others to share the knowledge they possess from their skills and experience (Akhavan and Hosseini 2016). The main objective of this process is to make individual knowledge become collective and organisational knowledge over time (Hislop et al. 2018). Accordingly, the organisation that creates an atmosphere that encourages individuals working within the organisation to share their knowledge within the group is more likely to develop new ideas and enhance organisational outcomes such as organisational performance (Abbas and Sağsan 2019). In contrast collecting knowledge represents the individual's desire to seek, accept capital and new intellectual knowledge (Hislop et al. 2018). This type of knowledge sharing processes represents the collection of knowledge by the individuals working in the organisation through asking questions, translation and consulting with others (Akhavan and Hosseini 2016). Hooff and Weenen (2004) indicated that knowledge collecting occurs when employees in the organisation are ready to learn from others. It means learning, understanding and applying knowledge.

These processes of knowledge sharing, promote trust and mutual respect, as well as facilitate the flow of knowledge assets to individuals to be invested and subsequently improve performance. It was also found that the collecting and donating of knowledge are linked to organisational learning because learning from others can help and generate new ideas that improve creativity and thus organisational performance (Akhavan & Hosseini, 2016).

Edgar and Geare (2013) asserted that contextual performance represents the employee behaviors that facilitate the organsational, social and psychological context in which the main technical tasks are performed. It consists of activities that improve morale, encourage cooperation among the organizational members, remove barriers to performance, maintain good working relationships, and help co-workers perform task-oriented job activities (Lopez-Cabarcos et al. 2022). Bryan and Vitello-Cicciu (2022) believes that contextual performance represents the behaviors which primarily aims at smooth performance of the organsation, as well as proactive behaviors aiming at changing and improving the work procedures and organisational processes, which include organisational citizenship behavior such as altruism, conscience, co-worker assistance, civil virtue, courtesy, sports spirit, and positive organisational behavior. Through contextual performance, employees can provide ideas for improving performance of the organisation and take action to protect the organisation from potential problems (Ribeiro et al. 2018). In the same context, Nam and Park (2019) explained that contextual performance represents the set of individual informal efforts that constitute the psychological, social and organisational context as a motivational and important factor for activities and processes related to the organization's tasks. When employees voluntarily assist co-workers, act in ways that maintain good working relationships, or make extra effort to complete the task on time, they are involved in contextual performance (Lopez-Cabarcos et al. 2022).

Organisation needs knowledge to improve its job performance, through knowledge sharing, problems are identified at work and new knowledge is created to solve them (Imran et al. 2018). Tacit knowledge is embedded in the minds of individuals working at all levels. Accordingly, it must be transformed into explicit knowledge (Hislop et al., 2018). When knowledge sharing processes practiced by members in the organisation, knew knowledge will create, routines and models, and which in turn facilitate solving business problems (Iqbal et al. 2019).The knowledge- based view recognises that knowledge is a valuable resource for the organization (Chen

and Nonaka 2022). The sharing of knowledge has emerged as an important area in the investigation of performance (Bryan and Vitello-Cicciu 2022).

Prior literature reported that knowledge management is an antecedent factor for performance. For instance, Urban and Matela (2022) found that that creativity plays a vital role in the relationship between knowledge management and the performance of companies. Meanwhile, Kokkaew et al. (2022) suggested that knowledge acquisition, creation, storage, retrieval, transfer and use positively related to the organisational performance in infrastructure construction companies in Thailand. In the same context, Ding et al.(2019) pointed out that prudent leadership has positive effects on the performance of organisational creativity through the mediating role of knowledge management.

Although these studies examined the relationship between knowledge sharing and performance, few studies dealt with knowledge sharing processes and their impact on the contextual performance of employees. Thus, there is a need for research that addresses practical difficulties of sharing knowledge on performance in developing countries such as Iraq in particular, and therefore, this research suggests the following:

H1: knowledge sharing through donating will positively effect on the contextual performance in the Ministry of Culture, Tourism and Antiquities in Iraq.

H2: knowledge sharing through collecting will positively effect on the contextual performance in the Ministry of Culture, Tourism and Antiquities in Iraq.

3. Method

This research used the quantitative approach to investigate knowledge sharing processes on contextual performance. This approach seeks to test the theory by examining causal relationships between variables. A self-administered questionnaire was used, all its elements were developed using the 5-point Likert scale ranging from 1 - strongly disagree to 5 strongly agree. The questionnaire was translated into Arabic using the translation back-translation procedure (Saunders et al. 2019).

3.1 Measurements

Ten items were developed from Hooff and Weenen (2004) to measure knowledge sharing, which reflect the exchange of work-related knowledge, experience and skills among employees at the Ministry through knowledge donating and collecting. Ten other questions measure contextual performance, which reflects the employees' adherence to job requirements, increasing the quantity and quality of work performed, perseverance and dedication to work, as well as helping others at work (Williams and Anderson 1991).

3.2 Sample and Procedure

The research was carried out in the Iraqi Ministry of Culture, Tourism and Antiquities, one of the ministries of the State sponsoring the oldest civilization and culture known in history. The Ministry was founded in 1964 and works diligently and faithfully to protect, and is committed to promoting and upgrading the pillars of Iraqi culture. It sponsors intellectuals and creatives, and develops tourist attractions, archaeological areas, and religious centers as one of the tributaries of the national economy.

The population size is 2000 employee in the ministry. Thus, a required precision level of 7% and a 95% confidence level gives a required sample of 185 employee according to Glenn (2003). Hair and Babin (2018) asserted that, in the structural equation modeling (SEM), the sample size should be greater than 100 to provide satisfactory statistical power. Thus, according to the results above, the sample size was deemed acceptable for the current study. 300 questionnaires were distributed using delivery and collection questionnaire to collect data. Employees from the ministry were randomly selected to receive the questionnaires. of which 278 (92% response rate) were returned and usable for analysis. The characteristics of the respondents are provided in Table 1. Females represented 41.4%% of respondents and males, 58.6%. Regards age profile, tenure and education level respondents were asymmetrically distributed across the different categories.

Table 1: Profiles of Valid Respondents

Characteristic		Frequency	Percentage
Gender	Male	163	41.4
	Female	115	58.6

Characteristic		Frequency	Percentage
Age	<30	45	16.2
	31-40	49	17.6
	41-50	120	43.2
	>51	64	23.0
Education Level	Secondary	46	16.5
	Diploma	12	4.3
	Bachelor	81	29.2
	Master	127	45.7
	Doctorate	12	4.3
Tenure	< 5	50	18.0
	6-10	54	19.4
	11-15	63	22.7
	>16	111	39.9

4. Findings

Structural Equation Modeling (SEM) with AMOS was used to test the impact of knowledge sharing processes namely donating and collecting on contextual performance. SEM consists of two steps: A measurement model to evaluate the convergent validity of the construct and structural model to test and evaluate causal relationships between variables.

4.1 Construct Validity of the Model

Confirmatory factor anaylsis (CFA) with AMOSv.28 was used in this research to evaluate the construct validity which consists of convergent validity and discriminant validity. The convergent validity indicates the degree to which independent measures are accurately related to the same variables under consideration. It was tested through the factor loadings and the average variance extracted (AVE) measure, both of, which should be 0.5 or higher (Hair and Babin 2018).

The research was assessed reliability based on Cronbach's alphas and composite reliability (CR), each of which should exceed 0.7. Table 2 shows that the convergent validity and internal reliability were satisfactory. All factor loadings, and the CR and AVE, were acceptable and significant:

Table 2: Results of the Confirmatory Factor Analysis

Construct	Item code	Loading	Average Variance Extracted	Campsite reliability	Cronbach's alpha
Knowledge donating	Q1	0.697	0.65	0.89	0.93
	Q2	0.784			
	Q3	0.865			
	Q4	0.840			
	Q5	0.836			
Knowledge collecting	Q6	0.880	0.66	0.88	0.94
	Q7	0.896			
	Q8	0.798			
	Q9	0.759			
	Q10	0.745			
	Q11	0.865	0.67	0.91	0.95

Construct	Item code	Loading	Average Variance Extracted	Campsite reliability	Cronbach's alpha
Contextual performance	Q12	0.885			
	Q13	0.716			
	Q14	0.806			
	Q15	0.868			
	Q16	0.659			
	Q17	0.818			
	Q18	0.901			
	Q19	0.759			
	Q20	0.839			

Note: N= 278

Discriminant Validity was also tested, which represents the internal consistency of one factor and distinguishes it from the another factor based on the standards established by (Fornell and Larcker 1981). According to them, the AVE should be greater than the squared correlation between two constructs.

Table (3) shows the acceptability of the discriminant validity for the model since the extracted AVE is higher than all of the squared correlations between items.

Table 3: Discriminant Validity and Descriptive Analysis

Construct	Mean	Standard Deviation	1	2	3
Knowledge Donation (1)	3.252	0.875	0.65		
Knowledge Collection (2)	3.410	0.885	0.512	0.66	
Contextual performance (3)	3.539	0.870	0.534	0.520	0.67

Note: N=278

The goodness of fit of the model was found to be acceptable, as shown in Table 4, according to (1) the absolute fit indices, namely χ^2/df and the root mean square error of approximation (RMSEA) and (2) the model comparison indices. The fit indices used most often are the incremental fit measurement, which includes a normed fit index (NFI), a comparative fit index (CFI) and goodness of fit index (GFI) (Byrne 2016):

Table 4: The fit Indices of the Model

Fit index	Knowledge Sharing	Contextual performance	Target
χ^2/df	1.35	1.32	≤ 2-5
GFI	0.960	0.970	≥ 0.90
NFI	0.975	0.950	≥ 0.90
CFI	0.983	0.967	≥ 0.90
RMSEA	0.034	0.044	< 0.05 – 0.08

4.2 Structural Model

The research used SEM with AMOS v.28 to test the impact of knowledge sharing processes on the contextual performance at the Iraqi Ministry of Culture, Tourism and Antiquities.

Table 5 and Figure 1 show the effect size of knowledge sharing on contextual performance to be 0.685. H1 is concerned with the effect of knowledge donating on contextual performance. The path coefficient for this is confirmatory at the level 0.533 and significance is shown by p<0.05, indicating that H1 is supported. H2 is

concerned with the effect of knowledge collecting contextual performance. The table shows an effective size of 0. 620, confirming H2(see Figure2).

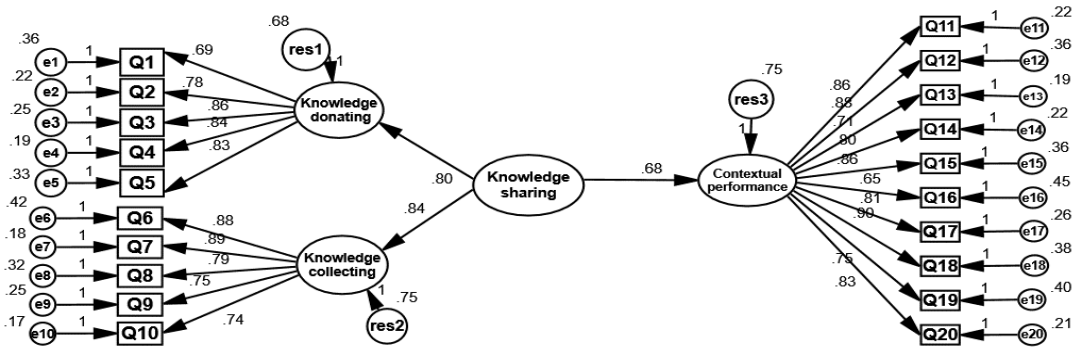


Figure 1: Structural Model

Table 5: Structural Equation Modelling Results

Independent variable	Dependent variable	Impact Value Estimate	t- value	Results
Knowledge Donating	Contextual performance	0.533**	112.11	Supported
Knowledge Collecting	Contextual performance	0.620 *	12.336	Supported
Knowledge Sharing	Contextual performance	0.685*	13.220	Supported
Fit indices	χ^2=819.264, χ^2/df=1.12, GFI=0.957, NFI=0.945, RMSEA=0.04, CFI=0.944			

Note: p * <0.05

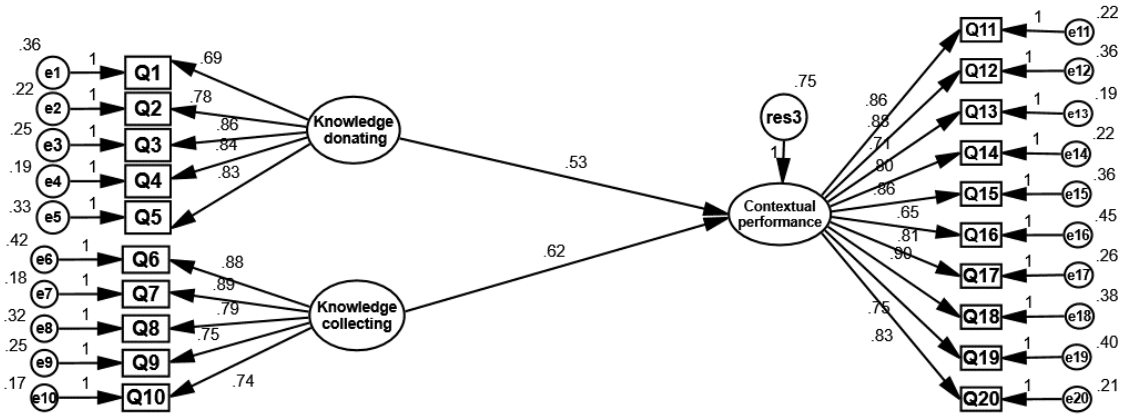


Figure 2: SEM results

5. Discussion

The results supported the impact of knowledge sharing processes (donating and collecting) on contextual performance (*H1* and *H2*) in the Ministry of Culture, Tourism and Antiquities in Iraq. The knowledge-based view considers knowledge is a valuable resource of organisations and suggests that organisations need not only to generate knowledge but also, more importantly, share it (Chen and Nonaka 2022). Knowledge sharing is a two-dimensional process, whereby the organisational members share their tacit and explicit knowledge. daily interaction creates new knowledge through donation and collection. knowledge donating aims to see tacit knowledge is transformed into explicit and proprietary to all. while collecting knowledge refers to searching for knowledge represented in consultations, which in turn improves the entire knowledge inventory available to the Ministry (Hooff and Weenen 2004).

The results indicated that, when knowledge is used, learning occurs, leading to the development of the knowledge inventory available to the ministry. This means that the performance will enhance when the Ministry's employees share their vision, skills, information, administrative knowledge and experience. Accordingly, it will increase the commitment of the employees at the Ministry by feeling that they want to make great efforts to achieve its objectives and talk about them proudly, thus improving the contextual performance (which emphasizes improving morale, encouraging cooperation among the employees of the Ministry, removing the barriers to performance, maintaining good working relationships, as well as helping the coworkers to perform job-oriented activities).

These findings are congruent with Kokkaew et al. (2022) who argued that knowledge knowledge management processes namely acquisition, creation, storage, retrieval, transfer and use can enhance organisational performance within infrastructure construction companies in Thailand.

The results of the current research have also shown that the effect of collecting knowledge on contextual performance is much higher both inside and outside departments than donating knowledge, whilst donating knowledge appears unnecessary outside departments. This is may be due to the Arab culture, especially those within the Iraqi organisational groups, where individuals tend to work in small groups with the same values, beliefs, and problems. Therefore, it may be easier to achieve a knowledge donation within departments, while knowledge collection requires active consultation with colleagues to learn from them. Therefore, it requires understanding new ideas and culture. These findings are consistent with the proposals from (Kamasak and Bulutlar 2010) who have also found that knowledge collection has a greater impact on creativity than knowledge donation.

6. Implications of Research

This research aims to examine the impact of knowledge donating and collecting on the contextual performance in the Iraqi Ministry of Culture, Tourism and Antiquities. These relations have not been considered before in this Ministry. This research provides a theoretical contribution to literature related to knowledge sharing and contextual performance. Knowledge sharing has been described as a key factor in building competitive advantage and is the main component of performance.

The results of this research emphasised the importance and role of knowledge sharing and performance and help provide a better understanding of the links between them. The research also provides support for a knowledge-based view and the strength of the role of knowledge sharing plays in enhancing contextual performance. The results indicated that contextual performance improves if the Ministry is able to encourage the culture of knowledge sharing among its employees. Therefore, the results contribute significantly to the literature on knowledge sharing and contextual performance, in addition to providing a better understanding of these relations in the service sector in developing countries, especially Iraq, which has been neglected in previous studies.

This research has field implications, as it can help managers at the Ministry of Culture, Tourism and Antiquities to develop strategies aiming at encouraging employees to share knowledge in order to improve contextual performance at the Ministry, such as conferences, seminars, workshops, training courses, formal and informal meetings…etc. In addition to spreading and encouraging team spirit, trust and cooperation among employees, encouraging them to increase communication among themselves, allowing them to express their ambitions and expectations, and encouraging the exchange of opinions and perspectives about work inside and outside their departments.

7. Conclusions, Limits and Future Research

Organizations need knowledge and knowledge sharing in order to enhance performance and competitive advantage. This research aims to study the impact of knowledge donation and collection on the contextual performance in the Iraqi Ministry of Culture, Tourism and Antiquities. The results of the research show the importance of performance and knowledge sharing processes.

The research has been applied in the service sector, specifically at the Ministry of Culture, Tourism and Antiquities. Therefore, the results cannot be generalised to other sectors. Future research can explore such relations in the industrial sector. The model was applied in a developing country, which is Iraq. Future research can examine the model in other countries that share similar structures, cultures, and contexts with Iraq.

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Academia Place in the Knowledge Triangle: How Students Recognize the Role of Scientists for Building an Innovation Ecosystem

Albena Antonova, Dilyan Georgiev and Elissaveta Gourova
Faculty of Mathematics and Informatics, Sofia University St. Kliment Ohridski, Bulgaria

a_antonova@fmi.uni-sofia.bg
dilyan.iv.georgiev@gmail.com
elis@fmi.uni-sofia.bg

Abstract: Universities traditionally play a central role in building a thriving knowledge and innovation ecosystem. However, in many Central and Eastern European (CEE) countries, universities and research centres are hardly recognized by students as attractive places for career development or as partners for successful business endeavours. Many factors can explain why the public image of scientists in countries like Bulgaria is underestimated: from low investments and under-financed research to old research infrastructure, poor media coverage, low international mobility and lack of interest from local businesses. At the same time, new opportunities and investments remain hidden for students and young people who remain sceptical about pursuing a research career. Considering this, the paper aims to explore the main challenges for positioning Academia back in the centre of the innovation ecosystem. Starting with a short overview of the main pillars of the knowledge triangle, it further enlarges the analysis with the role of the new national institutions (such as Centre of Excellence and Centres of Competence) within the modern innovation ecosystem. Focusing on the researchers' role, the paper summarizes how universities can further help to strengthen the knowledge sharing within the society. The paper is structured as follows. The literature review identifies the main components of the thriving innovation ecosystem, considering some of the pressing national and international challenges, recent technology opportunities and public expectations. Then, it presents the EU-level initiative – the European Researchers Night (ERN) role in boosting public awareness and interest in science. More specifically, it explores the K-TRIO project activities in Bulgaria from a knowledge-sharing perspective. In the next part it analyses the opinions of about 107 ICT students who took part during the last year in surveys and round tables dedicated to the role of researchers, research careers and research opportunities for building a sustainable innovation ecosystem. The outcomes of the surveys and round table discussions are presented along with the main conclusions and lessons learned, summarizing their perceptions, prejudices and recommendations. The last part highlights how working with young people and attracting them to Academia can boost its importance for the innovation ecosystem.

Keywords: Innovation ecosystem, European researchers night, Knowledge triangle, Research career

1. Introduction

Adapting business and society to the challenges of the digital transformation requires substantial efforts for strengthening the role of Academia in the knowledge triangle. Policy initiatives and public investments in research and innovation (R&I) are increasing, but many of these efforts remain unrecognized for the young generations and the general public. For example, several actions are taken recently for making Europe a modern, resource-efficient and competitive economy, and the first climate-neutral continent and empowering people with a new generation of technologies. Research and innovation are considered crucial for the economic recovery, and are in the centre of the industrial transformation for Green and Digital Europe (European Commission, 2020a). Recent actions for Deepening the European Research Area (ERA) consider how to translate R&I results in the economy, and contribute for sustainable development and to the common European efforts for bridging global challenges, building Green and Digital Economy, Smart Cities and Smart Factories, and take full advantage of Clean Technologies, Internet of Things (IoT), Artificial Intelligence, BIG Data, Cloud computing, etc. In addition, the synergy of ERA and the European Education Area (EEA) are essential for the European competitiveness, dual transformation and knowledge-based growth (European Commission, 2020b). Several policy instruments have been in place to facilitate the knowledge transfer between academia and industry: university-industry research contracts, internship schemes, innovation vouchers or tax credits for industry-university collaboration, technology transfer offices, innovation centres, business incubators, science/technology parks, innovation platforms, etc. As outlined in Cervantes (2017) the institutionalisation of knowledge transfers from academia to industry have been not successful in most cases. Among the factors are considered *"the tacit nature of knowledge, and the cost of network building and the difficulty of pricing knowledge."* At the same time, as a general failure of innovation policies is considered the push on academia to transfer knowledge to industry, and underestimating the multidirectional flows in the knowledge triangle (Cervantes, 2017).

The changes in the economy and society towards higher knowledge intensity have created new demands on higher education institutions (HEI) to develop the human capital to better respond to the labour market needs, and support the industry research and competitiveness with its competencies. Moreover, the need for "nourishing talent for excellence" and developing the next generation of researchers and innovators, is related to new educational methods and emphasis on Science, Technology, Engineering and Maths (STEM) at an early age. At the same time, young people should be equipped with competencies facilitating their engagement as citizens in Open Innovation and Open Science (Gourova et al 2021).

Bulgaria as a European Union (EU) Member State (MS) has followed the trends in ERA and EEA, and has aligned its national strategy, regulations and funding schemes to the EU actions in the areas. For example, recent legislation aimed at modernising universities ensured a framework for enhancing the research excellence in the leading research universities. At the same time, the Innovation Strategy for Smart Specialisation (ISSS) outlined regional priorities for industrial development. The funding mechanism for developing Centres of Excellence (CoE) and Centres of Competence (CoC) clearly emphasised the need for building research excellence in the ISSS priority areas, and thus, the centres to better serve the economic and societal needs (Gourova et al, 2021).

Sofia University (SU) as a leading research university in Bulgaria has been involved in some consortia for developing CoE and CoC. In the paper will be presented the role of the CoE UNITe (Universities for Science, Informatics and Technologies in e-Society) in Information and Communication Technologies (ICT) ecosystem, and its approach towards building the next generation of researchers and innovators within the K-TRIO project. The paper initially focuses on some concepts related to the innovation ecosystem and the role of universities in the triangle of knowledge. Next are presented the UNITe role in supporting the digital society, and the approach of the K-TRIO project for attracting talents to research. Within K-TRIO activities is carried out a survey among young people which results are discussed in the paper as well.

2. Universities in the Triangle of Knowledge

2.1 Role of Academia in the Innovation Ecosystem

The concept of the knowledge triangle emerged in the works of Etzkowitz and Leydesdorff (1995) and Leydesdorff and Etzkowitz (1998), exploring the relationships between universities, industry and government and naming them "triple helix", focusing on the importance of coordinating their efforts for strengthening innovation and knowledge economy. As a "fourth helix" was added the civil society by Carayannis and Campbell (2009) in response to the changing nature of the knowledge society. As highlighted by Cai and Lattu (2022), both models are very popular in innovation systems research, and they are complementing each other to a large extend.

The innovation ecosystem is an evolving concept in the research literature. Several studies (Gu et al, 2021; Granstrand et al, 2020; Scaringella et al, 2018; Tsujimoto et al, 2018) have focused on the understanding of innovation ecosystem dynamics, structure, components and positioning. As stressed by Granstrand et al (2020), the ecosystem concept has its origins in ecology, and is related to the flows of resources to living systems, their relations with non-living systems, etc. Furthermore, one of the first definitions of innovation ecosystem is given by Adner (2006) and focused on firm ecosystem. Generally, different types of ecosystems have been discussed by scholars. For example, in (Scaringella et al, 2018) are presented the specifics of business, innovation, entrepreneurial and knowledge ecosystems. Tsujimoto et al (2018) consider four steams of ecosystem research: industrial ecology, business ecosystem, platform management, and multi-actor networks. In a review of innovation ecosystem (Gu et al 2021) are considered five research streams:

- Technology innovation – investigating the creation, evolution, orchestration and inter-organizational collaboration in technological innovation ecosystems;
- Platform innovation ecosystems – focused on their organization, cooperation and competition, and diffusion of platform technologies and services;
- Regional development – considering innovation ecosystems of clusters, national, industrial, or smart and sustainable cities;
- Conceptualization and theorization of innovation ecosystems;
- Entrepreneurship and innovation – including entrepreneurial university or firms, and individual entrepreneurs.

Despite the differences in theory and practice, some important characteristics of the innovation ecosystems could be outlined: It is a dynamic system of various stakeholders who interact among them with a specific purpose. In most cases, the system purpose determines the rules of its functioning, the actors involved, the internal processes and relations (cooperation or competition), and the input and output flows (tangible and intangible resources, products and services, etc.). For this paper the main focus is on the national/regional innovation ecosystems, and the interactions between academia and other public or private institutions of the ecosystem.

As outlined in (Scaringella et al, 2018), in the knowledge ecosystem the universities or research organizations are in its centre of a network of companied, and focus on knowledge generation and its transfer to industrial stakeholders. Etzkowitz and Leydesdorff (2000) considered that the university model is changing towards an "entrepreneurial university" and application and exploitation of the research results. In fact, a large share of the research activities is performed at HEIs, and they have an essential role for increasing the knowledge capital. Universities are positioned in the centre of the knowledge triangle due to their role in generation of knowledge, on the one side, the knowledge transfer to the future labour force in education, on the other, and last but not least, their involvement in innovation with companies. As outlined by Cervantes (2017), knowledge generated by universities is a result of the interactions among education, research and innovation, and "*the bi-directional or circularly-caused knowledge flows between the tree core elements of the knowledge building process constitute the Knowledge Triangle."* This concept shows also that the knowledge production is not a linear process, and is based on various paths of learning, knowledge gathering and exchange. At the same time, it is essential that universities position themselves not only in the centre of the knowledge triangle, but also in their specific innovation ecosystem. The successful model for universities requires contribution to the knowledge demands of their environment – local, regional or national, taking into account industrial or regional specialisation.

2.2 The UNITe Innovation Ecosystem

The main goal of the UNITe project is to build a Centre of Excellence as a highly competitive, internationally recognized scientific research complex, that satisfies the requirements of the modern research infrastructures and the excellent scientific level in the ISSS research priority Informatics and ICT. In the project participate five universities: Sofia University "St. Kliment Ohridski" (as a leading organization), Technical University - Sofia; University of Rousse "Angel Kanchev"; University "Prof. Dr. Assen Zlatarov" - Bourgas; University of Shumen "Konstantin Preslavski". As guiding principles for formation of partnerships within the project were defined: high scientific quality, synergy and complementarity, knowledge transfer experience, wide regional collaboration and established networks with R&I actors. The existence of trust and tradition in cooperation were also considered as essential factors for development of a sustainable partnership and prevention of possible risks associated with the collaboration within the project.

The project goals required the UNITe partners to enhance their collaboration in R&I with various interested stakeholders, both at international, national and regional levels. The consortium considered its role in the centre of the ICT ecosystem and the collaboration opportunities for each individual stakeholders' group. As illustrated in Figure 1, the cooperation with the different types of organizations has different goals, determined by the research program of the UNITe. They are targeted at supporting ICT innovations, the digital transformation of industry, the extensive use in industry, science, government and society of Big data, the development of a new generation equipped with new values, skills and abilities to participate in the digital society and economy, as well as to achieve higher integration in the ERA.

- *Partnership with the ICT industry:* In order to reach the project research objectives, and to support the ISSS through research excellence, it is essential to achieve a greater integration of the research and innovation systems in Bulgaria. The CoE UNITe aims primarily to strategic partnerships with the ICT industry, which suggests launching joint projects for new scientific knowledge generation and its implementation by the ICT industry for design of new products and offering them in the market. These projects facilitate closer integration between universities and industry related to staff exchange, joint supervision of PhD students and mentoring of young researchers working on the joint projects, optimal use of the CoE research infrastructure and the created scientific databases. Within the project, the main directions of cooperation with the ICT industry are outlined by the scientific work packages and the aim to overcome the challenges associated with cybersecurity, optimal use of Big Data, real-time virtualization, digitization and visualisation objects, prototyping, and supporting the development of Cyber-physical systems, Factories of the Future and smart cities.

- *Partnership with small and medium enterprises (SMEs) and non-ICT industry:* The main collaboration form with this group is related to knowledge transfer and provision of services for research and technological development (RTD), supporting the digital transformation of the industry and the more extensive use of ICT for build the Factories of the Future. This is also a prerequisite for the formation of a greater demand for ICT services and products, which on its turn to stimulate related research and innovation activities of the CoE and the ICT industry. Within the project, partnerships have been sought for joint pilot projects for testing the research results in a real environment.
- *Partnership with innovation intermediaries:* The knowledge transfer from the CoE to the industry is carried out mainly in collaboration with intermediaries in the innovation system (clusters, innovation centres, technology transfer centres, branch organizations, etc.), with which have been undertaken joint activities according to the specific regional industrial needs. A special attention is paid to organizations supporting start-ups and building innovation and entrepreneurship competencies of young people and employees.
- *Partnership with state bodies and local authorities:* The CoE UNITe has been collaborating with local authorities for the development of e-municipalities, and offering advanced electronic services to citizens and businesses, as well as for development of smart urban environment. Within the project as a main collaboration form is considered launching joint pilot projects to test the research results in a real environment.
- *Partnerships with schools and other educational organisations:* The wide ICT penetration in the economy and society, and the creation of R&I attitudes critically depends on the formation of the human capital – future researchers and innovators, ICT professionals and ICT teachers. Major roles in this area have the educational organizations that create the basis for the development of future citizens and professionals. Despite that the partners as universities have significant contribution for preparing the workers demanded on the labour market, at local level has been launched collaboration with schools and other educational organizations (incl. for training and life-long learning) in order to integrate new teaching methods and ICT in education, as well as raise the awareness on science among the younger generation.
- *Partnership with non-governmental organisations (NGOs):* In order to overcome the digital divide, expand the e-participation and create prerequisites for e-democracy, the UNITe partners have collaborated with NGOs for enhancing the e-skills of citizens, and to identify their demands for new ICT products and services. With these organizations have been organized joint activities for raising the awareness on the contribution of science to the development of the economy and society, and to form a more attractive image of researchers and attract young people to research careers.
- *Partnerships with other research performing organizations (RPO) and universities*: Of particular importance for UNITe CoE is to expand the collaboration with other research organizations and universities in the country, so as to provide them opportunities to benefit from the research results of the project and the established research infrastructure and scientific databases of the CoE. The partner universities have collaborated for years with research organizations and universities in the areas of Communication and Computer techniques, and in Informatics and Computer sciences. Within the project are discussed joint initiatives for knowledge transfer and new projects.
- *Partnerships with the international community*: The goal is to establish strategic collaboration for joint projects and use of the UNITe research infrastructure, knowledge sharing through mobility and specializations of UNITe researchers and PhD students, in order to achieve higher integration of the CoE in the ERA. The UNITe CoE aims at building long-term collaboration for the development of ICT science and innovation with leading universities, research organizations and scientific networks in the EU.

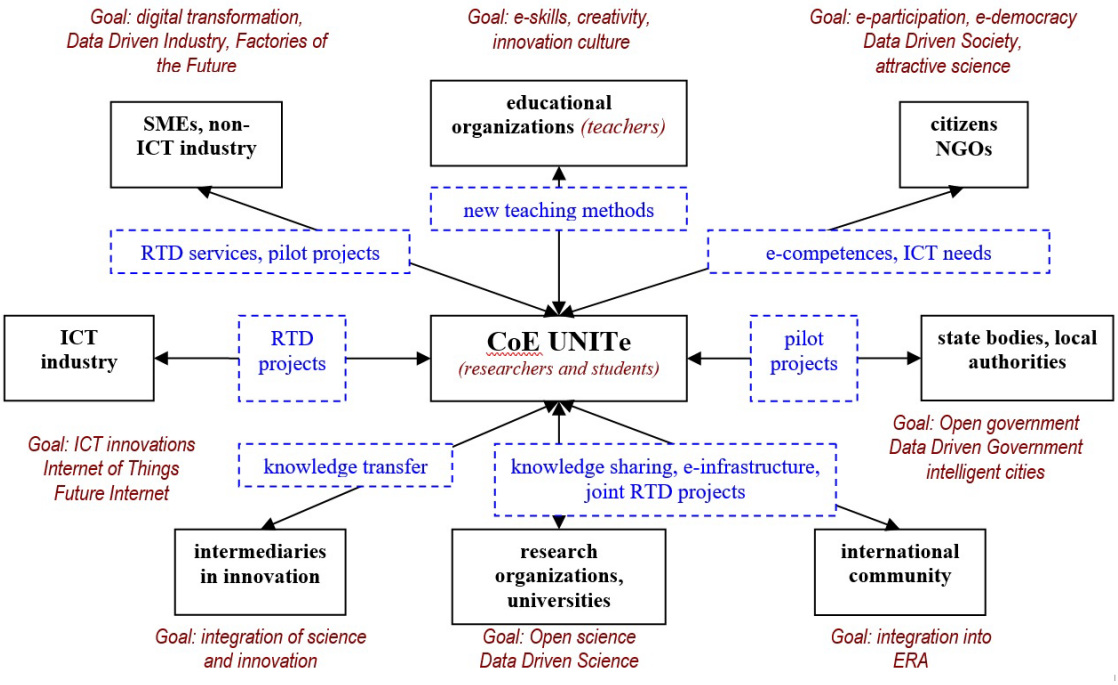


Figure 1: CoE UNITe Positioning in the ICT Ecosystem

3. Researchers in the Knowledge Triangle – the K-TRIO Concept

The difficult transition of Bulgaria caused a serious decline in education and in building real values of the new generations. The image of science and researchers, teachers and educational institutions was also damaged. Despite recent public attention to the impact of online education on building knowledge and skills of students, and the increased awareness of teachers' role, the challenges of Bulgarian R&I system remain (Gourova et al 2021). The UNITe Consortium has recognised that there is a need for cultural change and nurturing a new culture of creativity, scientific curiosity, innovative spirit and environmental responsibility. Subsequently, by designing the K-TRIO project, the partners considered how to address the human resources challenges of the national R&I ecosystem: How to encourage young people for research career? How to grow new talents? How to engage citizens with Open Science and Open Innovation? How to foster R&I and increase their role in Green and Digital transformation? There is no clear approach, however, the K-TRIO consortium followed a concept that universities should play a leading role in the knowledge triangle and facilitate:

- building the next generation of researchers by educating students to respect the principles of research integrity during their education, and involving them at an early stage in solving real problems and focusing on the needs of the economy, environment and society;
- integration of new teaching methods and tools in higher education of future teachers, and thus, facilitating changes in teaching styles in secondary education; nurturing creativity, innovation spirit and environmental responsibility, as well as Open Science and entrepreneurship attitudes at an early age;
- achieving scientific excellence and turning it into innovation by using the Open Innovation paradigm to engage the citizens in a dialogue on R&I agendas, valorisation activities, and subsequently, changing the attitude of the general public towards science and researchers;
- accelerating the change towards higher innovativeness and knowledge transfer by providing researchers with complementary skills and competencies to work with industrial stakeholders and better understand the role of academia for turning knowledge into innovation.

All partners collaborate with a large number of national or regional stakeholders, and have engaged more than 30 associated or supporting partners (the Ministry of Education and Science and its regional departments of education, several municipalities, schools, NGOs, etc.). This consortium composition has facilitated the smooth involvement of various target groups (Figure 2) in the K-TRIO activities.

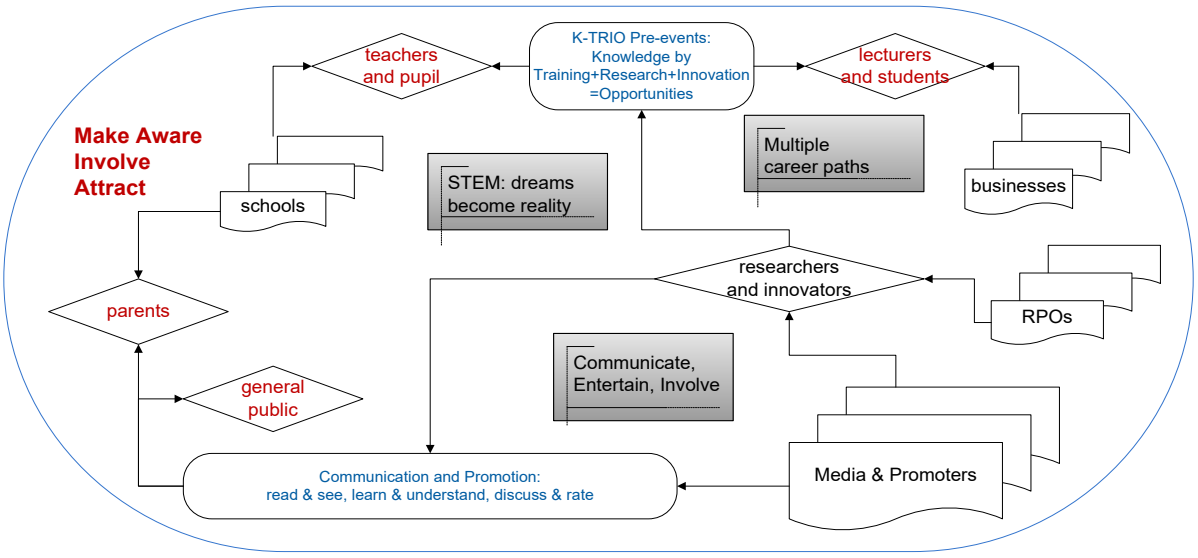


Figure 2: Stakeholders Engagement in K-TRIO Project

The K-TRIO project has engaged the most stakeholders of the UNITe ecosystem in the process of building the next generation of researchers.

- *Researchers and innovators,* both from industry, HEIs or RPOs, are placed in the centre of all activities as they can serve as role models for the youth with their R&I experience, and their multiple career paths.
- The K-TRIO partners involved researchers and innovators in joint activities with *schools and teachers* in order to raise the awareness of students and pupils on the R&I profession, involve them in STEM centres and research activities, thus, attracting the youth to a possible research career path.
- In the Open Labs or Open doors of partners universities and museums *students and pupils* (and the general public during the ERN) had opportunities to be involved in scientific experiments, learn and understand the real work of researchers, and discuss with them on various topics.
- At the same time, the K-TRIO partners focused on *teachers as multipliers* of the project messages, but also as essential actors for attracting students and pupils to STEM. Therefore, several seminars were organised to train teachers to use innovative teaching methods, or better use the available STEM centres infrastructure.
- Another essential target group are the *university students* who are involved in discussions about the R&I system and the respective career, involved in research projects or industrial internships. For talented students (both in schools and universities) have been organised also competitions (e.g. "Young and Energetic Scientists") whereas researchers were involved as their mentors or supervisors.
- *Civil society actors – NGOs, media and science promotors* have an essential role for attracting the young generations to research. The K-TRIO consortium used several communication channels (web sites, Facebook, YouTube, LinkedIn, traditional media) and formats (interview, podcast, short video, etc.) in order to present to the general public the contribution of individual researchers, research projects or RPOs to the economy and society, regional development and growth.

The K-TRIO model for collaboration with stakeholders facilitated the awareness raising and debates related to sustainable recovery, increasing the knowledge intensiveness of industry through R&I services or R&I projects, as well as focused on preparing of citizens for Open Innovation. The role of research for smart specialisation and regional; growth have been the focus of debates with public bodies and local authorities. In the centre, however, have been educational organisations and HEIs with their role for preparing the next generation of researchers and innovators, and facilitating a cultural change towards Open Science and Citizens Science.

4. Young People Attitude to Research and Innovation

4.1 Methodology of the Study

Within K-TRIO project, a short survey was made among the students in the ICT bachelor programs of SU in order to explore the perceptions and attitudes of young people toward the role of academia in the knowledge triangle. The students are an important part of the UNITe target groups, as ICT talents are among the most critical resources for further success of the research infrastructure. More specifically, the survey was completed anonymously as part of the seminars of the elective course "Knowledge Management", followed by a round table discussion on the role of science in the modern society.

The aim of the proposed approach was first to put students in the position to formulate their initial perceptions, and then, to openly discuss their concerns. Thus, students can prepare more carefully their arguments, considering evidence and examples for the round table and at the end they can summarize some common visions. The survey was organized in four parts:

- impact and role of the Bulgarian science in the society and the attitudes toward scientists in general;
- role of the science and technology transfer for the economy, business and social development;
- new perspectives and general attitudes for the role of the science in the society;
- statistical data.

4.2 Analysis of the Results

In total 107 students filled the questionnaire in 2022 and 2023. The demographic data shows that students are 45% females and 55% males, most of them (87%) aged between 21-22. To summarize the results, the answers are grouped in two main areas: the role of science in the modern society and economy and the attitudes of students towards research career.

- The role and the impact of science in the economy and society

The survey comprises 48 questions that directly or indirectly explore the role of science in the knowledge triangle. From this perspective, students recognize that Bulgarian research institutions significantly contribute to the progress of the economy and society. For instance, almost 80% of the students emphasize that research institutions promote knowledge discovery, and 77% consider its positive impact on the educational system and on national culture. At the same time, 61% of students find that research institutions contribute to a limited extent to the practical implementation of research discoveries in the business and society.

Almost 20% of the young people have concerns that science is underestimated in the last years, and students find that Bulgarian society in general is not really interested in new scientific endeavors. As identified on Figure 3, students find that Bulgarian science contributes very significantly for cultural heritage protection, for increasing the national prestige and for environment protection. At the same time, students don't see the role of Bulgarian scientific institutions for making better social regulations/strengthening institutions, for improved decision making on strategic company or government level and in general for innovative products and services.

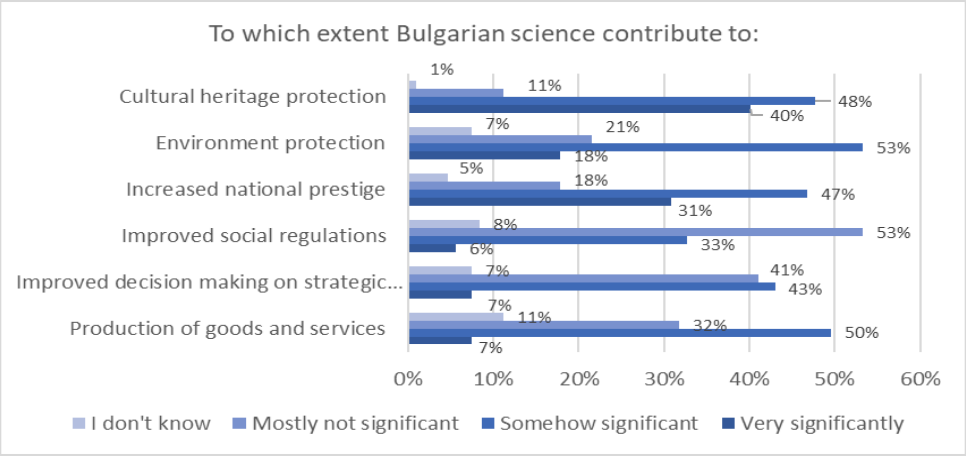


Figure 3: To Which Extent Bulgarian Science Contribute for the Economic and Social Development

Concerning the new challenges in front of the knowledge economy, most of the students agree that science should be supported as a national priority (68%). In the same time, the respondents find that the role of science is underestimated by the public authorities (62%) and by the businesses (35%). However, most of the students find that research institutions need to improve the visibility of the research career.

- The role and the impact of the scientists and the scientific career

In general, 86% of the students find that researchers and scientists have good reputation and about 60% find that research profession has a positive social image. However, considering the social status, almost all of the students (90%) claim that at least in the Bulgarian society, researchers receive low or very low renumerations comparing to their efforts. Concerning the personality of the researchers, most of the students find them to be smart and intelligent people (93%), good in theoretical knowledge (79%), mostly old (66%) and mostly men (30%). Some general (mis)conceptions for scientists are still recognized, viewing researchers as difficult for understanding (26%), with low communication skills (21%), and in general very distracted people (19%).

On the question whether students would like to become a scientist, 45% of them directly respond NO, 18% said YES, and 36% had never thought about research careers opportunities. On the Figure 4 are presented some data how students recognize the main stimulus for attracting young people for research career.

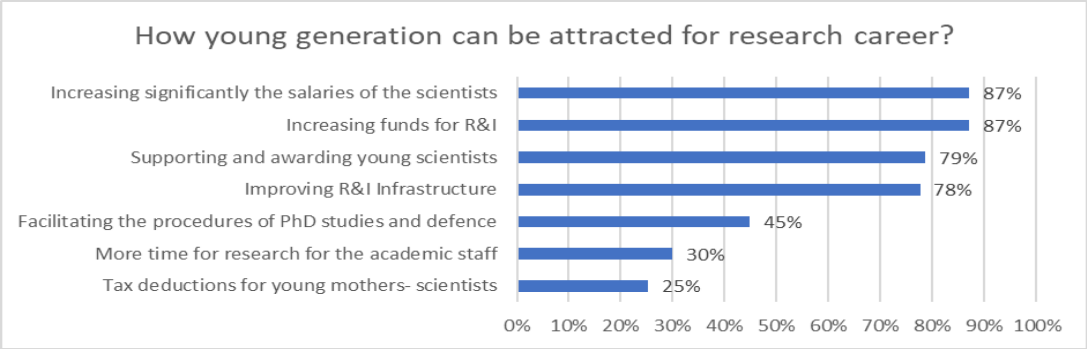


Figure 4: What are the key Factors to Motivate and Attract Young Generation for Research Career

5. Conclusions

Although the significant efforts and public investments in R&I, young people still do not see the role of Academia as crucial for thriving research and innovation ecosystem. The team of Sofia University regularly take part in similar surveys for measuring the attitude and perceptions of different target audiences. However, this survey is focused to investigate more specifically the attitudes of young talents in ICT. The survey results demonstrate that students still do not understand the multiple perspectives offered by the research careers. Many popular misconceptions for science and for the research profession are still dominating among young students and they hardly recognize the opportunities for becoming scientists.

All this show that the team of UNITe needs to pay more attention to raise the next generation of talents in science, actively involving and explaining various R&I initiatives. Researchers and lecturers have to openly communicate and discuss real-world examples, case studies and research evidences how ideas emerge and progress, nurtured in the academia environment. In plus, more dissemination activities orientated specifically to students and young people have to present how Academia strengthen the knowledge ecosystem.

Acknowledgements

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Financial Literacy and its Relationship to the Indebtedness of a Bank's Customers

Gerson Orlando Arce-Cruz[1], Juan Carlos Valencia-Mayuri[1], Wilder Oswaldo Jimenez-Rivera[1,] William Miguel Jiménez Rivera[1] and Franklin Cordova-Buiza[2,3]

[1]Business Faculty, Universidad Privada del Norte, Lima, Peru

[2]Research, Innovation and Social Responsibility Department, Universidad Privada del Norte, Lima, Peru

[3]Faculty of Business Sciences, Universidad Continental, Huancayo, Peru

n00047530@upn.pe
n00154577@upn.pe
wilder.jimenez@upn.pe
William.jimenez@upn.pe
franklin.cordova@upn.edu.pe

Abstract. The success or failure of economic agents, especially families, depends on decision making, which in turn will depend on the capabilities, knowledge and skills acquired through financial education. In this sense, the lack of financial capabilities is considered one of the most pressing problems in today's societies. In Peru, one of the main barriers to financial inclusion is the lack of financial education; these low levels of education affect the contracting of active and passive operations in the financial system. The objective of this research was to determine the relationship between financial literacy and the indebtedness of the clients of a banking agency. The methodology has a quantitative approach, correlational level, cross-sectional and non-experimental design. The population considered is finite, 1600 customers in the bank and the study sample was 310 customers. A survey was used as a technique and a 36-question Likert scale questionnaire was used as an instrument. The correlational results present a Spearman's Rho =0.474; the research also finds that 73.23 % of the bank's clients are interested in knowing the interest rate (TCEA) before contracting a loan on the active operations side and on the passive operations side 54. Regarding savings, 60% of the bank's clients consider it important to save in the financial system, which is consistent with the fact that 65.49% tend to keep their savings in the banking system for a period of more than 12 months, demonstrating confidence in the Peruvian financial system. It is concluded that there is a relationship between financial literacy and the indebtedness of the clients of the Lima branch of a bank, obtaining a positive correlation.

Key words: Financial literacy, Financial knowledge, Financial skills, Financial attitudes, Indebtedness

1. Introduction

According to the World Bank (2020) the COVID-19 pandemic has transformed the way in which economic agents face budgetary restrictions; many of them, in their search to improve their income, have opted for developing enterprises, making use of their pension funds and, above all, getting into debt in the financial system. Arellano et al. (2014), Machuca-Vílchez et al. (2023) and Cordova-Buiza et al. (2022) have already pointed out that society is characterized by high levels of indebtedness and growing savings needs, whose members have a general lack of understanding of financial matters. This is a serious problem in the economic and financial affairs of economic agents, especially families. In this regard, Martínez-Carrasco et al. (2016) and Huaman-Ñope et al. (2023) state that having an adequate financial education in society implies acquiring knowledge on this subject, in addition to generating diverse skills, confidence and mastery, to face risks, associated with an informed decision on financial opportunities and their wellbeing. Consequently, it is up to public and private institutions to promote financial inclusion strategies. For García et al. (2013) and Barro-Chale et al. (2023) the financial education initiatives promoted by these institutions can become an important complement to financial inclusion processes and poverty reduction measures. In this sense, many Latin American countries have implemented public policies focused on financial inclusion, such as Argentina, Brazil, Mexico, Colombia, Chile, Paraguay, Uruguay and Peru.

In this regard, in October 2020, after 15 years, the Organization for Economic Cooperation and Development (OECD) has renewed its objectives on financial education. According to López (2020) and Salazar-Rebaza et al. (2022) these objectives seek to have a fundamental impact on the design, development and evaluation of public policies on financial education, although private sector initiatives and financial education programs in general can also be useful, thus visualizing the commitment assumed by the different governments in the design of public policies focused on a framework of financial inclusion and various private institutions, especially financial institutions.

The supervisory agency in Peru, Superintendence of Banking, Insurance and AFP (2019), in the survey to measure financial capabilities, to measure financial knowledge, adopts the Methodology used by the OECD and the International Network on Financial Education - INFE, found that the percentage of adults with high financial inclusion in the segment with primary education was significantly lower compared to the results of the other educational levels. The findings show discouraging progress in the period 2013 - 2019, since, in this period, the score obtained by the group of respondents with lower educational level contracted only 1.2 percentage points. On the other hand, the results achieved by the secondary and higher education level had a notable increase over time, reaching double the score obtained by the secondary education level, with 36.3% of the total of adults with higher education having high financial inclusion. In addition to the introduction, in section 2 we review the literature, in section 3 the method of analysis is presented, in section 4 the data is shown, in the next section the results and discussion are shown, and finally, the conclusions.

2. Literature Review

Organization for Economic Cooperation and Development and the Andean Chamber of Development (OECD/CAF) (2020) define Financial Literacy as: "financial capabilities, understood as the knowledge, skills, attitudes and behaviors of specific population groups". Del Angel and Moreno (2021) define financial literacy as the process by which the economic agent develops awareness, knowledge, skills, attitude, discipline and behaviors necessary for making financial decisions; the same that contribute to his or her wellbeing.

Espinoza et al. (2019) notes that citizens improve their financial decisions by having high levels of financial education, which translates into positive results in economic growth and development. For the authors, "this type of education does not only imply having information and financial advice, but also seeking for people to improve their understanding of financial products and services and the risks they imply" (p. 4).

Kadoya et al. (2017) propose that financial literacy contributes to reduce anxiety about the economic future, through better savings and investment decisions, leads to the accumulation of more assets and obtaining more income, thus improving financial capability and reducing anxiety. In the same vein, Ramirez (2021) indicates that financial literacy implies for a person must be competent to understand how money works, how to manage income and expenses, how and where to invest, manage financial risks effectively and, most importantly, avoid financial problems.

Arroyo (2019) analyzes the financial capabilities of university students in Esmeraldas (Ecuador), finding that they possess little financial knowledge, the same that impacts their financial attitudes and behavior. Likewise, Mudzingiri et al. (2018) for the case of university students in South Africa their financial behavior related to confidence, time preferences, risk preferences, differ according to the level of financial literacy of university students differ according to the level of financial literacy, which reinforces the argument that people with high financial literacy achieve better results in life. In the same sense as Arroyo, Peñarreta et al. (2019) when analyzing the financial education of Ecuadorian banking clients in terms of the dimensions of knowledge, behavior and aptitude, find that only one third of the surveyed population has financial education.

Mamani (2020) studied financial education and its influence on the indebtedness of clients of the Municipal Savings and Credit Agency in the city of Cusco, using a Likert scale questionnaire as an instrument, and found a positive effect, which reinforces the idea that greater financial knowledge leads to optimal indebtedness. Muñoz-Murillo et al. (2019) studied the theoretical link between literacy levels and cognitive skills, and found that cognitive ability strongly predicts financial literacy, even after controlling for the confounding factors of arithmetic, these are positively related; also, the study shows that there is no significant difference between men and women and that the presence of financial products in the environment is important, but cognitive skills have greater significance.

3. Methods

This research has a quantitative approach, with a correlational level and a non-experimental cross-sectional design. The instrument used has been adapted from the instrument used by the OECD to measure financial education, with respect to the fact that financial literacy contributes to social welfare, having a positive impact on indicators such as savings, investment, indebtedness, among other economic and financial aspects of economic agents. The study population is made up of 1,600 clients of a bank agency in central Lima. A sample of 320 clients was drawn by means of probability sampling.

From the above, the unit of analysis is the client of a bank agency, who carries out active and passive operations with the financial entity selected for the study. Spearman's correlation coefficient was used to obtain the results,

as it is an appropriate measure of rank correlation (statistical dependence of the ranking between two variables). In this case, between the variables of financial education and indebtedness.

4. Data Collection

For data collection, the survey technique was applied in order to obtain information for the stated objective. An instrument was developed based on OECD/INFE (2018) that consisted of a questionnaire with answers on the Likert scale, 24 questions were posed for the financial education variable and 12 for the indebtedness variable, which the study subjects answered according to their criteria and visualizing the following categories: never (1), almost never (2), sometimes (3), almost always (4) and always (5). This instrument was validated by 3 experts with experience in the research topic.

Table 1: Dimensions for the Variable Financial Education (Financial Literacy)

Dimensions	Indicators	Items (Questions)
Financial knowledge	Interest	1,2
	Risk-return	3,4
	Inflation	5,6
	Diversification	7,8
Financial skills	Holding of savings products	9,10
	Debt compliance	11, 12
	Income and expense management	13,14
Financial attitudes	Short-term preferences	15,16
	Long-term preferences	17,18
Financial behavior	Types of products purchased	19-20
	Amount spent	21-22
	Frequency of purchases	23-24

Table 2: Dimensions for the Indebtedness Variable

Dimensions	Indicators	Items (Questions)
Cultural and Social	Consumer habits	25,26
	Credit practices	27,28
Debt Level	Debt to gross income ratio	29,30
	Delinquency/defaulted debt	31,32
Financial Weakness	Credit supply	33,34
	Over-indebtedness	35,36

In addition, by means of Cronbach's Alpha test with the SPSS program, the reliability of the items was measured by means of a pilot test applied to 60 clients from which a reliability level of 0.784 was obtained with respect to the 36 elements (items). The final information was collected by direct interview, approaching the clients at the exit of the bank agency, and with the use of the printed instrument to collect their answers, then the information was tabulated in an Excel file to obtain a database that allows the application of the proposed methodology.

5. Results and Discussion

5.1 Analysis at the Descriptive Level

Some results of the descriptive analysis of the financial education and indebtedness variables with their respective dimensions are presented below.

Table 3: Results on the Financial Education and Indebtedness Variables with Their Respective Dimensions (in percentages)

Category	When taking out a bank loan, I inform myself about the interest to be paid.	When opening a fixed-term or savings account, I find out in advance about the interest to be received (TREA).	I consider saving in the financial system to be important.	When taking out a bank loan, I usually pay the entire debt in a period of less than 12 months.
Never	0.97	9.03	2.58	16.77
Almost never	7.74	17.42	13.55	26.77
Sometimes	18.06	18.71	23.87	20.32
Almost always	29.68	23.23	33.55	20.97
Always	43.55	31.61	26.45	15.16
Total	**100.00**	**100.00**	**100.00**	**100.00**

Some noteworthy aspects are that 43.55% and 29.68% of the Bank's clients are always and almost always informed about the interest to be paid when contracting a loan in the financial system. Likewise, 31.61% and 23.23% of the Bank's clients are always and almost always informed about the interest to be received (TREA) when opening a time or savings account. It is also noted that 26.45% and 33.55% of the Bank's clients always and almost always consider that saving in the financial system is important. Finally, 15.16% and 20.97% of the Bank's clients, always and almost always, when taking out a bank loan, usually repay the debt in full in a period of less than 12 months, which is evidence of medium-term indebtedness.

5.2 Analysis at the Inferential Level

The results of the correlation are shown in the following table.

Table 4: Correlation Relationships of Some Important Variables

	Debt Level	Financial Weakness	Social Culture	Financial Skills
Financial skills			0.2728***	
Financial behavior	0.4417***		0.4288***	
Financial attitudes		0.2409***		
Financial literacy	-0.0498	0.1172**		0.3803***

Significance: 0.01***; 0.05**

As a general hypothesis, it was proposed that financial literacy is related to the indebtedness of the clients of the Lima Centro branch of a bank, 2022. As a result, an average negative correlation (-0.0498) is found between the study variables, so it is concluded that financial literacy has a negative relationship with the level of indebtedness of the clients of the Lima Centro branch of a bank. From the above, the higher the level of financial literacy, the lower the possibility of having an indebtedness that means a problem for the bank's clients, this goes hand in hand with the answers, for example, to the question regarding whether the clients were informed about the interest to be paid, with 73% responding that they have this good practice; as well as the same percentage considering that it is important to pay the financial entities on time. Another aspect to consider is time, 36% when contracting a bank loan usually pay in full in a period of less than 12 months.

The correlation between the dimensions of financial knowledge and financial weakness, measured by the items "When contracting a loan in the financial system, I find out about the interest to be paid" and "I make cash withdrawals from my credit card to pay off other debts", shows a low but significant positive correlation. Likewise, between financial skills and social culture, measured as "I consider it important to pay financial institutions on time" and "I take care of my credibility in the financial system", the correlation is positive and significant.

If we consider financial behavior related to social culture, measured as "Before buying something, I carefully consider whether I can afford it" and "My consumption patterns are related to my monthly income" respectively, we find a significant positive correlation, so that financial behavior has a positive average relationship with the dimension level of social culture, of the clients of a bank's downtown Lima agency. Similar results are found for financial behavior and level of debt, this time measured as "For the most part, the products I purchase cover my primary needs" and "My monthly payment installments exceed 30% of my net income"; consequently, the clients of a bank's Lima center agency, their financial behavior would be related to a higher payment of debt in the short term, which is a symptom of risk of default.

Regarding financial attitudes in relation to financial weakness, measured as "When taking out a bank loan I usually pay the debt in full in less than 12 months" and "I make cash withdrawals from my credit card to pay off other debts" respectively, a positive and significant relationship is found, which would not be a good strategy, given that the costs of credit cards are high compared to other financial products.

Finally, the correlation between the dimensions of financial knowledge and financial skills, measured as "When opening a time or savings account, I inform myself beforehand of the interest to be received" and "Saving in the financial system is considered important" respectively, shows a positive and significant correlation. This is positive, since the clients of this banking agency in Lima would be aware of the importance of being informed about savings payment rates and the importance of saving in their personal finances.

5.3 Discussion

The results for the general objective indicated that there is an average negative relationship between financial literacy and client indebtedness, so it can be argued that if financial literacy is increased in its different dimensions, financial knowledge, financial skills, financial attitudes and behavior, the level of client indebtedness decreases proportionally. This result is in line with the findings of Mamani (2020) and Franco & Venegas (2020) who agree that an adequate level of financial literacy leads to optimal debt levels among the different study groups. Likewise, with the findings of Muñoz-Murillo et. al (2019) who find that cognitive ability strongly predicts financial literacy, and that the presence of financial products in the environment is important, but cognitive skills are more significant.

Financial behavior is one of the most important dimensions of financial literacy, from our analysis we found that there is relationship between it and the level of debt, correlation coefficient was 0.4417, these results are consistent with the finding of Mudzingiri et al. (2018) who find a weak significant difference (of 10%) between financial behavior and the level of indebtedness of college students by their level of financial literacy. These results confirm that financial behaviors differ if people have different levels of financial education, which reinforces the argument that people with high financial education achieve better life outcomes. However, our findings regarding this dimension differ with Arroyo (2019) who finds that, regarding financial behaviors by making use of budgeting and planning either exactly or in a general way, however, despite the existence of planning, a large portion of students have had complications in covering expenses.

With respect to the financial knowledge dimension our study finds that 73.23 % of the bank's clients always and almost always are interested in knowing the interest rate (TCEA) before contracting a loan on the side of active operations and on the side of passive operations 54. 84% of the bank's clients, always and almost always, inform themselves about the interest to be received (TCEA), the same that differ with the finding of Peñarreta et al. (2019) whose results found evidence that only one third of the population surveyed in their study, has financial education. Regarding savings, 60% of the Bank's clients always and almost always consider it important to save in the financial system, which is consistent with the fact that 65.49% usually keep their savings in the banking system for more than 12 months, demonstrating confidence in the Peruvian financial system.

Finally, it is important to know the results of the study related to delinquency, as a manifestation of lack of financial literacy since this situation leads economic agents to lose the credibility of the financial system, to be reported negatively in the credit bureaus, in this regard, 73% of the Bank's clients always and almost always, consider it important to pay financial institutions on time, these results differ with the findings of Barzola et. al (2020) and Del Castillo (2019) who find that their study groups do not have adequate financial literacy which leads them to misuse financial products.

6. Conclusions

As for the relationship between financial literacy and the indebtedness of the clients of the Lima Centro branch of a bank, 2022, given the correlation coefficient obtained (-0.491) would indicate that there is a negative

relationship between the two variables. Therefore, clients with higher levels of financial knowledge would have fewer problems in meeting their liabilities. Regarding the relationship between financial knowledge and client indebtedness, the measurement of concepts such as active and passive interest rate, risk, profitability and inflation is deepened, in such a way that, the higher the level of financial knowledge, the higher the level of indebtedness of the clients.

It is found that there is a significant relationship between financial skills and customer indebtedness, in this second dimension the measurement of decisions such as the frequency of saving, timely payment to financial institutions, control over income and expenses both family and business, so that, the higher the level of financial skills, customers have a better management of their indebtedness. In addition, there is a significant relationship between the attitudes and indebtedness of the clients, in this fourth dimension the measurement of the attitude of the clients regarding the time in which they pay their debts and maintain their savings is deepened, in such a way that, the higher the level of financial attitudes, the better the clients manage their indebtedness.

On the other hand, a significant relationship is found between the behavior and indebtedness of the clients, in this fourth dimension the measurement is deepened with respect to the behavior of the clients at the moment of acquiring their products if these cover their primary or secondary needs, if they carefully consider if they can pay for what they acquire as well as the times they usually go shopping, such is the case that, with an adequate behavior, the clients have a better management and level of indebtedness.

Finally, the results obtained have implications with the theories used in the study, since they show us that financial education is an instrument that helps people or economic agents to make better financial decisions, in this case, bank customers with more financial education have better levels of indebtedness, taking as a reference the rate and terms.

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Knowledge Management: The Value of Inter And Intra-Firm Activities Towards Firm Innovation Performance

Emmanuel Ebo Arthur and Jan Stejskal
University of Pardubice, Czech Republic

emmanuel.arthur@upce.cz
jan.stejskal@upce.cz

Abstract: Firms mainly depend on innovation to remain competitive in business. New knowledge is a major resource for firms on the path of achieving innovation performance. This paper seeks to examine how intra-firm and inter-firm activities promote knowledge sharing toward innovation performance. We used the variables channels of information to represent inter-firm activities and workplace organization methods to represent intra-firm knowledge-sharing activities. The proxies for innovation performance were product innovation and business process innovation. Cross-sectional country-level data from CIS 2018 for 17 countries within the EU region was used for our study. The OLS regression method was used for the analysis. While existing studies concentrate on inter-firm knowledge transfer and single country-level studies, our study focuses on a blend of intra-firm and intra-firm cross-country studies. We also emphasized the value of knowledge sharing and cognition in the knowledge transfer process toward achieving firm innovation performance. Our model was built on the knowledge-based view (KBV) and social network theory (SNT). We found that cross-functional workgroups, conferences, trade fairs and exhibitions have a positive significant impact on both product and business process innovation. Published patent had a significant impact on product innovation but was not statistically significant for business process innovation. In conclusion, we found that intra-firm knowledge-sharing activities impact more on innovation performance of firms more than inter-firm knowledge-sharing activities of firms in the EU. Our study is limited to using cross-sectional data and the number of countries within the EU involved in the study. We believe longitudinal data and the involvement of more EU countries in future studies will yield robust findings for more reliable inferences.

Keywords: Knowledge sharing, Knowledge-based view, Social network theory, Channels of information, EU

1. Introduction

Knowledge is an undisputable resource for a firm's competitive advantage and profitability. Its creation, acquisition and transfer need to be cautiously planned and executed to achieve the intended purpose. The link between knowledge and innovation is crucial in the current technological and dynamic business environment. The creation of knowledge and its acquisition is as important as its sharing. A firm's proximity to other firms with similar business interests has the potential to share knowledge more than distant firms. Inter-firm activities involve collaborations between and among firms in leading to sharing of knowledge producing improved products and services. Knowledge sharing does not only occur between firms but within firms as well. Acquiring knowledge is not enough but consciously working and putting the right mechanisms in place to aid knowledge transfer among workers within a firm is essential to achieving innovation outcomes. Firms ought to appropriately balance the level of concentration given to both inter-firm knowledge generation activities and intra-firm knowledge generation activities. Acquisition of new knowledge through inter-firm cooperation and collaboration might not necessarily be costly but the process of acquiring new knowledge could be costly. It is, therefore, necessary for firms to get value for the knowledge acquired by ensuring that the new knowledge is not just shared among employees but gain cognition of the new knowledge to implement it successfully towards innovation. Scholarship on knowledge sharing has basically been focused on interfirm knowledge sharing (Cui et al., 2020; Xu et al., 2021; Majuri, 2022) at the expense of intra-firm. Extant literature is a dearth of intra-firm knowledge sharing activities and their impact on innovation. This is an issue because collaboration between and among firms is necessary for knowledge sharing and innovation but knowledge sharing within the firm through intra-firm knowledge activities is a sufficient condition for effective innovation within a firm. Wang et al. (2018) examined the impact of an inter-firm knowledge network on innovation performance among high-tech firms in Taiwan's science parks using snowball sampling techniques and knowledge-based theory. They found that an inter-firm knowledge network improves a firm innovation performance. In Singapore, Cui et at. (2020) found that IT-enabled inter-firm knowledge exploration capabilities help product effectiveness and process efficiency through the case study method. Using a single case of an aviation refuelling company in Canada as the study setting, Usman et al (2019) developed a framework for inter-firm and intra-firm knowledge sharing and learning. Their findings showed that intra-firm knowledge sharing capabilities promote the diffusion of inter-firm learning.

The findings of prior literature have been based on single firm or country-level data. In situations where inter-firm knowledge activities have been investigated, less emphasis has been placed on a very important variable

such as channels of information in the knowledge transfer process. Thus, even though prior literature has stressed the importance of both inter-firm and intra-firm knowledge activities toward innovation, we were unable to find a study that blends both concepts and assesses the impact on innovation. Practically, knowledge is transferred into firms through inter-firm collaboration and is shared within the firm-through intra-firm activities. The effect of knowledge transferred on innovation is complete if there is a simultaneous assessment of both inter-firm and intra-firm knowledge-based activities among firms. This study seeks to fill the gap in extant literature by exploring how intra-firm and inter-firm activities promote knowledge sharing towards innovation performance. We used the variables channels of information to represent inter-firm activities and workplace organization to represent intra-firm knowledge sharing activities. The proxies for innovation performance were product innovation and business process innovation. Cross-sectional country-level data from CIS 2018 for 17 countries within the EU region was used for our study. The OLS regression method was used for the analysis. We based our model on knowledge-based view (KBV) and social network theory (SNT) which have been tried and tested (Wang et al., 2018) to foster knowledge sharing from outside and within the firm.

This paper extends extant scholarship on inter-firm and intra-firm knowledge activities as well as innovation in three ways. First, it synthesizes ideas from inter-firm (Cui et at., 2020; Majuri, 2022; He et al., 2021) and intra-firm knowledge activities (Usman et al., 2019; Muhammed & Zaim,2020; Song et al., 2020) and innovation literature (Arthur & Stejskal, 2022; Di Vaio et al., 2020) examining the effect of inter-firm knowledge activities in the form of channels of information and intra-firm knowledge activities in the form of workplace methods on product and business process innovations. Second, this study fills the literature gap on how inter-firm and intra-firm knowledge activities simultaneously impact product and business process innovation. Thirdly, it contributes to the body of knowledge on knowledge-based view and social network theory. Our findings have key implications for managers and owners of firms on the value of both external and internal activities that aid knowledge flow leading to innovation. It also helps them to understand key activities and mechanisms to be implemented to support the free flow of new knowledge to the firm and within the firm structures.

The next chapter is the theoretical framework of the study. It reviews related current literature of the study and formulates the hypothesis of the study. Chapter 3 deals with the data and methodology of the study. The data analysis and results are in Chapter 4 while Chapter 5 captures the discussion and conclusion.

2. Theoretical Framework

2.1 Firm Innovation the Nexus Between Intra and Interfirm Knowledge Activities

Intra-firm knowledge activities involve all mechanisms used by a firm to transfer or share knowledge within the firm. Knowledge especially in tacit form is best shared through social interactions. The bedrock of innovation is knowledge. Managers ought to exhibit great skills in ensuring that, all forms of knowledge that enter the firm are adequately shared for employees to be cognizant of its implementations to achieve the expected innovation outcome. Usman, Ahmad & Burgoyne (2019) suggest that to improve organizational learning intra-firm knowledge sharing mechanisms such as teams, meetings, training and mentoring should be in place. Without intra-firm knowledge sharing activities, acquired knowledge if tacit, remains in the minds of people, while expressed knowledge is restricted to the confines of books, magazines, computers and other storage devices. The process of unleashing acquired knowledge is key to reaping the full benefit of the cost of knowledge acquisition. All workers across all departments of the firm are expected to full be abreast of the new process of producing the new product. Information asymmetry among workers creates imbalances in knowledge sharing and its implementation. Regardless of the vitality and quality of information, if workers of firms do not have the know-how of its implementation, it remains valueless and does not produce the expected innovative outcome. Existing literature (Arthur& Stejskal, 2022) supports the importance of a firm's internal knowledge sharing in the promotion of innovation. In order for acquired knowledge to be shared effectively, it must be released randomly in both time and space. This is what Fan, Lian & Wang (2020) referred to as the cafeteria effect. The creation of a new product or adoption of a new process in the production process needs to be learned and understood by all workers within the firm to effectively impact positively on the expected innovation. This study adopts work method organizations as an intra-firm activity that influences innovation. Based on these intra-firm activities expressed above, the following hypothesis is formulated.

H_{1A}: Work method organization has a positive significant impact on firm product innovation.

H_{1B}: Work method organization has a positive significant impact on business process innovation.

Knowledge travels between and among firms through cooperation and collaboration. Inter-firm knowledge activities aid knowledge exchange, sharing and evolution. Firms are likely to interact and share knowledge when concentrated or agglomerated at a geographical area. Agglomeration according to Marshall's theory of innovation stemmed from interaction of technology, labour pool and networking of firms (Shoufu, 2022). Two main factors that influence inter-firm knowledge activities are geographical and cultural proximity. The spread of knowledge, especially tacit knowledge is effective when firms are not just closer but interact through a number of knowledges sharing activities. Geographical proximity is the physical concentration of firms in a specific space. Firms that are geographically concentrated benefit from economies of scale in the form of lower costs. They are also able to pool resources together to undertake a research or infrastructure project which normally could not have been done by any single firm due to the high cost involved. Emphasis must be made that, geographical concentration of firms alone is not enough to create inter-firm collaboration, but mutual share of trust, values, norms and interests are catalysts for inter-firm knowledge activities. It implies that firms that are culturally related are more likely to interact and share knowledge toward innovation. Complexities associated with the innovation process are reduced and resolved in an environment where there are active inter-firm knowledge sharing activities (Cui et al., 2020). In the current volatile, complex and dynamic business environment, no firm could claim to be independent and remain innovatively competitive. It is an era of high interdependence, cooperation and collaboration and the surest way is inter-firm knowledge related activities that promote innovation. However, inter-firm cooperation is not at smooth as might seem. The process of collaboration and cooperation through inter-firm knowledge activities is hampered by trust issues between firms, varied cooperate cultural interest, great disparities in resource endowment, public rules and regulations. The main aim of inter-firm cooperation is to share knowledge. In a circumstance where one firm withholds part of information or knowledge to be shared, it does not promote successful inter-firm cooperation. Inter-firm knowledge activities must ensure a win - win situation. When a firm perceives to be more endowed in resources than the other, it, might stand not to gain as much as the other firm, this could hinder the smooth process of inter-firm knowledge activities. The forgoing arguments points to the fact that, an effective interfirm cooperation is based on diverse and distinctive channels of information accessible to firms. The more variations channels of information available, the quality of options available for firms to access and gain knowledge to promote innovation. We therefore hypothesised that:

H_{2A}: The more distinct firms' channels of information, the stronger its impact firm product innovation.

H_{2B}: The more distinct firms' channels of information, the stronger its impact on business process innovation.

2.2 Theoretical Background: Knowledge-Based View (KBV) and Social Network Theory (SNT)

This paper draws on the axioms of KBV and SNT to buttress on the impact of inter-firm and intra-firm knowledge-based activities on innovation performance of firms. KBV is an extended version of the Resource Based View (RBV). The KBV argues that, knowledge is the most significant and strategic resource of the firm. Its proponents assert that, knowledge especially if tacit is difficult to imitate and involves a complex means of transferring it from one entity to the other. Without the right quality and quantity of resources, all firms would struggle in achieving the needed innovation. Thus, all departments and employees should have the know how to effectively utilise the knowledge resources acquired for production of goods and services. If KBV considers knowledge as an important resource, then every bit of the resource should be equally and adequately accessible to employees within the firm among enhance productivity and innovation. The means of knowledge transfer and sharing is through interactions of firms. This is where the Social Network Theory (SNT) aids in the process. The focus of SNT transfer of knowledge and information through interpersonal ties and social interactions (Do, Nguyen & Shipton, 2023). Social networks involve social interactions which have an impact on business relationships and innovations through the exchange and sharing of valuable information across departments and among employees of firms. In this direction, we argue that social networks within firms are essential for transmitting knowledge from one employee to the other in the process of firm innovation. Scholarship therefore supports the assertion that developing and maintaining social network in firms enhance knowledge sharing and innovation (Xing & Cao, 2019; Do et al., 2023). At the firm level, firms regard relationship ties and social networks as key contributor to innovation outcomes and internal change. Social network theorists acknowledge the fact that social networks offer support for firm innovation and firm internationalization (Perry-Smith & Mannucci, 2017)

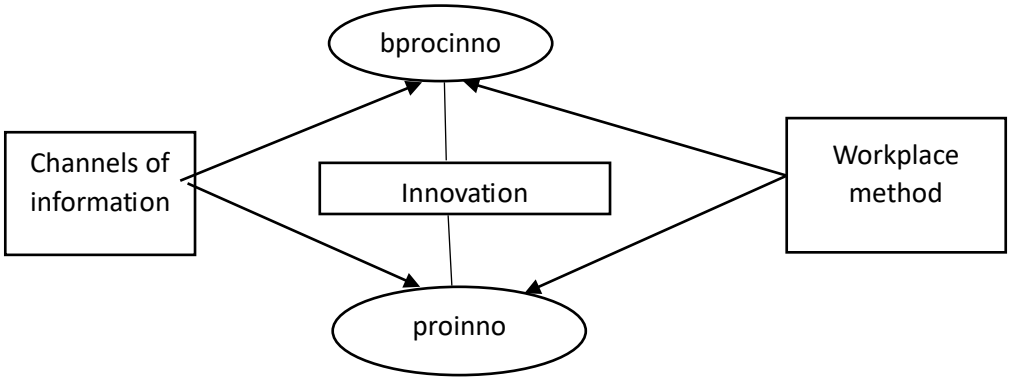


Figure 1: Conceptual Model

3. Data and Methodology

3.1 Data

Cross-sectional country level data from CIS 2018 Eurostat database for 17 countries within the EU region was used for our study. Prior studies have used data from the Eurostat database for several years due to its credibility, reliability, ethical and accurate methods used in the data collection process (Arthur et al., 2023). This makes the data credible for high level of validity for research analysis. The entire population of the firms in Europe engaged in innovation are classified as NACE2 and is usually the population of the survey. The survey comprises harmonized questionnaire based on the Oslo manual (EU, 2020). This nature of the data is consistent with the study aim. The EU was chosen as the context of the study due to high level of incentives and collaboration among firms within the EU. In 2019, the EU had 5 out of 10 most innovative Countries in the World. Germany (2nd), Finland (3rd), Switzerland (4th) Sweden (7th) and France (10th) (Scuotto et al., 2020). The intensity of innovative activities within the European region supports the view that, European firms are and ideal setting to examine inter-firm and intra-firm knowledge transfers towards innovation. CIS allows voluntary participation and answering of questions. There is therefore a high possibility of missing data. To forestall this problem, we limited our data selection to countries and variables whose data are entirely available. Data were controlled for normality of distribution and residuals. The OLS regression method was used for the analysis. This was after a test for normality indicated that the data is normally distributed (Motta, 2019). OLS regression results are highly actionable and predictive for managerial actions.

3.2 Description of Variables

The dependent variable is innovation. Innovation was proxied by two main indicators. Production innovation (proinno) and business process innovation (bprocinn). Product innovation is where a firm has introduced to the market a new or improved good or service that differs significantly from the firm's previous goods or services while business process innovation is a new or improved business proccess introduced on the market by firms that differ significantly from the previous business processes by the firm (Rydvalova & Skala, 2021). Our study had two models. Model 1 examined the impact of inter-firm and intra-firm knowledge related activities on product innovation. Model 2 on the other hand, examined the impact of inter-firm and intra-firm knowledge related activities on business process innovation. The unit of measure is the number or quantity of innovative products or processes.

The two main variables used for the analysis worked organization methods denoting intra-firm knowledge activities and channels of information representing inter-firm knowledge activities. Work organization method is proxied my planned job rotation of staff and cross-functional work groups or teams. Also, channels of information are measured by conferences/ trade fairs/ exhibitions, trade publications, published patents and crowd-sourcing. All are measured in numbers or quantities of activities held (Muhammed & Zaim,2020; Montecchi et al., 2022). Crowdsourcing is a new method for acquiring knowledge and ideas through collaborative events where experts meet to develop specialized software to solve specific problems confronting the industry (Manual, 2018)

Firm age is used as a control variable. This is because firms that have existed for a long period of time are more likely to be innovative than relatively new firms. This was obtained based on the year of registration of the firm starting from 2009 and after (Pellegrino & Piva, 2020).

4. Data Analysis and Results

We used the OLS regression model for the analysis. Stata 17 was the statistical software adopted to investigate the impact of inter-firm and intra-firm activities on the innovation of firms. Tables 1 and 2 below show the detailed results of the analysis.

Table 1: Regression Analysis of the Work Organization Methods and Channels of Information Toward Innovation

Variables	Model 1 prodinno	Model 2 bprocinno
Conferences, trade fairs or exhibitions	0.881*** (0.037)	1.570*** (0.156)
Scientific/technical journals or trade publications	-0.353*** (0.047)	-0.882*** (0.170)
Published patents	-0.577*** (0.228)	-0.577 (0.654)
Social web-based networks or crowed-sourcing	-0.211*** (0.496)	-0.557* (3.71)
Planned job rotation of staff	-7.076*** (1.283)	-10.597*** (2.087)
Cross-functional work groups or teams	8.878*** (1.428)	13.121*** (1.892)
Firm age	3.16** (0.433)	2.74* (0.399)
_cons	-7.692*** (1.956)	4.582** (2.58)
	R-sqr **0.618**	**0.504**
	N **153**	**153**

Note: Co-efficient in parenthesis * p< 0.1; ** p < 0.05; *** p < 0.01

Model 1 in Table 1 shows the results of the relationship between indicators of inter-firm and intra-firm knowledge activities and product innovation. The results indicate that there is a significant positive (β=0.037, p<0.01) impact of conferences, trade fairs and exhibitions on product innovation. Also, scientific/technical or trade journals showed a significant positive (β=0.047, p<0.01) impact on product innovation. The other inter-firm knowledge activity indicators such as published patents and social web-based networks or crowd-sourcing have a significant positive impact on product innovation. Similarly, all indicators of intra-firm knowledge activities showed a positive and significant impact on product innovation with cross-functional work groups or teams having the higher impact (β=1.428, p<0.01) on product innovation. The Pseudo R^2 is 0.618, which means, all other things being equal, our model explains 61.8% of the variations in the independent variables used. In model 2, there is a positive and significant impact of intra-firm knowledge activities and business process innovation with planned job rotation of staff having the higher impact (β=2.087, p<0.01). With the exception of published patents, which did not have a significant impact on business process innovation and crowed-sourcing having a positive significant impact on business process innovation at p<0.1 significant level, all other inter-firm knowledge activities had a positive significant impact at p<0.01 significant level. Model 2 has a Pseudo R^2 of 0.504. This means our model explains 50.4% of the variations in the independent variables.

4.1 Test for Robustness

Table 2: Results of Average Marginal Effects Estimations

Variables	Delta-method	
Variables	dy/dx	z score
Conferences, trade fairs or exhibitions	1.570*** (0.156)	10.05
Scientific/technical journals or trade publications	-0.882*** (-0.170)	-5.18
Published patents	-0.577 (0.655)	-0.88
Social web-based networks or crowed-sourcing	-0.557* (0.197)	-2.83
Planned job rotation of staff	-0.596*** (0.887)	-5.08
Cross-functional work groups or teams	0.121*** (0.792)	6.94

Note: Robust Co-efficient in parenthesis estimated P- values: * p<0.1; ** p<0.05; ***p<0.01

Average marginal effect estimation was conducted to examine the robustness of the model. The results in Table 2 showed that all inter-firm and intra-firm knowledge activity variables have a significant effect on innovation except published patents. All things being equal, inter-firm activities such as Conferences, trade fairs or exhibitions, firm innovation improves by 15.6%. Surprisingly, the average marginal effect of scientific/technical journals or trade publications on firm innovation showed negative (-0.170) results. But the rest of the inter-firm and intra-firm indicators have positive effects on innovation with a unit increase. The intra-firm variables showed a higher marginal effect of 79.2% and 88.7% on firm innovation for cross-functional work groups or teams and planned job rotation of staff respectively.

5. Discussion and Recommendations

Our study reveals that intra-firm knowledge activities such as planned job rotation of staff and cross-functional work groups or teams improve product and business process innovation. But the impact of intra-firm knowledge activities on product innovation is greater than business process innovation. This supports our hypotheses H_{1A} and H_{1B} that work method organization has a positive significant effect on firm product innovation and business process innovation. Work method organization involves teams and planned job rotation of staff. Working in teams promotes knowledge sharing and learning due to information synergy. Teamwork among firms produce results that could not have been obtained independently. It is therefore effective for firms to adopt teamwork in an effort to introduce a new idea or process towards the creation of new product, service or process. Planned job rotation enriches work experience of the worker, offer new challenges to the worker in question and new avenues for knowledge sharing and learning among workers in the department. This is consistent with Usman et al., (2019) and Arthur & Stejskal (2022) that intra-firm or internal knowledge sharing promotes firm innovation. Working in teams complements knowledge sharing. New business processes introduced into the firm with the aim of producing a new product or service must be well understood and applied by all workers. Information asymmetry among workers could be resolved through teamwork. Planned job rotation should consciously be executed by managers or HR practitioners to promote firm innovation. By implication, HR managers should encourage teamwork and rotation of staff across departments for the furtherance of firm innovation. On the other hand, our hypotheses H_{2A} and H_{2B} are supported by our findings that the more distinct firms' channels of information, the stronger their impact on firm product and business process innovations. These findings further support Cui et al., (2020) that inter-firm interactions lead to the inflow of knowledge into firms and further enhance innovation. This is consistent with

open innovation theory. The open innovation theory states that, firm innovation is driven by new knowledge from outside the firm. It is necessary for firms to collaborate with other firms of common interest for knowledge sharing towards innovation. It is also sufficiently important for firms involved in the collaboration to ensure that intra-firm activities are put in place to promote internal knowledge sharing. Although inter-firm knowledge activities have been the most focused area in knowledge sharing, our results show that intra-firm knowledge-sharing activities promote innovation among firms in the EU better than inter-firm knowledge activities. By implication, policymakers and managers of firms should place equal importance on both intra-firm and inter-firm knowledge activities for improved innovation performance among firms in the EU region.

5.1 Limitations and Future Research

Notwithstanding the fact that our findings supported the stated hypothesis, the findings of our study is not without limitations. The data used is cross-sectional and does not allow for periodic analysis of the variables employed. Also, the European Union region comprises countries with varied levels of economic development which leads to differences in innovation outcomes. It could therefore be misleading to lump 17 EU countries together for a single analysis. This opens an opportunity for further research. We recommend further research into intra-firm and inter-firm knowledge activities using panel data and categorizing the EU region on basis of the economic development of the countries involved. Our study contributes to KBV and SNT by emphasizing that knowledge sharing is a priceless resource towards innovation. This could be achieved through a conscious and simultaneous interplay of inter-firm and intra-firm knowledge activities.

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Preconditions for the Development of Organizational Knowledge Ecosystem Inside an Audit Firm

Ema Aukščenytė and Giedrius Jucevičius
Vytautas Magnus University, Kaunas, Lithuania

ema.aukscenyte@gmail.com
giedrius.jucevicius@vdu.lt

Abstract: The paper aims to present key preconditions for the development of organizational knowledge ecosystem inside an audit firm. The audit activities represent a specific context for knowledge management, especially what concerns knowledge sharing and generation of new knowledge in organizational environment of formal rules and standards. We present the survey of audit firm employees (68) and their management by discussing the key challenges related to the dynamic knowledge sharing and new knowledge creation inside an audit firm. The paper investigates the nature of knowledge within an audit firm and analyses the cultural and structural aspects of KM practices that may lead to the emergence of ecosystem for sharing the existing and generating new knowledge. The paper adopts the intra-organizational perspective to knowledge ecosystem. The audit firm operates as knowledge organization that, despite its strong formal side, is a complex dynamic system of knowledge professionals, who form the different communities of practice inside the firm. Research presented in this paper helped identify the key challenges and opportunities for the emergent knowledge partnerships inside the professional audit firm. The key cultural preconditions behind the effective knowledge ecosystem - trust-based relations, organizational culture, positive horizontal and vertical relations, and strong intrinsic motivation to share knowledge - are in place. Research findings also reveal a good fit between the employee expectations and organizational practices. However, certain challenges need to be addressed, such as bringing out and embodying the tacit knowledge of employees, and the need for continuous upgrading of the processes of knowledge creation and integration. To establish an effective and sustainable knowledge ecosystem inside the professional services firm, the paper argues for striking a delicate balance between the formal and informal parts of organization, as well as its KM system.

Keywords: Knowledge ecosystem, Knowledge sharing, Organizational learning, Knowledge management in audit and accounting

1. Introduction

Extant knowledge management research is traditionally focused on the classical approach to KM as efforts designed to capture knowledge, convert personal knowledge to group-available knowledge, connect people to people, people to knowledge, knowledge to people, and knowledge to knowledge; and measure that knowledge to facilitate management of resources and help understand its evolution (O'Leary, 2001). However, we can see a gradual transition in the firm-level KM analysis away from the issues of improving the knowledge management processes towards building the dynamic organizational knowledge ecosystems (Järvi et al, 2018; Almanopoulu, 2019). Extant research increasingly treats the organizations as complex multi-level entities than discrete units (Boutros, 2014; Brychan, 2019). A significant part of ecosystem-related research stressed the inter-organizational dimension (Clarysse, et al., 2014; Valkokari, 2015). The intra-organizational dimension of ecosystem research is represented by the focus on the aspects, such as organizational diversity and integration of technical, organizational, and institutional subsystems (Parsons, 1960; Brychan, 2019), the complex interactions where changes in one part of organization affects other parts (Boutros, 2014), the balance of formal and informal relations in organizations (Brychan, 2019). Most of these aspects also affect the effectiveness of knowledge management processes inside organizations, yet still receive insufficient attention in the KM community. Moreover, these aspects did not receive sufficient attention in the KM research, especially in the context of audit and accounting firms that operate within the constraints of formal regulations, which represent a specific research problem.

The *aim* of our paper is to discuss the preconditions for the emergence of organizational knowledge ecosystem from the perspective of a firm specialising in audit and assurance services.

The paper presents conceptual analysis of knowledge management in the professional services firms (PSFs) and contextualises the findings of KM research in an international audit and assurance services firm (branch office in Lithuania). The empirical research covered 68 employees and management of the audit firm. The findings open the discussion regarding the potential improvement of KM system within the firm, as well as acquiring the traits of knowledge ecosystem.

First, we discuss the KM processes and systems commonly established by the professional services firms (PSFs) that includes consulting, accounting, audit, and other professional services (as often exemplified by the Big

Four). At the latter half of the paper, we present the findings of empirical research in the chosen audit firm and discuss the potential improvements of KM processes as preconditions for establishing an effective organizational knowledge ecosystem.

2. Knowledge Management in Professional Services Firms: Key Issues and Strategic Choices

Research on knowledge management in professional services firms (PSFs), especially the areas of audit and accounting services, covers various aspects of classical KM while considering the industry specifics, e.g., the different knowledge bases and diverse modes for capture, conversion of new knowledge, and its connection to the existing knowledge (O'Leary, 2001), linking the KM process and audit firm's performance (Salleh et al., 2011), the different combination of knowledge management strategies in audit and consulting firms (Janicot et al., 2021).

Research shows that despite their possible divergence in size and profile, the professional services firms all gain their competitive advantage thanks to individual and collective knowledge and reputation in the market (Reihlen, Werr, 2012). Such intangible assets are difficult to create and relatively easy to lose. Therefore, having effective systems that support and upgrade the intellectual and institutional capital is of a strategic importance to the long-term survival of PSFs.

Janicot et al (2021) explore the modes of knowledge codification and personalization strategies in audit and consultancy firms (ACFs) by the taking into consideration the different nature of knowledge and forms of knowledge sharing. As far as the first parameter is concerned, there are two major types of knowledge: *declarative knowledge* codified and stored in the internal and external databases, and *procedural knowledge* used when applying conceptual knowledge in specific situations and act as patterns for problem solving inside the organization. As far as the second parameter is concerned, Hansen et al. (1999) distinguishes between two major strategies that enable the knowledge sharing: *knowledge codification* and *knowledge personalization* strategies. The first one emphasises the setting up of networks of shareable databases, while the latter places great importance on inter-individual and collective communication as a source of value. The knowledge codification strategy relies a lot on the ICT tools used not only for capturing and storing valuable (codifiable) knowledge, but also for enabling easier sharing inside the organization. The ICT influenced perspective played a strong role in the earlier stages of KM development. However, the contemporary ACFs pay particular attention to *personalization strategies* with their focus on the creation of networks for effective knowledge sharing and innovative outputs. The success of such strategies relies less on technology and more on the intangible social aspects of organization, such as trust, that promote sharing behaviour.

In such context, the concept of *organizational knowledge ecosystem* has come to the forefront of academic discussions. The general ecosystem approach in business and management research takes its roots in the works of Moore (1993, 1996), while Adner (2006) is behind the concept of innovation ecosystem as the collaborative arrangements by which firms combine their offerings into a coherent, customer-facing solution. Traditionally, researchers treat such ecosystems as dynamically organized meta-networks and knowledge meta-clusters of different organizations (Carayannis, Campbell, 2009). More recently, the ecosystem concept increasingly permeates the intra-organizational contexts. The knowledge ecosystem approach is useful while operating in turbulent environments where the need for specific knowledge is difficult to predict. Bray (2007) stresses that ecosystem approach promotes dynamic knowledge exchange activities, and "frees organization from nearly impossible task of identifying what knowledge its employees have, need now, and will later find valuable". Ecosystem perspective considers not only the formal aspects of KM system but puts special emphasis on the quality of organizational relationships and organizational culture, trust, diversity of knowledge actors, their propensity to capture and share knowledge. Ideally, the knowledge ecosystem should possess the key characteristics of complex adaptive systems with their emphasis on (Anderson, 1999; Lichtenstein, 2016; Carapiet and Harris, 2007; Uhl-Bien, Marion and McKelvey, 2007). Jucevicius et al. (2021) discuss the knowledge ecosystem from CAS perspective although approaching the knowledge ecosystem from inter-organizational perspective. In research presented in this paper, we aim to assess the preconditions for the emergence of knowledge ecosystem in a selected audit firm. Focus is on getting a deeper understanding of cultures and structures that enable knowledge sharing and new knowledge generation inside the firm that must address the strategic contradictions of operating in heavily regulated environment, while at the same time having to ensure internal flexibility and learning.

3. Presentation and Discussion of KM Research Findings in Audit Firm

The empirical research covers the Lithuanian branch office of international firm with primary specialisation in audit and accounting services. It also offers other business services, such as tax advisory, compliance and reporting, risk management, and financial reporting. The authors of the paper have agreed to the firm's anonymity request; thus, the paper presents only the general profile of the company. The international firm is among global leaders in audit and assurance services. The branch office under study has been operational for 20 years (parent company – for more than 60 years), and employs ~100 professionals across the country. The study combines quantitative and qualitative research methods: survey of employees and semi-structured interviews with management. Both questionnaires and their categories draw upon the structure of Nonaka & Takeuchi's SECI model and McElroy's knowledge lifecycle model.

The survey covered 68 employees (or 68%), of which 2 (2.9%) represent the administration department, 25 (36.8%) - audit department, 41 (60.3%) - accounting department. The tax department did not participate in the survey, which is a limitation of the study. It is important to mention that study has reached around 80 percent of employees from two key departments – audit and accounting, thus one can make objective generalizations for these two fields. In terms of work experience, 14 (20.6%) employees have been working in the organization for less than 1 year, 35 respondents (51.5%) - for 1 to 3 years, 13 (19.1%) - for 3 to 5 years, and 6 (8.8%) - for more than 5 years. The age distribution of the respondents is as follows: 35 research participants (51.5%) are between 18 and 29 years old, 26 (38.2%) - between 30 and 39 years old, while only 7 (10.3%) were over 40 years old. The demographic data shows that young professionals with few long-established links dominate organization, which has its effects on the knowledge processes inside the firm. The questions in the survey adopt Likert's 5-point scale.

First, we sought to understand *what kinds of knowledge and information the employees consider valuable in their work environment*. Most employees completely agree with the statement that personal and professional knowledge is the most valuable in the work environment (4.53), closely followed by the information and assistance provided by colleagues (4.32) and work experience (4.25). The access to training materials (390), sharing personal life experiences (3.84) and internal company procedures and documents (3.79) are of somewhat lesser importance. Then we asked respondents how often they shared the above-mentioned types of knowledge and information with their colleagues. All answers were on a lower side of the scale compared to the previous block, which indicates that employees are generally less eager to share knowledge and information that they consider valuable (see Table 1). On the other hand, the employees were most active in sharing the same three aspects considered as most valuable: personal and professional knowledge (4.26), work experience (4.09), and information and help provided by other colleagues (3.93). Personal life experience (3.56), internal company procedures and documents (3.21) and training materials (3.09) were also shared, but less intensely. The greatest gap between "considered as valuable" and "shared with others" has been observed in the latter two – training materials, and company procedures and documents. Thus, the greater challenges arise when sharing the codified knowledge in the organization.

Table 1: Comparison of Valued vs. Shared Knowledge and Information

	Considered as valuable	Shared with others
Personal and professional knowledge	4.53	4.26
Information and assistance provided by colleagues	4.32	3.93
Work experience	4.25	4.09
Training materials	3.90	3.09
Personal life experience	3.84	3.56
Internal company procedures and documents	3.79	3.21

We then asked the respondents to tell us (using similar categories) what knowledge and information they are lacking and would be most eager their colleagues to share. The majority emphasised practical knowledge (4.29) and technical knowledge (4.07), and to a lesser extent theoretical knowledge (3.93). The sharing of individual work documents, such as personal notes (3.25) and customer information (2.88) were considerably less important. The respondents are moderately satisfied with the way the knowledge sharing processes take

place in their organization (3.28), knowledge and information they receive from their colleagues are clear and reliable (3.85), as well as valuable (3.99). Employees carefully analyse new work-related knowledge (3.54), they generally claim there is no ambiguity or uncertainty in the required knowledge (3.37). The most critical points concern the clarity and structure of received information (3.13), and the overall effectiveness of system of knowledge sharing (2.81). So again, most problems are associated with capturing and systemization of information and knowledge inside the firm.

The respondents also provided their opinions regarding the engagement of organization's management and employees in KM activities. The situation was moderately positive on the following fronts: employees often come up with ideas on how to improve work-related processes (3.57), management knows what competence and expert knowledge the employee has (3.16), management tends to consider employee suggestions related to process improvements (3.41) and tends to implement such suggestions (3.32). However, relatively few respondents agreed that company keeps record of and stores the suggestions and ideas of employees (2.63), while employees who leave the company rarely save and transfer their knowledge so that it remains in the company (2.78). Creativity methods are rarely used for generating new ideas, thoughts and solve problems (1.97). This represents a KM challenge to the company dominated by relatively young employees, who have (more than 70 percent work for less than 3 years). It means that firm is experiencing potential disruptions in knowledge transfer as employees leave the organization and new employees arrive. Although the KM processes are generally functioning on the operational level, ensuring the continuity of knowledge due to high-level workplace mobility remains an issue of strategic importance.

When asked about the key barriers to sharing knowledge and information, the employees stressed the fact that the necessary information is not systematized (3.37) as the key barrier. On the other hand, respondents tend to disagree that the knowledge received from colleagues is not clear, hard-to-understand and unreliable (2.40). Nor is intra-firm competition an important barrier to knowledge sharing (2.04). Respondents claim that management does not ignore the employees' personal suggestions for better performance (2.19). They remained relatively neutral in their assessment of the motivation system for sharing knowledge inside the organization (2.90) and accessibility of needed information (2.87). Therefore, the main issues to be addressed by the organization concern systematization and improved access of information and knowledge.

When asked about the knowledge dissemination and implementation problems within the company, they emphasised three major issues: a lack of documents describing what and how to do specifically during a certain process (3.59), high cost of work execution time (3.54), and many corrections of the work performed (3.24). The problematic areas mainly concern the daily operations of the firm and execution of various operational tasks. The aspects related to knowledge dissemination, its access and feedback were not of any major concern: lack of feedback (2.25), different interpretations of knowledge transferred (2.50), lack of sharing (1.97), miscommunication in knowledge transfer (2.66).

The main motivating factors to share knowledge and information inside the organization are related to the horizontal intrinsic aspects of organization, such as organizational culture (3.87), willingness to reach for the shared goals (3.82), willingness to create added value to the organization (3.71). However, trust and positive relations with colleagues and management were the greatest motivating factors. It is important to mention that positive relations with colleagues (4.10) and trust in colleagues (4.22) were identified as even more important than positive relations with superiors (3.85) and trust in management (4.07). The bonuses have by far the least effect on employee decision to share their knowledge and information (3.07), which shows the "soft" intrinsic nature of the organizational catalysts.

The analysis of organizational practices has shown that they to a large extent correspond to the identified motivating factors to share information and knowledge. The employees identify equally positive relations with colleagues (4.00) and management (4.00), as well as trust-based relations with both parties (4.15 and 3.99 accordingly). Other factors, such as organizational culture (3.91), willingness to reach the shared goals (3.76) and create added value (3.65) are also ensured by the organization. On the other hand, economic motivators, such as bonuses, play almost no role in the organizational practices of knowledge sharing (1.88). However, as already mentioned above, the study shows that their motivating impact is not at all significant. Table 2 presents the comparison of key motivators to share knowledge and actual organizational practices.

Table 2: Comparison of Motivators to Share Knowledge and Organizational Practices

	Motivating factor	Organizational practice
Trust in colleagues	4.22	4.15
Positive relations with colleagues	4.10	4.00
Trust in management	4.07	3.99
Positive relations with superiors	3.85	4.00
Organizational culture	3.87	3.91
Willingness to reach the shared goals	3.82	3.76
Willingness to create added value to the organization	3.71	3.65
Bonuses	3.07	1.88

Finally, the employees identified the most common forms of generating new knowledge inside the organization. The most common way to generate new knowledge was through informal face-to-face interactions (4.09). Some knowledge, although to a moderate extent, is generated through collective discussions (3.15) and systemization of different knowledge bases through responsible employees (3.17). However, the use of databases for integration of knowledge is regarded as virtually non-existent (2.47), which brings us back to the same key challenges faced by the audit firm.

The semi-structured interviews with management allowed us to complement and contextualize the findings of the employee survey. The management representatives stated that the key external forces determining the evolution of the firm's KM system are the new technological developments as well as the external requirements set for audit and accounting firms. Knowledge, experience, and skills sharing processes are constantly taking place in the company, since the organization under study is rather specific and has specific needs. In terms of procedures, the company must follow the industry requirements that are set and supervised by certain institutions. Colleagues constantly update and share knowledge among each other, as it is a key success factor of professional service firms. The organization is constantly thinking about improvements, but unfortunately, it does not happen very quickly. The current method of knowledge management in the organization is to a significant extent defined by the external actors and their descriptions where knowledge sharing with colleagues and mutual communication should take place.

There have been certain instances in the practice of audit firm where knowledge management methods did not work either because they were rejected by the employees, or were unused due to the employees' workload, or due to the lack of staff. As seen from the management perspective, employees have a lot of work during the season, so they tend to focus on their tasks rather than share knowledge with their peers. Due to their workload, they do not put their insights on paper. As a result, some valuable knowledge fades into oblivion before being shared.

Despite some problems, one can also observe success stories when it comes to KM practices in the audit firm, e.g., concerning the feedback loops behind the learning processes inside the organization. When sending notifications, messages and other important information, the company requests confirmation from the employee. There are responsible persons who supervise the feedback and if they do not receive it, they send a reminder. In this case, assimilation of information is monitored. As far as monitoring of knowledge acquisition is concerned, employees have to take tests at the end of the training. Tests show how much knowledge and information have been absorbed, which is an effective way to check the acquisition of new codified knowledge. Respondents confirmed that employees present their personal knowledge to colleagues by making presentations about what they know and train others. It usually happens during the quarterly management meetings. Colleagues share knowledge with their departments, or managers between managers, as well as with other departments.

Talking about what is considered as valuable knowledge, management particularly emphasised personal qualities (next to the professional competences) as they underlie the employees' learning ability to learn and collaborate. There are incentives to the employees to share their knowledge to improve processes and solve problems. Among such incentives are gifts and bonuses. However, not all employees are aware of this opportunity or have forgotten about it. The employee survey has also confirmed this observation.

Training remains the main channel of equipping employees with new knowledge. However, training is subject to specific company regulation. Employees must acquire the needed professional knowledge during set period (40 hours of training). Since there are specific periods in the year when the employees of audit firm are extremely busy, training takes place during the "off season". In case of the remote training sessions, the employees also receive the recorded training materials. Important knowledge is stored in the firm's internal system. Management meetings take place every month where managers share their department's observations, feedback and necessary changes. Every meeting is recorded, the minutes reveal the problems discussed and solutions proposed; this information is stored. However, the survey findings suggest that employees still face challenges due to insufficiently effective systemization of knowledge inside the company.

Management representatives also stressed the importance of cultivating the climate of organizational trust where employees feel like one big family. Company seeks to avoid the emergence of negative culture. The competition among employees is rare and happens only in isolated cases (this observation was also confirmed during the survey). Managers hold annual individual interviews with their employees to achieve their best fit in organization and its culture.

Management representatives were less convinced that knowledge of employees is used to the maximum for improving the processes of the firm. During the periods of intense workload, the specific knowledge and talents often remain unobserved. When the top season is over, employees usually fail to write down the key problems, solutions, and other valuable insights, so they often do not receive the needed dissemination inside the organization. The more introvert employees have access to a special anonymous knowledge platform where they can put their opinions, ideas, and suggestions, but such inputs are rarely received. Management recognizes the importance of having a formal KM system, and using the "soft" elements of organization, such as trust, culture, positive social relations inside the firm for gradually developing an effective organizational knowledge ecosystem (i.e., with strong formal and informal subsystems of diverse actors, also across the boundaries of domestic branch office).

4. Conclusions

Research has shown that the firm's knowledge management system can be improved by focusing on three courses of action: 1) capturing and codifying the employees' tacit knowledge, 2) systemizing the diverse knowledge already found inside the organization and making it accessible to users, 3) involving the knowledge workers to be more (pro)actively engaged in improving the company's processes.

To establish an effective and sustainable knowledge ecosystem inside the professional services firm, one has to strike a delicate balance between the formal and informal parts of organization, as well as its KM system. This is a challenging task given numerous formal requirements in the environment of audit and accounting firms. The research conducted in the chosen audit firm has shown that the firm has some of the prerequisites needed for developing such ecosystem: horizontal and vertical organizational trust, collaborative organizational culture, employees' willingness to learn and contribute to the shared goals of organization, general coherence of employees' motivational factors and organizational practices promoting the sharing of knowledge. On the other hand, to achieve knowledge ecosystem that has sustainable systemic impact and does not rely on the *ad hoc* KM initiatives, one must take into consideration further actions. First, to strengthen the formal aspects of capturing and systemizing valuable declarative and procedural knowledge in the field. Secondly, to connect the diverse knowledge actors into the network that spans the organizational boundaries. Research has shown that most of the knowledge sharing is still taking place within the branch office, but connecting the knowledge workers from different branches of international audit firm into one common knowledge platform could be a welcome initiative. Finally, the KM processes in audit and accounting firm remain largely focused on training activities and learning the industry-specific knowledge, and less so on generating the new knowledge (e.g., standards) in the field. As the *raison d'être* of knowledge ecosystems is the creation of new knowledge, the audit firm could use its international profile and leadership to engage new diverse actors into shaping new forms of collaborations. Such 'strategic communities' could span the organizational boundaries and lead to the creation of new *de facto* and *de jure* standards in the field.

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Impact of Non-Human Actors in Communicating Meaning: Towards a Knowledge Translation Framework

Denise Bedford[1] and Alexeis Garcia-Perez[2]

[1]Communication, Culture, and Technology (CCT), Georgetown University, Washington DC, USA

[2]Research Centre for Business in Society (CBiS), Coventry University, UK

db233@georgetown.edu
ab1258@coventry.ac.uk

Abstract: Knowledge Translation is a core research topic in the field of knowledge sciences. To date, traditional research on knowledge translation has come from medical and health sciences. This is not surprising because in health sciences and medicine, there is a long tradition of review of evidence-based research, information dissemination and translating theory to application. While providing a strong foundation for understanding knowledge translation, research focused on the healthcare domain overlooks the scope or the scale of knowledge translation we all encounter every day in the course of living in the 21st century. In the knowledge economy, knowledge exchange and simple sharing represent an economic transaction. Wherever and whenever knowledge is exchanged, knowledge transactions should be as effective and efficient as possible to ensure the flow of knowledge is maximised. Knowledge exchange frequently occurs between human and non-human actors. In contrast, the traditional knowledge translation literature focuses on human-to-human knowledge translation. This paper looks at knowledge exchanges between human actors and non-human actors in two specific environments. The first is human-to-machine knowledge translation in service call centres. The second environment focuses on doctor-patient conversations during patient visits, with the participation of third-party non-human actors, e.g. machine transcription applications. These non-human actors create persistent records of exchanges between doctors and patients. They also have been found to generate high rates of errors in knowledge translation. The problems, challenges and opportunities involved in each of these fields are the focus of this paper. The authors identify factors that contribute to knowledge translation failures.

Keywords: Knowledge translation, Knowledge economy,Human-nonhuman interactions, Call centers, Doctor-patient dialogs

1. Introduction and Research Rationale

Knowledge Translation is a core research topic in the field of knowledge sciences. To date, traditional research on knowledge translation has come from medical and health sciences. It is not surprising because there is a long tradition of reviewing evidence-based research, information dissemination and translating theory to application in health sciences and medicine. In that field, the goal is to ensure that state-of-the-art medical research and knowledge are deployed as soon and as safely as possible to the field, where these can significantly impact those who require the research results for patient care.

In the knowledge economy, what we refer to as knowledge exchange, knowledge sharing, knowledge transfer, knowledge dissemination, and knowledge absorption is all part of a knowledge transaction. Knowledge translation must be as effective and efficient a transaction to ensure knowledge value is maximized for all parties. Therefore, knowledge translation is vital to all organizations, all groups and even individuals. Furthermore, knowledge translation is vital to today's managers in a knowledge economy where optimal use of knowledge is a competitive advantage. Therefore, every knowledge organization's core business activity is effective knowledge translation.

In addition to expanding our work in knowledge translation to every domain and every level, we must now add a third dimension – the role of non-human actors. In our world, there is an increasing role of non-human actors in everyday and professional knowledge transactions. However, there is little foundation for this new dimension in the literature on human-to-human knowledge translation. This paper examines knowledge exchanges between human and non-human actors in two specific contexts. The first is the role of non-human actors in automated call centers. The second is the role of non-human actors as recorders and transcribers in medical conversations during patient visits.

1. Knowledge Translation – Definition and Characterizations

Several definitions of KT are reported in the literature (Dal Mas et al., 2020; Savory, 2006; Semeone Secundo and Schiuma, 2017; 2018; D'Andreta & Scarbrough, 2015; Hodgins & Dadick, 2015; Jull, Giles & Graham, 2017). Strifler et al. (2015) identified 159 different theories, models, and frameworks for knowledge translation in their comprehensive review of the literature. In general, the definitions and frameworks found in the literature today represent three perspectives, including (1) research utilization and uptake; (2) evidence-based research; and (3)

information dissemination. The emphasis in these perspectives is on translation from source to target. The authors noted that a perspective focusing on the knowledge component is generally absent from the peer-reviewed literature.

There is a growing consensus that the optimal definition and conceptual model are those proposed by Baumbasch et al. (2008). Their definition and model include knowledge and translation's fundamental elements and processes. Paraphrasing Baumbasch et al., knowledge translation is an interactive and reciprocal process involving synthesizing knowledge within a complex system of interactions. They conceptualize knowledge translation as a dialog, interaction, communication, and collaboration between actors with different perspectives and domains.

The Baumbasch et al. definition and model focus on knowledge translation from unidirectional, linear research utilization and evidence-based practice models toward a complex, dynamic model. This model provides new research opportunities to explore and better understand the complexities of translating knowledge among humans who have different levels of understanding and come from different cultures and contexts. Knowledge translation is much more complex than translating research into practice.

2. Research Goals

This paper presents exploratory research. The authors have both short and long-term goals for their work. In the short-term, we expect to: (1) raise awareness of the everyday knowledge translation activities between humans and non-humans, and non-humans to non-humans; (2) explore the nature of knowledge translation among diverse actors where one or more actors are non-human, representing varying types and levels of knowledge; and (3) explore the capacity of non-human actors to articulate, absorb and engage in transactions with humans and other non-human actors. In the longer term, we hope to (1) develop a theory about the role that non-human actors can effectively play in knowledge translation and to identify their advantages and disadvantages; (2) to provide reliable and valid guidance to intelligent non-human actors to ensure there is a built-in capacity for knowledge awareness, articulation and absorption; (3) explore these questions in an extended scope and scale of engagement - from the simplest conversations to everyday collaborations, to business transactions, to complex diplomatic conversations, to interacting with automated help center agents, and even doctor-patience consultations.

3. Conceptual Model and Framework

This exploratory research is grounded in a conceptual model to reduce the complexity of integrating research from multiple disciplines (Figure 1). The conceptual model draws from the traditional literature and existing models but expands it based on knowledge drawn from the communications literature, the field of linguistics, business management practice, and the knowledge sciences literature. And, unlike the current literature, the conceptual model is domain, sector, and goal agnostic. It is both knowledge ecosystem- and scale-aware. It incorporates but goes beyond the existing models. The model provides a foundation for identifying and organizing influence factors, competencies, and capabilities by anchoring in the four components- knowledge, translation, scope, and scale.

The model provides a holistic description of the essential components of knowledge translation and the factors that influence them. The model is grounded on but expands the work of Baumbasch et al. The model has two core components – knowledge as substance and translation as a process. We expand the model to include two additional components: the translation's scope and scale.

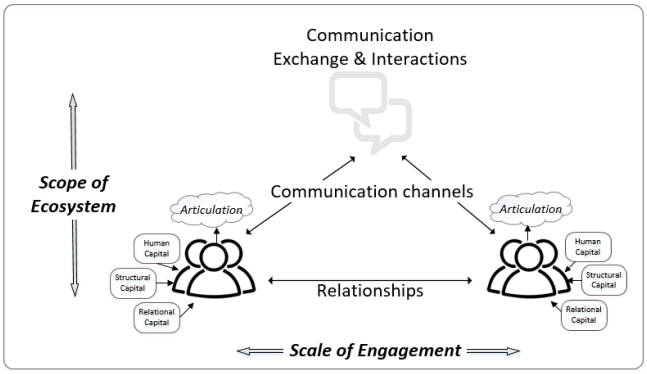


Figure 1: Foundational Components of a Knowledge Translation Conceptual Model

Knowledge translation is effective when a shared understanding and meaning among actors is achieved. To achieve this shared level of understanding, we must consider: (1) the knowledge being shared; (2) the translation process; (3) the knowledge ecosystem; and (4) the scale and scope of the communication. Each of these is comprised of multiple factors. Each knowledge translation action is unique because the goal, the context, the agents, and the knowledge is unique. When we can "see" the factors in play, we can better understand its uniqueness and how to improve its effectiveness. The literature is rich in discussing factors, but we do not have a comprehensive and inclusive picture of where they fit in any translation. A comprehensive conceptual model and a framework grounded in the model can act as a guide to identify which factors may be relevant. And a framework tied to competencies and capabilities can help us to gauge how effective that translation might be. This chapter presents a conceptual model with four components, the elements comprising each component, and critical questions for each element. The framework is grounded in the conceptual model, aligns critical questions, and calls out competencies and capabilities.

The conceptual model also translates into a framework. Because it is grounded on the conceptual model, the framework provides a comprehensive view of the translation landscape. From the framework, we can develop a checklist and set of key questions practitioners can leverage to design an optimized picture of knowledge exchanges and translations.

Table 1: Knowledge Translation Framework

Component	Parts
Knowledge	Knowledge Asset Actors Relationships
Translation	Communication and Interaction Channels Articulation
Scope of Ecosystem	Diversity of Actors Range of Goals Range of Domains Range of Languages (Linguistic) Range of Cultures Range of Status and Roles Range of Communication Styles Range of Capabilities
Scale of Engagement	# of Actors # of Channels # of Interactions The Extent of the Impact

The guiding framework is structured around the four components of the conceptual model – knowledge, translation, the exchange's scope, and scale. Within each component, key elements are identified and described. Finally, the framework offers guiding questions for each element to help anyone achieve an effective outcome.

4. Research Methodology

We have chosen two business cases to explore the role of non-human actors and their role in knowledge translation. In each case, we apply the conceptual model and framework to develop a full accounting for all four components. The first case explores non-human actors' role in automated service and calls systems. The second case explores the role of non-human actors in medical information systems and their capacity to capture, record and transcribe conversations between medical professionals and patients. In both business cases, the scope is limited to a single domain, common goal, controlled vocabulary, and common expectations to allow us to derive important observations about the actors. Also, in both business cases, the scale is limited to micro-level transactions to allow us to focus on the nature and characteristics of the non-human actors.

5. Business Case 1: Knowledge Translation in Automated Service Center Dialogs

Automated service centers are integral parts of every domain and every economic sector. Every individual encounters some form of automated service every day. They are found in banking, restaurant services, home improvement stores, appointment scheduling, retail services, library services, pharmacies, insurance, human resource, and transportation services.

Service and call center automation replace human agents with non-human agents to reduce human labor costs and improve the accuracy and quality of service requests. Non-human agents are comprised of various software and technology components. These non-human agents are designed to perform routine, time-consuming tasks and processes (Hardy et al., 2004; Legos, 2021; Paek & Horvitz, 2004; Salcedo-Sanz, 2008). The expectation is that these non-human agents will reduce the need for human intervention. However, while cost reduction may

be achieved, the literature and practical experience suggest that non-human agents have not yet achieved the same quality or efficiency of service as their human counterparts. To date, the peer-reviewed literature has assessed the performance of these non-human actors using quantitative methods applied to logs and recorded interactions. In this business case, we consider how applying the knowledge translation framework might help us identify and address challenges.

5.1 Applying the Framework to Automated Service Centers

We define service and call center interactions as focused dialogs between humans and non-human actors. We begin by profiling each component in the call pr service center dialog (Figure 2).

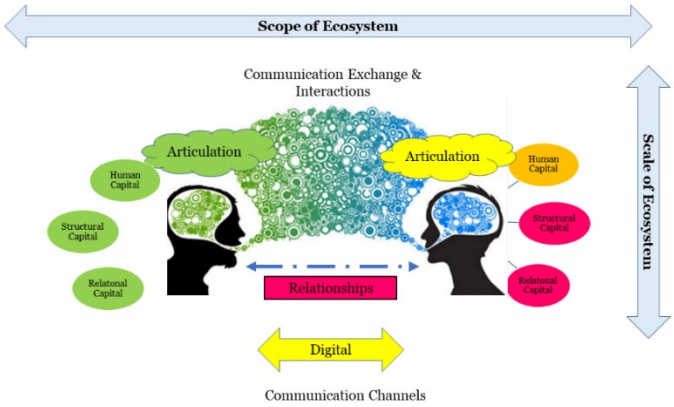


Figure 2: Automated Call and Service Centers in the Knowledge Translation Framework

Let's walk through each of the components in the framework. As a starting point, we have coded each component to suggest the challenges, limitations and constraints it brings to the task.

The ecosystem

We first want to understand the ecosystem's scope and scale when applying the framework. These two components describe two dimensions of complexity that may increase the translation challenge. In this case, the scope is minimal, as the dialog takes place in a specific domain and is related to a select set of options. It means that the vocabulary and the knowledge base will be well-known to all actors.

At first glance, the scale is also limited because the dialogue is between a single human and a non-human actor. However, our understanding of the scale changes when we realize that the non-human actor is designed to interact not only with a single actor but with any possible actor. In this case, the scale is different for each actor. The human actor is dialoguing with a single non-human actor. But the non-human actor is dialoguing with any one of potential thousand or millions of human actors. The non-human actor is designed to communicate at the meso level – with many actors within a defined domain and activity. Variations in the scale of dialog are the first challenge the framework exposes.

Actors, capabilities and competencies

The *knowledge component* of the framework surfaces variations and imbalances that can lead to miscommunications, misunderstandings and failed dialogs. Focusing on the actors, Figure 2 suggests an imbalance in the knowledge capital the actors bring to the dialog and their ability to develop relationships to improve the dialog iteratively. The human actor brings all three types of knowledge capital to the conversation, including tacit knowledge of the service and their needs, their ability to answer questions, adapt to responses by the non-human actor, develop relationships and adjust their vocabulary to communicate with others.

On the other hand, the non-human agent's knowledge capital is limited to the specific task it is designed to perform. The knowledge base is defined by its human developer. In most cases, the non-human actor's knowledge is embedded in several applications and technologies, including (1) decision support trees comprised of the conditions/responses in the non-human actors' knowledge base; (2) a domain knowledge base and vocabulary sufficient to fill the decision support tree; (3) other applications such as calendars, product descriptions, service descriptions relevant to the domain and the activity; and (4) frequently a collection of frequently asked questions or frequently given answers. The limited knowledge base of the non-human actor

can be a challenge depending on the nature of the vocabulary used in the dialog and the semantic variations built into the non-human's semantic repertoire.

We acknowledge that human actors have different capacities for understanding and absorbing knowledge. While there are variations, humans can articulate what they know (e,g., tacit knowledge) and absorb knowledge from other humans. An actor's ability to articulate and absorb knowledge speaks to his ability to learn, unlearn, adapt, relearn and reframe the dialog. It is a challenge for non-human agents for several reasons. First, non-humans can detect when an interaction is not on track, an error has occurred and needs correction, and when there is frustration in the dialog. Second, non-human actors can detect mismatches in options based on coding and semantic capabilities but cannot detect frustration or anger in human speech. Third, they cannot determine when it is appropriate to hand the dialog over to a human actor.

Additionally, human actors can learn from an effective dialog, whereas non-human agents cannot. As a result, human actors will adjust their knowledge base for future dialogs. Only the human developers of non-human actors can make those changes. In general, the knowledge imbalance across actors raises challenges that may be addressed or improved by leveraging lessons learned from knowledge translation.

In the translation component, though, we find the most significant challenges. In a human–non–human dialog, the success of the translation is very much dependent upon the architecture and the capabilities of the non-human actor (Levin, Peraccini & Eckert, 2000; Polzehl et al., 2011; Sarosi et al., 2014; Schmitt, Hank and Liscombe, 2008; Schmitt, Pieraccini & Polzehl, 2010). In this component, we find a significant communication and articulation capacity imbalance between human and non-human actors. Humans have the capacity to articulate what they know, and they can adapt how they articulate to suit others in the dialog. We take all human competencies for granted. These have to be constructed for a non-human actor, however. A non-human actor must have access to voice recognition applications, speech-to-text capabilities to translate what they hear into text for matching or form filling, named entity extraction, natural language processing to understand the response of the human actor, natural language generators, a set of scripted rules for responding, slot filling, vector-based task identification, dialogue act classification applications, and also Bayesian database record selection algorithm.

In addition to these components, non-human actors must also have the capacity to detect emotion in human speech. Detecting emotion is one of many communication problems that may occur and for which there may not yet be solutions (Hirsh et al., 2007; Suendermann et al., 2010; Yongho-Hyun, Kim & O'Keefe, 2014; Zweig et al., 2006). Nevertheless, by leveraging these applications and technologies, non-human agents can achieve some level of understanding of human words, sufficient to make a probabilistic decision regarding their meaning.

From this single business case, we observe that applying the knowledge translation model surfaces challenges that have not yet been addressed by developers building these systems. When we view the interaction from a knowledge translation perspective, there is potential for improving the human interaction with call centers.

6. Business Case 2: Non-Human Actors in Doctor-Patient Dialogs

We begin building out this business case by describing the nature of a doctor-patient dialog. Then, we overlay this dialog with the knowledge translation framework to understand the challenges and opportunities. We are concerned about non-human agents in doctor-patient dialogs because of the increased number of medical errors reported in medical situations that leverage non-human actors in some capacity.

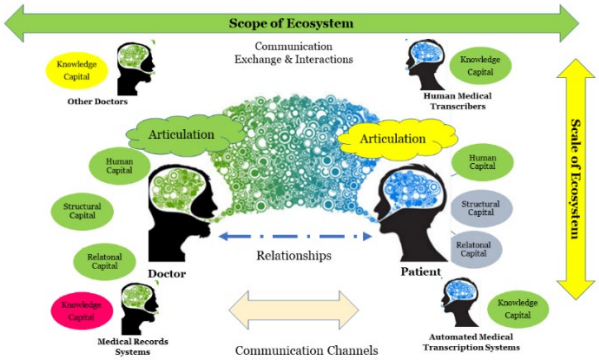


Figure 3: Doctor Patient Dialogs in the Knowledge Translation Framework

The ecosystem

How would we characterize the scale of the dialog? The label would suggest that it is a one-on-one dialog – between doctor and patient – at the micro level. It is what is initially visible. But the scale changes as we look for other invisible actors. There are at least four invisible actors involved in this dialog. The first is a medical information system – a non-human actor whose knowledge base contains records of all previous doctor-patient dialogs and interactions. The second is a community of other doctors who may take the doctor's role in future events or specialists who may provide related care. The third is a human medical transcriber who works with doctors to create medical records. And finally, we now have automated medical transcription systems that may take on the role of the human medical transcriptor to create medical records. We note that as medical records become more widely available and accessible, the scope of the doctor-patient ecosystem will continue to expand to include insurance companies, legal professionals, medical researchers, billing coders, audit contractors, other doctors and the patient. This expanding scope increases the number of opportunities for translation errors and failures. Given what we can see, we suggest the scale is micro-level and meso-level at the invisible and behind-the-scenes levels.

How do we characterize the scope of the dialog? The scope of the dialog is patient-focused – micro level. Depending on the patient's issues and medical situation, the scope may grow to the meso level as more specialists and other supporting actors are brought into the ecosystem. It is highly probable that as the scope increases, each new actor from a related discipline may bring in their non-human actors and automated applications. Scope creep may increase the knowledge translation challenges and opportunities for errors.

Actors, capabilities and competencies

As Figure 3 suggests, the knowledge component of a doctor-patient dialog significantly affects knowledge translation (Carboni et al., 2002; Poder et al., 2018). The two visible and four invisible actors best understand the knowledge component. An ideal dialog between a doctor and a patient is based on one of two conditions. First, the doctor and patient have an existing relationship and are familiar with the patient's condition and situation. They share a joint knowledge base about the patient. Second, the doctor does not know the patient but can gain some knowledge of the patient's condition and situation from medical records. The doctor must have a complete picture of the patient to elicit information from the patient and provide information back to the patient that will be understood, absorbed by, and turned into practice by the patient. So that's our setting. Doctors and patients must have substantial social capital and emotional and psychological capital. Doctors must be able to demonstrate social capital for there to be trust between the two actors. Without trust, the literature suggests the patient may be unlikely to provide additional explanatory or sensitive information essential to a correct diagnosis and medical remedy.

Patient's medical records are held in medical information systems. These are invisible actors in the doctor-patient dialog. These systems have evolved from paper to digital. Medical records have predefined structures, use predefined vocabularies and concepts, and free test fields for doctors' notes, diagnoses, remedies, therapies and general notes about the conversations with patients. Medical records are not just for the originating doctor but other healthcare professionals. While a limited number of people may be present for a given medical encounter, the number of potential actors in the longer-term dialog increases through the use of medical records. Today, these records may be created by doctors, medical transcriptionists, or automated speech recognition systems. While the use of electronic health records is intended to reduce errors, bring down costs, ensure privacy and support patient care. If the information in medical records is inaccurate, poorly organized, or untimely, medical mistakes can occur, affecting the patient's care and health. (Roop, 2009; Star 1999; Star and Griesemer, 1989; Timmermans and Berg, 2003); Garfinkel, 1967)

Medical transcriptionists are important but invisible actors in doctor-patient dialogs. They create medical records for doctors and patients. Their work has been supported or replaced by speech recognition technology in the past decade. However, transcriptionists do more than record a doctor's recordings or notes verbatim (Cora Garcia, David & Chand, 2010; David et al., 2009; Fahini et al., 2009). Medical transcriptionists use a wide range of skills and knowledge to produce accurate records. They rely on the extensive medical knowledge of terminology, anatomy and physiology, procedures, diagnosis and treatment to do their work. In addition, transcription requires an understanding of spoken language, healthcare documentation processes, medical spelling, medical terms, critical medical errors made by dictating physicians, discerning voice inflections for punctuation, and filtering background noise and distractions in the voice recording.

Additionally, transcriptionists leverage professional and sense-making skills and knowledge of how doctors speak and record their notes in their work. These very human professional and common-sense competencies allow them to discover errors in notes. These competencies add a critical level of defense against inaccurate medical records and resulting medical errors, which existing speech recognition technologies cannot duplicate.

Physicians are increasingly encouraged to create patient records using automated medical transcription applications. Physicians may use these non-human actors as dictation and transcription support as they dictate their notes after the dialog. They may also be invisible non-human actors recording the whole doctor-patient conversation as it occurs. When doctors dictate their notes, the transcription quality will depend on the doctor's articulation and speech skills, vocabulary quality, and knowledge base (e.g., medical knowledge) embedded in the application. Automated medical transcription applications do not always have built-in computational linguistics or grammar-checking components. If a human does not review the transcription, errors could exist and sustain (Brenner et al., 2015; David, Change & Sankaranarayanan, 2014; Hodgson & Coiera, 2016; Wahl et al., 2008).

The translation component is as important as the knowledge component in any knowledge translation action (Blakley et al., 2010; Halkowski, 2011; Ihlebæk, 2020; Lyons et al., 2016; Shaeff, 2017). And communication is the focal point in translation. In the doctor-patient dialog, communication between human and non-human actors is primarily one way – the non-human actors receive, translate and memorialize the communication of medical personnel. There is little interactivity or exchange in the dialog at any point. It presents challenges as the lack of interaction would suggest few checks or validations of the non-human actors' representation of the communication. The literature suggests that the critical review and validation of non-human actors' representation can raise significant concerns.

Knowledge translation between actors is the critical success factor in whether that communication is a success or a failure. A preliminary observation of introducing two non-human actors into this dialog is that the communication model may be shifting. We are prompted to ask whether the invisible non-human actors may be playing more significant roles in the translation of patient and medical knowledge among all the actors. The increased use of non-human actors may be shifting the attention of doctors and other medical personnel towards a dialog with non-human actors during patient consultations. Similarly, non-human actors may now encourage doctors to listen to their "medical data and information" in preference to knowledge from the patient. While these systems provide many new advantages in tracking and providing access to medical data and information, introducing non-human actors has changed the traditional doctor-patient knowledge exchange. These exchanges were historically challenging, but now they are abbreviated or eliminated. Have the non-human agents taken on the role of a translator in the knowledge translation process?

This case raises questions about whether this shift is occurring and, if so, how the shift might be affecting translation between doctor and patient. The authors believe it is worth further exploring how a traditional human-to-human knowledge translation process may be affected. Medical risks and unintended consequences may shift when doctors do not converse directly with patients. We suggest these are important questions to explore while the opportunity to redesign and reshape the design of non-human actors exists. Information in the popular press and gray medical literature suggests that a high percentage of hospitals plan to expand their use of the applications and technologies referenced in this paper. However, standardized methods for evaluating these technologies are currently lacking. An opportunity exists to add a knowledge translation framework to future evaluation methods.

7. Preliminary Observations From the Businesses Cases – Implications for Further Research

The authors offer two observations from their exploratory research. The first is that applying the knowledge translation framework to business cases helps us to identify the critical gaps and challenges in any knowledge translation activity. For example, in the case of knowledge translation in the call center, the translation and communication component exposed the challenges. It highlighted opportunities for improvement, specifically the non-human actor's lack of capacity to communicate with the human actor. In the case of the doctor-patient dialog, the main challenges appeared in the knowledge component – precisely, the non-human actor's lower capacity to accurately represent the knowledge of human actors and the lack of opportunity to discover and correct errors. We suggest the framework has value but requires further testing and elaboration in a broader range of examples.

Our second observation is that although smart technologies are marketed as a cost-effective and efficient way to reduce the use of human labor, they come with significant risks. The knowledge translation literature teaches us that interaction and feedback are critical quality control and assurance factors at any level and scope.

We conclude this work with an invitation to the wider community of scholars and practitioners to consider the importance of knowledge translation in their efforts to embed the latest technologies in fields that have traditionally been driven by human interactions. Our business cases show that –despite their potential to improve processes and add value, the introduction of non-human actors in a traditional dialogue must be part of a carefully designed strategy that also includes the development of key capabilities and competencies within the organisation.

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SMEs in Collaborative Innovation Networks: A Maturity Model Evaluating Their Absorptive Capacity

Lamiae Benhayoun[1], Marie-Anne Le-Dain[2] and Bouchaib Bahli[3]
[1]Rabat Business School, International University of Rabat, Morocco
[2]Grenoble Institute of Technology, Université Grenoble Alpes, France
[3]Ted Rogers School of Management, Toronto Metropolitan University, Canada

lamiae.benhayoun@uir.ac.ma
marie-anne.le-dain@grenoble-inp.fr
bahli@torontomu.ca

Abstract: SMEs increasingly engage in Collaborative Innovation Networks (CINs) to access valuable knowledge for innovation from complementary partners. They deploy their absorptive capacity (ACAP) to make efficient use of this new external knowledge. Despite the importance of ACAP to support the contribution of SMEs to innovation throughout the lifecycle of a CIN, there is no operational measure to guide them regarding ACAP implementation to reach the network common innovation goal. We propose to design a grid-based maturity model allowing SMEs to evaluate their ACAP given their embedding contexts in CINs. We follow a mixed methods' Design Science approach to define the content of the maturity model and adjust it by predicting the ACAP aspects that an SME should primarily master considering its context in a CIN. Our results expand academic understanding on the contingent peculiarities of ACAP by unveiling the natures of its practices and its contextual variability for the examined SMEs. We improve practice by providing SMEs with an assessment tool to early spot their ACAP deficiencies and implement the relevant corrective actions.

Keywords: SMEs; Collaborative networks; Collaborative innovation; Absorptive capacity; Maturity models

1. Introduction

Innovation helps SMEs differentiate themselves from competitors and thrive in increasingly dynamic environments. However, the lack of resources and knowledge hinders their innovation efforts (Lubatkin et al. 2001). Hence, they rely on open innovation alternatives especially by participating in collaborative innovation networks (CINs), involving heterogeneous actors that work together to achieve a common goal. This strategy has become critical for organizations to enhance their resilience in times of crisis (Ramezani and Camarinha-Matos 2020) such as the COVID-19 pandemic. CINs enable SMEs to pool their resources with other actors and share the risks and benefits inherent in innovation development. Most importantly, they facilitate access to complementary knowledge provided by these actors to jointly develop mutually beneficial innovations (Lubatkin et al. 2001).

This collective blending of knowledge requires coordination to capitalize on the complementarities between the actors while protecting the key expertise of each from possible leaks (Lubatkin et al. 2001). These challenges are significant for SMEs whose lack of resources prevents them from dedicating a team to the CIN. Also, their competitive positions may be jeopardized when they collaborate with large firms that can easily appropriate the key knowledge of these SMEs (Hallen et al. 2014). Despite the substantial literature on CINs, no study guides SMEs towards the appropriate approach to efficiently integrate and use new external knowledge to contribute to a CIN.

Accordingly, we rely on Absorptive Capacity (ACAP) concept to uncover the peculiarities of new knowledge integration by SMEs in this interorganizational innovation setting. ACAP refers to a firm's ability to identify relevant external knowledge, assimilate it, and apply it to commercial ends (Cohen and Levinthal 1990). Several instruments were developed to measure it in intraorganizational contexts (e.g., Ter Wal et al. 2011) or interorganizational long-term alliances of large firms (e.g., Thuc Anh et al. 2006), but none for SMEs within CINs. Extant measures are not suitable to these SMEs as they overlook the contingency incidence of CINs on ACAP, in terms of limited temporality (Sydow and Braun 2018), SME nature, the partners' cognitive distance, etc. (Lubatkin et al. 2001).

We follow a Design Science approach to develop a maturity model measuring ACAP of SMEs for their contribution to CINs. Maturity models raise firms' awareness of best practices, identify trouble spots, and stimulate improvement activities (Maier et al. 2012). The proposed model will guide the SME towards the practices most suitable to its CIN embedding context. It predicts such practices considering ACAP's contextual determinants such as the SME's role in the CIN, or its cognitive distance from the other actors.

2. Theoretical Foundations

2.1 Collaborative Innovation Networks for SMEs

Collaborative innovation networks (CINs) involve entities largely autonomous, geographically distributed, and heterogeneous in terms of their structures, cultures, and goals, but that collaborate to better achieve a jointly beneficial innovation (Camarinha-Matos et al. 2009). The network actors are organized across two distinct stages as an external community of practice (Dewhurst and Navarro 2004) to reciprocally learn, through artefacts and exchanges, explicit and tacit knowledge for accomplishing the common innovation. They first implement a network setting-up phase by frequently participating in fairs to gain inspiration and identify complementary partners (Van Egeraat et al. 2013). Then, the development stage requires intensive exchanges within the network, for instance using boundary objects to facilitate the joint integration of knowledge for innovation development and commercialization (Mäenpää et al. 2016).

CINs are a fundamental open innovation alternative for SMEs to share with other partners the financial and development risks of innovation and to balance their relative dependence and power in negotiation with buyers. These networks also enable SMEs to overcome their lack of knowledge and skills to manage the entire innovation process (Smolander et al. 2020) by accessing complementary knowledge for innovation from other CIN actors. An SME would then remain focused on developing specific expertise in the few technological areas that provide it with a stable market position, while accessing new external knowledge to generate an innovation (Lee et al. 2010).

2.2 Absorptive Capacity

To make efficient use of external knowledge for innovation in CINs, firms deploy their absorptive capacity (ACAP), referring to a firm's ability to recognize valuable new information and knowledge, assimilate it, and apply it to commercial ends (Cohen and Levinthal 1990). It is a dynamic learning capability enabling firms to align with their turbulent environments by efficiently using external knowledge (Najafi Tavani et al. 2018). In interorganizational contexts, ACAP also embodies the degree to which an organization learns from its partner (Omidvar et al. 2017).

Most empirical research mobilizes the ACAP conceptualization of Zahra and George (2002) to measure it. It gathers dimensions of acquisition, assimilation, transformation, and exploitation. Acquisition reflects the organization's ability to identify and access externally generated knowledge critical to its operations. Assimilation refers to the analysis of externally acquired knowledge to assess its potential. Application or exploitation refers to the firm's ability to leverage and create competencies by incorporating acquired knowledge into its operations (Cohen and Levinthal 1990). For the studied SMEs, we do not include transformation as it conveys a firm's efforts to create perceptual schemas from newly acquired knowledge that will be exploited for long-term value creation (Zahra and George 2002). Hence, it is not consistent with the ACAP in our study which focuses on the SME's contribution to achieving the temporary network's innovation goal.

ACAP of a firm in a CIN is subject to several contextual determinants that influence its deployment. First, external activators such as rapid technological evolution would drive an intense activation of ACAP (Zahra and George 2002). Second, internal activators conveying specific performance objectives such as strengthening technological and financial capitals can trigger new knowledge integration (Gluch et al. 2009). Third, units with central roles in innovation networks efficiently use new knowledge only if they deploy an intense ACAP (Tsai 2001). Fourth, a firm in a reciprocal learning partnership such as CINs, is required to deploy an intense ACAP when its cognitive distance regarding the other actors is substantial; and when the network includes members with expertise and commercial orientations close to the SME, which may generate liabilities (Lubatkin et al. 2001).

3. Methodology

We propose to develop a maturity model measuring ACAP for an SME contributing to a CIN. These improvement instruments assume that processes correctly defined, managed, and executed, lead to better performance (Dooley et al. 2001). The first type of these models is CMMI that was developed to certify organizations' maturity for delivering a software compliant to the requirements. Its certifying usage has been extended to institutionalized processes other than computer programming. The second type is maturity grids that are designed to communicate good practices in an efficient way (Maier et al. 2012). Grid-based maturity models are less expensive and less time-consuming compared to CMMI. This helps quickly measure the gap

between an organization's current practices and the ones to target, thereby making them adequate for the examined SMEs.

To develop our maturity model, we follow the design science approach suggested by Maier et al. (2012) consisting in four phases: planning, development, evaluation, and maintenance. Our investigation covers the two first phases. We are currently proceeding with the model's evaluation in real-life case studies. Maintenance is rather related to the continuous upgrade of the model as it is applied. The model's design requires determining the key process areas (KPAs) that are mutually exclusive and collectively exhaustive to describe the evaluated object. Each KPA is defined through associated practices, implemented collectively to satisfy important improvement goals. KPAs are described at different levels of performance. The highest maturity level is where the KPA's practices are efficiently applied and culturally rooted. We complement this approach with a quantitative study to contextualize the ACAP of SMEs contributing to CINs. This capacity varies according to several contextual determinants. Hence, the ideal maturity level of ACAP KPAs and practices should be defined according to the SME's context.

3.1 Planning

This phase determines the model's audience, its aim, scope, and its success application criteria. To inform these elements, we performed a literature review on SMEs' collaborative innovation, complemented by 10 exploratory semi-structured interviews. We interviewed four CEOs of SMEs in France that have operated in several CINs within the multimedia and textile sectors. We also interviewed two innovation management consultants used to applying maturity models and four representatives of French industrial clusters from sectors with different technological intensities, who frequently support collaborative innovation projects. The interviewees confirmed that collaborative innovation is a major focus of European policymakers to capitalize on synergies between organizations in an environment where knowledge is highly scattered.

For the model's audience, they recommended addressing the key members of the SME's project team including the CEOs, as they are involved in the strategic and operational aspects of innovation projects. The model should aim to quickly identify the SME's capabilities' strengths and gaps since the CIN early phases. For the scope, the maturity grid must be applicable to SMEs in all sectors and CIN configurations. Finally, the model's application is successful when the SME perceives it as useful, usable, and complete to guide improvement (Moultrie et al. 2007).

3.2 Development

The development phase defines the KPAs, the maturity scale, the content formulation, and the administration mechanism. To inform these elements, we combined an muti-topic literature review and three empirical sources. First, 19 semi-structured interviews were conducted in three different CINs in the mechanical, software, and medical sectors. These CINs involved 13 SMEs embedded in various collaboration configurations considering the ACAP contextual determinants. We interviewed key project team members within these SMEs and within some of their partners, resulting in 23 hours of recordings that were transcribed and grammatically sub-divided to enable their thematic analysis with NVivo. We reached semantic saturation by the 16th interview. Second, we organized two focus groups with 14 experts including researchers in knowledge management and practitioners in CINs to discuss the interviews' outcomes and define the appropriate architecture of the maturity model. Third, we performed a quantitative analysis to elaborate the contextualization approach of the maturity model. The resulting architecture is explained below.

First, for the KPAs, our literature review underlined six exclusive dimensions that holistically describe the SME's ACAP. They refer to knowledge acquisition, assimilation, and application by the SME to contribute to CIN setting-up then development. Their accuracy as KPAs was confirmed following the empirical process. Second, for ACAP maturity, we reviewed several studies around maturity models and selected two criteria, namely capability and willingness. The relevance of these criteria and their associated scales for the studied SMEs were discussed and validated during the focus groups. Third, to formulate the model's content, we applied a hybrid approach recommended for cognitive rather than technical concepts as is the case of ACAP (Cohen and Levinthal 1990). The approach consists in describing the KPAs with set of questions expressing best practices. The respondent scores the KPA's practices on a Likert scale ranging from 1 to n, where n is the highest maturity level of the KPA. To define these best practices, we combined the outcomes of an in-depth review of the existing ACAP multidimensional measures, those of the interviews, and the outputs of the focus groups. Fourth, both focus groups recommended an interactive administration mechanism in the presence of a

moderator and the SME's representatives, as it is more engaging and stimulating for the participant than individually informing the model.

Finally, as the SME's ACAP varies according to its embedding context in the CIN, we designed a prediction process to guide the SME toward the most important KPAs and practices for its context. Under SmartPLS4.0, we used PLS (partial least squares) algorithm because of its forecasting virtues (Tenenhaus et al. 2005), to quantitatively analyze 74 responses of a survey conducted with SMEs contributing to CINs. PLS allows prediction with latent variables by performing regressions from the scores obtained through a succession of factorial analyses. Accordingly, the contextual determinants and ACAP practices were refined and the prediction equations formulated.

4. Results

4.1 Practices Associated with the ACAP KPAs

As underlined in Table 1, 56 practices were determined to describe the six KPA. 31 were adjusted from the extant ACAP multidimensional measures. The interviews confirmed some of these adapted practices and highlighted 25 new ones. Most of these emerging practices refer to the issue of risk management throughout both stages of a CIN. No new practices were proposed in the focus groups.

Table 1: Items of the Contextual Factors and ACAP Dimensions

Construct type	Label	Definition	Items	Scales
Contextual factors	*EXT*	External circumstances driving knowledge absorption by the SME	*EXT1*	Rapid evolution of the industry's technologies
			*EXT2**	High regulation of the industry's policy
			EXT3	High frequency of innovation in the industry
			EXT4	High competitiveness of the market in the industry
	ROLE	Role's centrality of the SME in the CIN	*ROLE1*	Strong involvement in exchanges with the market
			ROLE2	Strong involvement in project management
			ROLE3	Strong involvement in technical coordination
	INT	Internal circumstances driving knowledge absorption by the SME	*INT1*	Achieve an innovation that you will own
			INT2	Generate financial profit
			INT3	Acquire learnings
			INT4	Extend the professional network
			INT5	Re-orientate the firm's strategy
	COG	Cognitive distance of the SME and the CIN actors	*COG1*	Distant disciplines regarding the other CIN actors
			*COG2**	Different structure and/or culture regarding the other CIN actors
	COOP	Competition among the SME and the CIN actors	*COOP1*	Similar expertise and/or activities regarding the other CIN actors
			COOP2	Similar commercial strategy regarding the other CIN actors
KPAs for the SME's contribution in CIN setting-up	*ACQ1*	Acquisition of external knowledge for CIN setting-up	*ACQ1.1**	Investigate technological knowledge
			ACQ1.2	Investigate supply chain knowledge
			*ACQ1.3**	Investigate market knowledge
			ACQ1.4	Investigate knowledge on innovation project management
			ACQ1.5	**Investigate knowledge on collaboration innovation**
			*ACQ1.6**	Mobilize databases

Construct type	Label	Definition	Items	Scales
			ACQ1.7	Solicit the CIN actors
			ACQ1.8	Solicit experts outside the CIN
			*ACQ1.9**	Solicit the client
			*ACQ1.10**	Participate in industrial/scientific events
			ACQ1.11	Be inclined to investigate any other useful knowledge area
	ASS1	Assimilation of external knowledge for CIN setting-up	*ASS1.1*	Involve the client
			ASS1.2	Ensure a coherent vision by exchanging with the CIN actors
			ASS1.3	Exchange with CIN actors and the client using boundary objects
			ASS1.4	**Evaluate the pros and cons of a network with unusual actors**
			ASS1.5	**Be inclined to integrate a network with unusual actors**
	APP1	Application of external knowledge for CIN setting-up	***APP1.1***	**Explain your participation in the budget**
			APP1.2	**Explain your intended operational contribution**
			*APP1.3**	Designate individuals from your firm for this project
			APP1.4	Recognize your future interfacing actors in the CIN
			APP1.5*	**Set-up project management procedure**
			APP1.6	**Set-up features for monitoring the innovation performance**
			APP1.7*	**Implement the tools for collaboration and interface steering**
			APP1.8	**Explain your terms of collaboration**
			APP1.9	**Define a commonly agreed business model with the CIN actors**
			*APP1.10**	Designate boundary spanners for the CIN
			APP1.11	**Agree on the legitimacy of the boundary spanners**
			APP1.12	**Sign formal contracts with the other actors**
			APP1.13*	**Evaluate the consistency of the project with your strategy**
			APP1.14	**Be inclined to adjust your own goals for the network benefit**
KPAs for the SME's contribution in CIN	*ACQ2*	Acquisition of external knowledge for CIN development	***ACQ2.1***	**Recognize requirements of input actors for your contribution**
			ACQ2.2	**Recognize requirements of output actors for your contribution**
			ACQ2.3	Solicit the CIN actors
			*ACQ2.4**	Solicit experts outside the CIN
			*ACQ2.5**	Solicit the client
			ACQ2.6	Mobilize databases
			*ACQ2.7**	Participate in industrial/scientific events

Construct type	Label	Definition	Items	Scales
development			*ACQ2.8*	Be inclined to investigate any other useful knowledge area
	ASS2	Assimilation of external knowledge for CIN development	*ASS2.1**	Involve the client
			ASS2.2	Exchange with your interfacing actors
			ASS2.3*	**Ensure a coherent vision by exchanging with the CIN actors**
			ASS2.4	Exchange with CIN actors and the client using boundary objects
			ASS2.5	Use IT means to share knowledge with CIN actors and the client
			ASS2.6*	**Question the suggestions of the other actors and the client**
			ASS2.7	**Be attentive to leakages of your key knowledge in the CIN**
			ASS2.8	Be inclined to integrate uses other than your ways of doing
	APP2	Application of external knowledge for CIN development	*APP2.1*	Work jointly with your interfacing actors
			APP2.2	**Test the innovation with the client**
			APP2.3*	**Promote the innovation in events**
			APP2.4	**Use advanced technologies to achieve your contribution**
			APP2.5	Document your contribution
			APP2.6	Challenge your contribution's performance
			APP2.7	**Raise your doubts for development and commercialization**
			APP2.8*	**Allocate further resources to the project id required**
			APP2.9	Assist the other CIN actors to achieve their contributions
			APP2.10	**Be inclined to adjust your contributions based on the CIN needs**

*Item omitted during the quantitative analysis **Item resulting from the interviews**

Then, we performed factor analysis to eliminate the non-significant practices, which resulted in retaining 38 absorption practices. This required assessing the practices' reliability based on a bootstrapping procedure with 500 sub-samples, then evaluating the constructs' convergent validity in terms of AVE, and their reliability with Dillon-Goldstein's Rho and Cronbach's alpha. Regarding discriminant validity, all the constructs verified the Fornell-Larcker and HTMT criteria.

4.2 Prediction Process

We formulated equations predicting the scores of the relevant ACAP dimensions and practices for an SME according to its embedding CIN context. PLS generates these equations with the outer and inner models (Hair et al. 2011). The former measures the latent variables using their indicators. The latter calculates the scores of the dependent variables based on their structural links with the independent ones. KPA ACQ1 is used as an example below.

To calculate ACQ1, the inner model (equation 1) aggregates a coefficient and the scores of the contextual factors determined as the scalar products of their items and weights' vectors, pondered with their structural coefficients regarding ACQ1. The coefficients and factors' weights result from the PLS algorithm, while the items are informed by the SME to describe its context.

$$(1)\ \boldsymbol{ACQ1} = \ 0.304\ COOP + 0.406\ ROLE + 0.164\ EXT + 0.457$$

ACQ 1 in the outer model (equation 2) is the scalar product of its items (practices) and weights' vectors. These weights result from the PLS algorithm.

$$(2)\ \boldsymbol{ACQ1} = \{0.163 \quad 0.101 \quad 0.105 \quad 0.226 \quad 0.153 \quad 0.251\} \begin{Bmatrix} ACQ1.2 \\ ACQ1.4 \\ ACQ1.5 \\ ACQ1.7 \\ ACQ1.8 \\ ACQ1.11 \end{Bmatrix}$$

The equality between the two previous equations generates a new equation where the practices' vector is the unknown variable (equation 3). We solve it using the pseudo-inverse of Moore-Penrose (Penrose 1955), which determines the scores of the KPA's absorption practices as:

$$(3) \begin{Bmatrix} ACQ1.2 \\ ACQ1.4 \\ ACQ1.5 \\ ACQ1.7 \\ ACQ1.8 \\ ACQ1.11 \end{Bmatrix} = \frac{0.304\ COOP + 0.406\ ROLE + 0.164\ EXT + 0.457}{0.163^2 + 0.101^2 + 0.105^2 + 0.226^2 + 0.153^2 + 0.251^2} \begin{Bmatrix} 0.163 \\ 0.101 \\ 0.105 \\ 0.226 \\ 0.153 \\ 0.251 \end{Bmatrix}$$

To determine the relevant practices of this KPA for the SME, we first standardize the practices' predicted scores on a scale of 1 to 4. Then, we retain the practices whose standardized scores are greater than 2. This average value was discussed and validated during the two focus groups.

4.3 Maturity Scale

CMMI evaluates maturity through operational mastery, while other studies consider it a composite notion including the mastery of processes, and the attitude of individuals regarding these processes (Le Dain et al. 2008). As knowledge absorption practices do not correspond to institutionalized processes as in CMMI and integrate a behavioral dimension (Razak et al. 2016), we evaluate ACAP maturity in terms of the SME's ability to operationally implement absorption practices 'Capability', and its propensity toward these practices 'Willingness'.

A maturity level between 1 and 4 is assigned to each evaluated practice within a KPA following the SME's response to two questions related to the maturity criteria (Table 2). For capability, an SME is expert (level 4) if it perfectly applies the methods required for the absorption practice. For willingness, an SME is a firm believer (level 4) if it perceives the interest of implementing the practice and is willing to perform it whenever it is necessary.

Table 2: Scale Assessing an SME's Maturity for Each Practice Within the six KPAs

Capability				**Willingness**		
For this project, are you to capable of performing the following practice?				*For this project, do you think it is relevant that you implement the following practice?*		
Yes, I am perfectly capable	**4**	**Expert**		Of course, it is even necessary	**4**	**Firm believer**
Yes, I am capable but need more formalization	**3**	**Capable**		Yes	**3**	**Culturally rooted**
I have some ideas but don't know how to proceed	**2**	**Some ideas**		I am neither against nor convinced	**2**	**Potentially receptive**
I can't do it and have no idea about it	**1**	**Not capable**		No, I don't find it relevant	**1**	**Culturally resistant**

The SME representatives discuss with the moderator their maturity results and improvement actions for each KPA, starting with the most important KPAs predicted for the SME's context. A lack of capability will essentially require training and support for the SME's project team to better deploy the absorption practice. A lack of

willingness will mainly entail motivational and communication initiatives to improve the awareness of the SME's project team regarding the benefits of the absorption practice. In the critical case, the SME's project team is neither convinced of the interest nor capable of implementing the absorption practice. If a large number of the practices evaluated by the SME is deficient regarding both capability and willingness, participating in the CIN with such a team can be risky. Also, the necessary improvements will be substantial in terms of implementation cost and time. Thus, it seems wise, before taking improvement steps, to analyze the adequacy of these individuals to represent the SME within the CIN, as well as the SME's role in the network. This maturity scale was approved following the two focus groups.

5. Discussion and Conclusion

5.1 Theoretical Implications

First, this research unveils the contingent nature of ACAP for an SME contributing to a CIN (Lubatkin et al. 2001). On one side, although some absorption practices seem to be transverse to a CIN's lifecycle (Table 1), their implementation substantially differs according to the considered stage. For instance, the empirical study underlined that the use of databases for new knowledge acquisition is more significant in the development phase. Also, the involvement of the client for the interpretation of its specifications is rather important in the upstream stage. On the other side, a significant number of emerging absorption practices focuses on managing the risks of knowledge internalization specific to each CIN stage. Among these practices, we emphasize the necessity for an SME to assess, in the setting-up phase, the risks of collaborating with competitors and to question, in the development stage, the other actors' propositions likely to alter its contribution's quality.

Second, we demonstrate how the relative importance of each ACAP dimension differs according to an organization's context (Flatten et al. 2011) in the case of SMEs contributing to CINs. Indeed, the quantitative analysis enabled the elaboration of a predictive process that guides an SME toward the most relevant ACAP dimensions and practices for its context in a CIN. Each ACAP component is deployed differently depending on the level of the SME's external and internal triggers, its role centrality within the CIN, and the peculiarities of its partners.

Third, this study complements the information processing perspective (Galbraith 1974) of SMEs contributing to CINs. Although more knowledge improves performance, firms need to establish rules to organize themselves and guide employee behavior regarding knowledge. This is particularly important when firms are dealing with uncertain environments as they require more "*information that has to be processed between decision-makers*" (Galbraith 1974, p. 28). The examined SMEs are directly concerned by this requirement since they engage in CINs to align with their increased sectors' turbulence and to propose innovative solutions involving different stakeholders to face competitive pressure (Tojeiro-Rivero and Moreno 2019). Hence, we demonstrate that the right deployment of ACAP can help these SMEs resolve the information processing dilemmas when contributing to CINs.

5.2 Managerial Implications

We provide SMEs participating in CINs with an assessment instrument to harness external knowledge according to their CIN contexts.

Also, we raise their awareness on highly critical absorption practices that the partners should perform to achieve their common innovation goal. These practices include conceiving a business model commonly approved by the CIN actors, contracting the relationships in the CIN to establish trust, using IT means for better sharing and capitalization of knowledge, etc.

Moreover, the developed model may help SMEs determine what collaborations make sense for them and what role they can play in CINs. By assessing its ACAP, an SME can be aware of the most appropriate partners to better respond to its internal and external innovation triggers and to compensate for its ACAP deficiencies.

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Rejecting Innovation: How Italian Public Employees are Killing Creativity and Digitalization

Marco Berardi, Andrea Ziruolo and Fabrizia Fontana
G. d'Annunzio, University of Chieti-Pescara, Italy

marco.berardi@unich.it
andrea.ziruolo@unich.it
fabrizia.fontana@unich.it

Abstract: Within the general context of new ideas generation, there is a grey area that still concerns the organizational design solutions related to creativity. In fact, if personal characteristics and other community-related issues have been quite explored so far, some organizational mechanisms still need to be deepened. In this paper we aim to investigate the impact of professional networks on Innovative Work Behaviour in the local government to achieve public value. We investigate the contribute of creativity in the digitalization of Italian public administration considering the contribution of public employees on developing knowledge management. Moreover, we investigate a community of 190 employees of municipalities divided into three macro categories: deputy employees, Managers and Senior Managers. An OSL regression model has been used to understand to what extent the degree of collaboration and advice among employees and their propensity to adopt digitalization in ordinary practice considering social capital variables. What emerges from the OLS regression is that despite accelerating the ordinary work using the leverage of digitalization and knowledge management, there is the custom of not applying the enormous benefit of process re-engineering and continuing their work attitude in what the economic literature defines "the comfort zone". The results consolidate the current literature about the creation of public value showing the resilience of public employees to change their state of mind reflecting any kind of innovation.

Keywords: Innovation, Creativity, Knowledge management, Public sector

1. Introduction

In the post covid era, digitalization and knowledge management practices should be considered two of the main leverages in the creation process of public value (Berardi et. al. 2022). International literature agrees on this point showing that the improving of socio-economic systems are strictly connected to the skills of the organization to quickly re-act on unconventional forms regarding external disturbs through innovation and digitalization in order to achieve smart governance (Vial, 2019). Moreover, in a new public management scenario, public value is created when public organization can measure the outcome or the impacts that their policy brings in the referred context or ambient (Boyne, 2002). Even if part of international literature has shown that the creation of public value refers to a multiversity of variables such as intellectual capital components of public workers (Ramirez, 2021), public performance and alignment between managers and politicians (Walker et. al, 2013), social capital (Stolle, 1999) only a few authors are investigating the contribution of creativity (Di Vincenzo et. al, 2021) while other authors are considering innovation (Amabile, 1990).

As confirmed by part of international literature, innovation practices such as digitalization (Vial, 2019) and creativity (Di Vincenzo, 2021), have been deeply investigated in literature especially in the private sector (Amabile 1996). In this sense, innovation is a fundamental strategic asset for all organizations (Crosby et al. 2017). To innovate with effective results, managers and entrepreneurs must clarify the relationship between creativity and innovation. Innovation is considered as the implementation of ideas in useful business. Therefore, we may have creativity without innovation but not innovation without creativity. The understanding of the link between innovation and creativity requires to focus on how the ideation process works. Amabile (1996, 1997) argues that innovation is the successful implementation of creative ideas within each organization. So, the ability to promptly devise innovative solutions and answers is a priority for any organizations, mostly in conditions of low intelligibility of information and limited ability to forecast.

On this topic, we must consider the effort of authors such as Soliman and Spooner (2000), as they highlighted that the successful implementation of new technologies is dependent on many factors including the efficient management of human resources. As shown by those authors, the strategic role of the human resources department in identifying strategic and knowledge gaps using knowledge mapping as far as they propose drivers and implementation strategies for knowledge management programs.

Moreover, many authors refer creativity to the generation of ideas or solutions that are simultaneously innovative, unusual and original as well as appropriate, practical and useful for the problem in question (Shalley, 1991; Woodman et. al, 1993). Considering this definition, the post-covid era represents the perfect scenario

inside whom to verify the contribution of innovation and creativity in a non-investigated context such as the public sector. In this sense, we have conducted an exploratory study trying to identify how public organizations creativity and innovation have affected the post covid era and how those two variables contribute to the creation of public value through the leverage of knowledge management.

As shown in different studies, knowledge management has deeply conditioned the public administration scenario in different countries even if the most investigated one until know it is Italy as it is considered the most hardly hit by the pandemic (Berardi et. al, 2022; Sebastiani et. al, 2020). As shown by other authors, in the first year of the pandemic, Italy had more than 90,000 deaths and over 2,500,000 Covid-19 cases (Senate of the Italian Republic, 2021). In 2020, faced with an international health emergency and to avoid the spread of the virus, the prime minister, Giuseppe Conte, ordered various restrictions on Italian citizens, with an initial severe lockdown lasting three months and then a series of other restrictions. This strategy strongly pushed, among other things, a rethinking of the way in which public services acted, based upon the rapid digitalization of the Italian public sector through Knowledge Management patterns, and thus a rethinking of the "public administration mindset" with a smart governance approach (Heeks, 2002, 2003).

So, the aim of this paper is to continue investigating this country on this research topic: *is creativity and digitalization pushing the creation of public value in Italy in the post covid era?.* This paper will show that, despite the enormous effort conducted by the Italian central government to push for digitalization and innovation, the resilience regarding part of public employees is literally killing innovation and creativity hindering the creation of public value through those two leverages.

2. The Effort Of Creativity on Digitalization and Knowledge Management on the Italian Context

Part of international literature has shown that the reaction on extraordinary events such as Covid-19 has modified what it has been considered for decades the so called "Knowledge management toolkit for public policies (Robinson et al., 2010)" considering new variables such as the trust of citizens in the public policy (Berardi et. al, 2022), (figure 1).

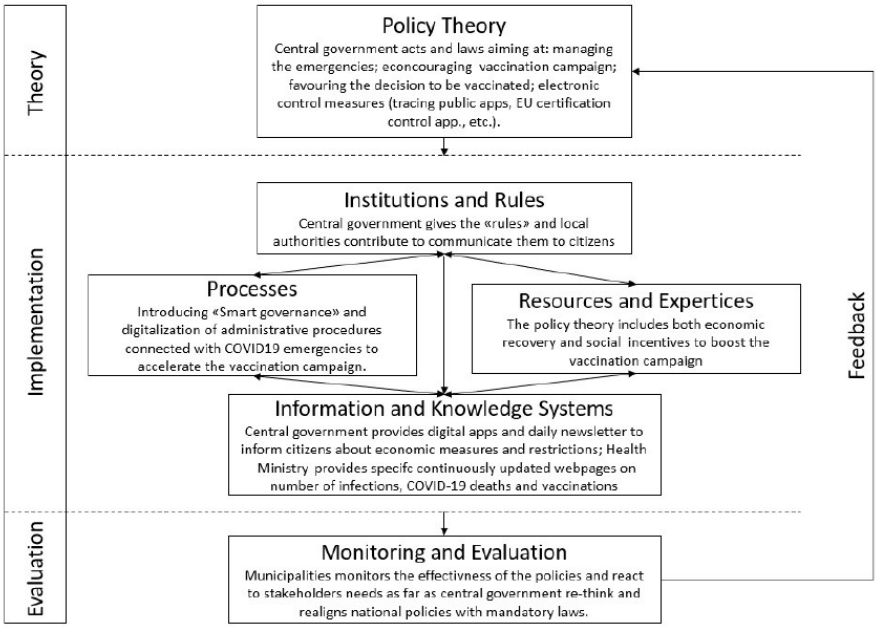


Figure 1: Knowledge Management Toolkit for Public Policies (Robinson et al., 2010)

Once the emergency has passed, public entities continue to guarantee the efficiency of public services with a lack of resources such as the effort of public money and a lack of public employees due to emergency transfers of resources from the central government. So, in order to achieve public value and maintain the same level of efficiency for public services, international literature underlines that innovation and creativity should guarantee the achievement of public goals. As a matter of fact, increased performance requirements subsequently to the emergency requests by citizens and stakeholders has led many public service organizations to develop innovative service delivery mechanisms in response to wicked issues, by creating and adding value to service

delivery (Bonner, 2023). Moreover, what is considered by social and public value is what brings value in terms of satisfaction to stakeholders dealing with : user value, value to wide stakeholders, value to wilder society (Moore, 1995; Talbot, 2008). Because of the Covid-19 emergency a kind of "pressure for reform" has generated in all public agencies that forced public managers and leaders to collaborate in partnerships with other stakeholders to develop novel methods of delivery, evaluation, and measurement services. In the Italian scenario, this aspect has resulted in an almost total transformation of public management services for customers that boost on digitalization and innovative tools to guarantee public services. As far as the push for digitalization, the creativity of central governments on introducing new strategies to guarantee public services comes out. The most emblematic was the "Reform of digitalization in emergency" (legislative decree n. 18) that the Italian government applied in 2020.

Because of this extraordinary intervention by the central government what comes out was a facilitated process for all public administrations to acquire digital goods and services, with reference to services that operate in the cloud (Software-as-a-Service, such as for example hosting services, but also applications, services that allow teleworking, or direct services to citizens and businesses). Organizations will be able to purchase these goods and services with a negotiated procedure but without a call for tenders and in derogation of any provision of law other than criminal law, subject to compliance with the provisions of the Italian anti-mafia law code. This kind of intervention is defined by international literature as "government creativity" (Rangarajan, 2008) and represent a good example of the definition of creativity given by some authors (Shelley, 1991; Woodman et. al, 1993). Part of the literature and in particular Sternberg (1999) proposed a conceptual framework of creativity called the propulsion model that focuses on the creative outcome. The propulsion aspect reflects the will to shift from a current state to a future state as envisioned by the proponent of the boost leverage (figure 2).

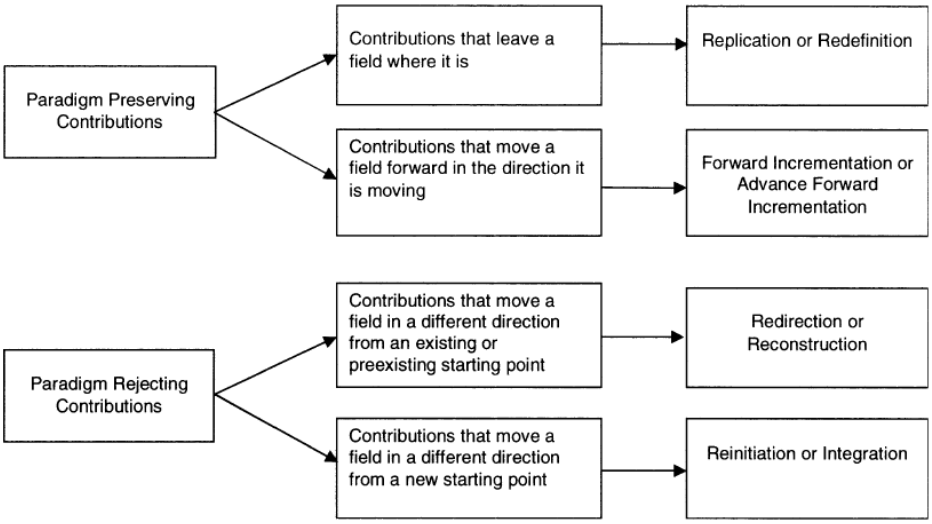


Figure 2: Propulsion Model of Creativity Inspired by Stanberg (1991) and Adapted by Rangarajan (2008)

Following this theoretical framework two possible paradigms should come out. In the first paradigm we have the preserving contribution of creativity while in the second we have the rejection. Considering the knowledge management toolkit for public policies, we should consider the creativity paradigm (Rangarajan, 2008) as an integrated part of the "process" included in the "implementation phase". So, the effectiveness of a public process is directly linked with the preservation of the creativity of ideas that the policy maker proposed in their own policies. More specifically, the efficiency of a public policy is strictly connected with the capabilities of public entities to achieve specific goals "a field forward in the direction it is moving" or that at least contributes to "a field where it is". Otherwise, a public policy fails if public bodies "move a filed element in a different position" or at least "in a different direction" (Rangarajan, 2008; Stanberg, 1991).

Concerning that literature considers that the efficiency of a public policy is directly affected by the human capital that operates in different public entities (Lappi et. al, 2019; Al Ahbabi, 2019) we investigated a data set constituted by 190 employees of municipalities divided into three macro categories: deputy employee, Managers and Senior Managers. This represents a preliminary study conducted on a sample of employees of the four biggest cities in the Italian Abruzzo Region: Pescara, L'Aquila, Chieti and Teramo that has been considered

by the Italian Health Agency as the mostly hidden hit during the second and third wave of Covid-19 and that are considered by the Italian Agency for digital innovation (AGID) as the most responsive on digitalization and implementation of knowledge management procedures all across the Italian peninsula.

3. Methodology of the Research

Considering previous literature, we focus our study on the same geographical area that has been investigated by other authors such as Battiston et. al. (2021), Marziano et. al. (2021) Berardi et. al. (2021b, 2022) to provide more details that can contribute to better understanding how the public policy has affected local authorities.

In the period between September 2022 and January 2023 we conducted 190 interviews with public employees of the municipalities of Pescara, L'Aquila, Chieti and Teramo divided into three macro categories: deputy employee (150 interviews), Managers (30) and Senior Managers (10). Those four municipalities are the Largest in terms of total inhabitants of the Abruzzo Region (296.130 inhabitants in the four municipalities over 1.312 million of total inhabitants of the entire region) and have been largely investigated by Italian literature (Papi et. al, 2022; Deidda Gagliardo, 2012). In Table 1 we reported the demographic of the respondent.

Table 1: Demographic Characteristics of the Respondents

Employee	Deputy Employee (150)		Managers (30)		Senior Managers (10)	
	Frequency	%	Frequency	%	Frequency	%
Age						
18-30						
31-44	10	6				
45-59	115	76	25	83	10	100
60 - 79	25	18	5	17		
80+						
Gender						
M	90	60	25	83	8	80
F	60	40	5	17	2	20
Education						
No schooling completed						
Nursery school to 8 year grade						
High School	120	80				
Bachelor or master's Degree	30	20	30		8	80
Phd					2	20

Starting from this dataset we extract from interviews our dependent variable (Y) called "preserving creativity" computed as the use of new technological procedures inducted by ne national policies on digitalization of procedures to achieve smart governance (Vial, 2019). Such variable was based on prior studies and used a validated single item measure (de Jong & den Hartog, 2010; Mascia &Cicchetti, 2011), by asking them: 'How often have you adopted new technological items introduced in your organization after the covid-19 emergency?'. This measure captured the effectively usage by new software or digital procedures introduced in the local body with responses on a five-point scale ranging from 1 (never) to 5 (very frequently). We chose this variable in consideration of the impact that the central government acts consequently to the legislative decree 18/2020 should have on the efficiency of public procedures. The dependent variables reconduct to social capital

variables identified by international literature (Ramirez, 2020) and identified in table 2 in coherence with the process phase of the "knowledge management toolkit" (Robinson et. al, 2010) measured with a Likert scale 0-5.

Table 2: Research Items of the Process Phase of the Knowledge Management Toolkit (Robinson, 2010)

Process research Items	Deputy employee	Managers	Senior Managers
	Likert scale average	Likert scale average	Likert scale average
Smart governance	2	4.66	4.66
Are the measures adopted in line with the goal of achieve a digital environment?	1	5	5
Are the internal policies adopted in line with the national policy?	3	4	4
The timeline for the adoption of measure has been respected?	2	4	4
Digitalization	1	5	5
Do you work now in a more digital environment?	1	5	5
Has the digitalization of procedures made an improvement of your productivity?	1	5	5
Outcome	1	3	3
Do you have received positive feedback from stakeholder over the introduction on new digital procedures?	1	3	3

Once the indicators were defined, the following regression model was applied (OLS) to consider all the variables included in the survey. In the equation below, Y represent the dependent variables, *a* represents the constant of the model, β represents the coefficient of the estimation of the variables (independent variables), logxni represents the logarithmic conversion of the variables measured with Likert scale 0-5 (Table 2), while ε represents the standard error (Bun and Harrison, 2019). The logarithmic conversion of some variables has been applied to reconduct the model to a Gaussian distribution. As a result, we build up three different regression models considering the three different clusters of interviews:

- Deputy employee's creativity model: YDE= a + βx1 + βlogx2 + βlogx3 + βx4 + βlogx5 + βlogx6 + εi;
- Manager's creativity model: YM= a + βx1 + βlogx2 + βlogx3 + βx4 + βlogx5 + βlogx6 + εi;
- Senior Manager's creativity model: YSM= a + βx1 + βlogx2 + βlogx3 + βx4 + βlogx5 + βlogx6 + εi;

The combination of the 6 variables which were considered showed no problems in all the three models related to heteroskedasticity (Breusch–Pagan tests results: $\chi 2 = 0.00$; Prob> $\chi 2 = 0.856$) and specificity (Ramsey test results: F (1.86) = 0.88; Prob> F = 0.473), as well as autocorrelation of some variables so it was no necessary to proceed through step-wise regression (Shapiro–Wilk test results: *pvalue= 0.732*)

4. Analysis of the Results

What emerges from the analysis of the results and answering to rq1 is a misalignment between employees and managers contribution on creativity and digitalization to the creation of public value. As shown in table 3 the YDE model is completely irrelevant for our analysis as it has shown non-significant results while YM and YSM model reflects a complete opposite situation.

Table 3: Results of the OLS Regression

Item	Regressor	YDE	YM	YSM
Smart Governance	x1	-1,187 (0,245)	3.274 (1.988) *	3.172 (1.978) *
	logx2	0,137 (1,287)	6,846 (1,903) **	6,786 (1,897) **
	logx3	-1,481 (1,377)	8,133 (2,003) ***	7,983 (1,992) ***
Digitalization	x4	-1,876 (0,345)	4,179 (2,078) *	3,879 (1,578) *
	logx5	-2,385 (2,273)	6,074 (1,738) *	5,874 (1,684) *
Outcome	logx6	-3,175 (1.548)	2,507 (1,887) **	2,498 (1,787) **

To better understand the sense of this statical approach we report some extracts from the interviews conducted in the data set included in the YDE following the methodology suggested by part of the literature (Heeks, 2002; Heeks, 2003, Della Porta, 2018). In reference to the research item Smart Governance, we asked them: "*Are the measures adopted in line with the goal of achieving a digital environment*?" while the managers just answer without any doubt that they are operating in the right direction, most of the employees specified that: "*we are just doing what they asked us to do with absolutely no knowledge about the new software. We are just inserting data but honestly, we do not have any kind of acknowledgment or training about those new procedures. We are acting in the old way but with new sophisticated tools and instruments. Honestly, most of us are still having problems on procedures as they had a real lack regarding back knowledge about Information Technologies. We have just received some basic commands and we move one step at a time . This aspect had a terrible impact on our productivity because we must help those who are still having a problem after at least two years after the introduction of these new procedures. Moreover, many of us are afraid about the consequences of making an error so we spent a lot of time on re-checking all the phases of the single processes".*

Another point of relevant discordance can be found in the measurement of the outcome or, in other terms, about the impact that the new procedures are having on the benefits for citizens and stakeholders.

What emerges from interview is that managers had a more long-range point of view about the outcome on communities: "*we are giving our citizens the possibility to literally manage the service from their own beds. In our context almost the 80% of public services can be managed online or by sending an email or filling an online format. With the electronic identity everyone should manage and control their own business without coming here in person. In my opinion that is a revolution in the Italian public sector. On the other hand, we are encountering several problems especially with old persons that have serious issues on learning the new procedures. In this sense, the public policy is probably to far from the real needs of citizens. Probably what we really earn is a shift in culture that must start from the re-training of citizens. As a matter of fact, many of them have still problems with them so it is not easy for us to manage all the issues that come out. As a consequence, we have to ask to our employees to take care of the issues and, as a consequence, we overcharged their workdays".*

The extract of the interviews and the analysis conducted clearly show that while the managerial area of local bodies contributes to preserve the creative steam inducted by introducing new policies to introduce digitalization in public bodies, the employees almost reject innovation declining all the positive effects that these could have on their daily routine confirming the second paradigm proposed by Rangarajan (2008) and the paradox suggested by Soliman (2000). This creates a "way of no return" in the process of creating public value in terms of user value, value to wide stakeholders or "value to wilder society" and basically let the achievement of public value as you are not in the condition of measuring the real outcome on stakeholders or at least you have no impact as suggest by Stolle (1999)

5. Conclusions

As shown in the introduction of this paper, within the general context of new ideas generation, a grey area still concerns the organizational design solutions related to creativity. As a matter of fact, there is a lack of literature that investigates the contribution of creativity in the creation of public value and this field is almost unexplored (Soliman, 2000; Sebastiani, 2020; Rangarajan, 2008). With this paper we explored just one dimension of the policy making process that considers a knowledge management approach also considering that the data set that we referred only considers the public bodies organization of four cities (Berardi et. al, 2021b).

On the other hand, this paper gives a first contribution on this topic showing that in a complex organization constituted by employees, managers and senior managers, the process of creativity is completely different divided in three different categories (Heeks, 2002; Della Porta, 2018). The results of the OLS regression are emblematic and confirm that the process of creativity is strictly correlated on different levels and attitude as supposed by different authors (Bonner, 2023; Rangarajan, 2008; Stanberg, 1991). Moreover, creativity positively affects the creation of public value only when there is an alignment between the entire technostructure that gives the opportunity to effectively measure the impact of the policies and measures adopted.

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Hologram of Firms with Respect to the Productive Fabric of a Region. A Case of Business Transformation Through Knowledge Transfer in Medellín (Colombia)

Jorge Betancur, Gastón Rodríguez, Juan Pablo Restrepo and Juan David Hernández
Faculty of Business Science, Institución Universitaria de Envigado, Colombia

jhbetancur@correo.iue.edu.co
grodriguez@correo.iue.edu.co
jprestrepo@correo.iue.edu.co
finance.admon@gmail.com

Abstract: The holographic principle states that the whole is contained in each of its parts. In this study, we apply the holographic concept to business studies, with a particular focus on how business transformation might have an impact on the growth of a region. Following an experimental approach, mixed methods research was used to collect descriptive data from a set of firms in Medellín (Colombia). Two measurements (MET1 and MET2) were performed as part of the management model (MM) implemented, which allowed us to quantify the variables defined in the MM. Once a transformation was evidenced, a second measurement was carried out to compare the results and identify improvements in each dimension of the intervened firms. Additionally, the findings of this research (conducted over the course of eight years) were contrasted, from a holographic perspective and per economic sector, with reports on the region's economic growth provided by organisations such as the local chambers of commerce. Through the implementation of an MM developed by the Universidad de Envigado in a set of firms in the region, this study contributes to the literature on how the university impacts the industry through knowledge transfer.

Keywords: Firms, Knowledge management, Knowledge transfer, Management models, SIGET PROS, Business strengthening

1. Introduction

Just as a drop of water contains the characteristics of the ocean, a cell reflects the genetic traits of a living being, and a grain of sand represents the structure of a desert or a beach, each organisational process may be thought of as mirroring the structure of a firm and each firm may reflect the characteristics of the productive fabric of a region.

When applied to business studies, the holographic principle allows the economic development of regions, countries, and sectors to be analysed so that universities can understand the needs of firms and contribute to their strengthening. For this reason, stimulating knowledge transfer (KT) will always be one of the main concerns of universities, which seek to align their mission-related activities with the problems, demands, and interests of society.

The KT approach considered in this study focuses on the role that management models (MMs) play in the transformation of firms, particularly on the implementation of an MM called SIGET PROS by the Universidad de Envigado (IUE). The architecture of this MM is structured into dimensions, which allows for measuring and grouping sets of variables into attributes. Each attribute represents the components of each dimension, and each dimension, in turn, reflects each firm, each sector, and the characteristics of a region. With this, the purpose is to apply the holographic principle to the business field.

In this study, following a holographic approach, each attribute is thus intervened, which has an impact on each dimension and thus results in the strengthening of firms and economic sectors. This, indeed, contributes to the growth of the region where the university operates.

2. Theoretical Framework

2.1 Knowledge Management

Codification, teachability, uncertainty, and complexity are key attributes for KT (Zapata-Cantú et al., 2019) because they enhance its impact (Kogut & Zander, 2003) and reconfigure practices within industries (Sepúlveda-Rivillas et al., 2022). For their part, organisational learning (OL) (Serinkan et al., 2014), organisational knowledge (OK) (Kitapçi & Çelik, 2014), and learning organisation (LO) (Druker, 1993) have been reported to complement knowledge management (KM).

2.2 Knowledge Transfer

Categories such as knowledge sharing, knowledge capture, knowledge creation, and knowledge application flow from the university to the industry (Ibidunni et al., 2020) with varied strategies for their strengthening. In addition, they pose unique challenges to universities and focus on intellectual capital exchange (Hermans & Castiaux, 2007).

Participation, for its part, influences the outcomes and decisions made (De Silva et al., 2022), reshaping the KM practices of actors (Sucena et al., 2022) in addressing challenges through the use of new MMs. KT generates new knowledge (Mazorodze & Buckley, 2020) that is transferrable to all members of an organisation, resulting in process innovation and transformation (Nonaka & Takeuchi, 1995).

Various studies have confirmed the existence of a dynamics in KT, as well as certain limitations associated with the reconciliation between the interests of universities and the needs of firms (Segarra Ciprés & Bou Llusar, 2004). It is noteworthy to emphasise the importance of KM in organisations and its impact on individuals (Lenis, 2015).

2.3 Management Model

MMs are supported by information systems and reinforced by the learning processes of the members of an organisation (Kaiser et al., 2016). Also, they aid in the development of methodologies based on strategies that connect the different components of firms with their environment.

There is a pressing need for MMs that consider the specificities of small and medium-sized businesses (SMBs) (Peña Guarín et al., 2020; Ortega et al., 2021). Given the challenges faced by productive sectors, they require MMs to transform them, which makes the interaction between universities and productive sectors strategic (Rossetti et al., 2020).

SIGET PROS is an MM created by the IUE in collaboration with the Research and Consulting Centre of the IUE. It is based on a study of the SMBs in Medellín (Colombia), which was supported by the Aburrá Sur Chamber of Commerce and began by identifying the characteristics of the business fabric in this region. The design and architecture of SIGET PROS focus on the needs of SMBs as a tool for their strengthening. Additionally, this MM is founded on the concept of complex systems, where different agents interact (Viana Barcelo et al., 2012) to develop projects with strategies for each process. Furthermore, it is structured under the concept of comprehensive organisation (Ortiz & Pedroza, 2006) and includes the following four dimensions: people, management, structure, and environment. These dimensions, in turn, unfold into 13 attributes, and each attribute is further divided into 197 variables.

Considering the holographic principle, a change in any of the components (variables, attributes, dimensions) generates new states of order (Öberg, 2023), which is reflected in the strengthening of SMBs.

- The *People* Dimension

In SIGET PROS, the *people* dimension (PD) constitutes an important competitiveness factor (Ordóñez de Pablos & Lytras, 2008; Harney & Nolan, 2022). It includes three attributes: (i) human management as a competitiveness factor (Kim et al., 2023), (ii) organisational climate as a strengthening element (Xing et al., 2023), and (iii) organisational culture linked to innovation (Pedraza-Rodríguez et al., 2023).

- The *Management* Dimension

In SIGET PROS, the *management* dimension (MD) is crucial for the growth of firms and economies (Ma, 2023). It comprises three attributes: (i) processes, which are drivers of growth (Ramos-Gutierrez et al., 2023), (ii) functions, which play an important role in business sustainability (Macchi et al., 2020), and (iii) institutional philosophy, which embodies values for business creation (Milchram et al., 2019).

- The *Structure* Dimension

In SIGET PROS, the *structure* dimension (SD) encompasses three attributes: (i) finance, which has always been a key performance factor (Klein & Espinoza, 2022; Lerner & Nanda, 2020) requiring a structured management (Zhang et al., 2020); (ii) technology, which acts as a catalyst in organisations and can be applied to all business processes (Ancillai et al., 2023); and (iii) infrastructure and production, which represents a fundamental attribute in operations (Guise et al., 2023).

- The *Environment* Dimension

In SIGET PROS, the *environment* dimension (ED) serves as a reference for defining business policies and strategies (Wang et al., 2023). It includes four attributes: (i) appropriation of political-legal factors to define a firm's orientation (Li & Jin, 2021); (ii) context to which firms must quickly adapt; (iiI) factors associated with socio-environmental aspects (Florez Rios & Morales Sierra, 2019) that meet the demands of the environment; and (iv) aspects related to international trends, which serve as references for strategic design (Ragazou et al., 2022).

2.4 The Holographic Concept in Firms

According to the holographic principle, the whole is contained in each of its parts, just as the parts are contained in the whole (Morín, 2001). In the business field, organisational processes operate on the holographic principle (Al Jamal, 2020; Hall, 1995) similar to how the brain functions (Yazici, 2022). Each part of a firm represents the whole (Khademloo, 2021); hence, when one element is affected, all others are impacted. Likewise, interventions to firms influence the transformation of the productive fabric of a region (Brunetti et al., 2020).

In SIGET PROS, firms are conceived as a 'relational whole' in which specific properties and interdependent characteristics make sense as parts of a hologram. Each dimension represents each element that comprises a firm and allows us to understand each attribute insofar they capture the essence of reality.

2.5 Business Strengthening

The notion of business strengthening (BS) poses, as the greatest challenge, the strengthening of organisational change management (Sancak, 2023). To achieve BS, leadership from within organisations is necessary (Rave-Gómez et al., 2023).

Organisational change must be planned and guided by scientific approaches, especially MMs with defined structures and a methodology with clear and organised steps that engage all individuals in the organisation. Transformations within a firm are linked to its environment and dependent on the changes that may occur in the sector to which it belongs (Mouzas, 2022), just as a network of relationships within and around organisations (Capello & Cerisola, 2023). Furthermore, the outcomes of business transformation (BT) depend on the interventions made in the dimensions that constitute the architecture of the firm (Haftor & Climent Costa, 2023).

Thus, implementing an MM with an architecture that aligns with the characteristics required in the sector and its environment favours a greater impact in achieving business objectives (Worasinchai et al., 2008).

3. Methods

This research, which was conducted over the course of eight years, focused on examining the impact of KT from the university to the industry through the implementation of a set of strategies defined in an MM (SIGET PROS). Following an experimental approach, mixed methods research was used to collect and analyse data from 52 firms in Medellín between 2015 and 2022 (Figure 1). This was done given the complexity of the phenomenon under study (Cameron et al., 2013; Buckley, 2015; De Lisle, 2011) while maintaining academic rigor (Stockman, 2015).

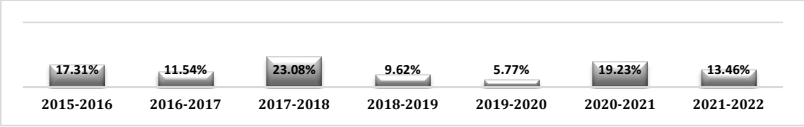


Figure 1: Distribution of Firms by Year

Data collection included two stages: (i) initial diagnosis (MET1) using four techniques (direct observation, document review, interviews, and focus groups), and (ii) measurement and analysis of results with experts from the university and executives from the firms (Magnani et al., 2023) using the Likert scale of SIGET PROS (Table 1).

Table 1: Data Measurement Scale

LEVEL	*SCORE*	*DESCRIPTORS*
ADVANCED	*8.0–10.0*	*High levels of achievement, documented evidence, progress in processes, dissemination of information, technological support*
VIABLE	*6.0–7.9*	*Some advances, some evidence, adjustable processes, concentrated information, some technological aspects*
WARNING	*4.0–5.9*	*Little evidence, failures in processes, poor documentation, obsolete technology, scattered information*
RISK	*0.0–3.9*	*Scarce evidence, outdated documents, scarce technology, diffuse information, lack of clarity in processes*

Source: Authors' own work.

After data collection, SIGET PROS was implemented in each firm (experimentation phase), which entailed the creation and implementation of a strategic plan. The resulting information from monitoring the variables (MET2) was collected in each firm over a period of six to twelve months.

Table 2: Distribution of Firms by Sector

SECTOR	***% OF FIRMS***
FOOD SECTOR	***11.54%***
COMMERCIAL SECTOR	***7.69%***
INDUSTRIAL SECTOR	***32.69%***
SERVICE SESCTOR	***36.54%***
TEXTILE SECTOR	***11.54%***
Total	***100.00%***

Source: Authors' own work.

One component of this study sought to investigate BT and BS in the economic sectors and productive fabric of the firms under analysis. To that end, the measurements before (MET1) and after (MET2) KT were compared and then analysed against the growth of the sectors in the region.

This paper aimed to provide an analysis, from a holographic perspective, of all the intervened firms and the economic sectors of the region. For such purpose, the following two questions were addressed:

- What transformations are evidenced in the firms after implementing SIGET PROS?
- How are the transformations in the productive fabric of the region reflected in the BS measurements of the firms in which SIGET PROS was implemented?

Figure 2 shows the analysis strategy for comparing the results per sector with the average MET1 and MET2 data. Such analysis includes the dimensions, firms, and economic sectors of the region.

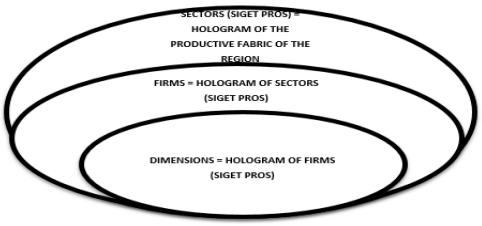


Figure 2: Analysis Strategy Using a Holographic Approach

4. Findings and Discussion

4.1 Results

Figure 3 presents the average measurements provided by SIGET PROS, with the following results for BT: 0.947 for the food sector, 0.939 for the commercial sector, 1.04 for the industrial sector, 0.993 for the service sector, and 1.065 for the textile sector. The percentages shown in Table 3 were calculated using the MET1 data.

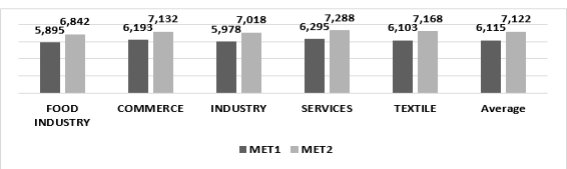


Figure 3: MET1 and MET2 Data by Sector

As shown in Table 3, the difference between MET1 and MET2 data was used to calculate the strengthening percentages of each economic sector when SIGET PROS was implemented, which were distinguished per dimension. By averaging these percentages, it is possible to estimate BT in each sector.

Table 3: Business Strengthening by Sector After Implementing SIGET PROS

% TRANSFORMATION BETWEEN MET1 AND MET2 – SECTORS AND DIMENSIONS					
Sector	*BS - FIRMS*	*BS - PD*	*BS - MD*	*BS - SD*	*BS - ED*
FOOD SECTOR	*16.061*	*17.065*	*28.216*	*12.329*	*12.910*
COMMERCIAL SECTOR	*15.157*	*13.233*	*27.146*	*12.361*	*14.695*
INDUSTRIAL SECTOR	*17.398*	*17.467*	*48.168*	*14.512*	*14.762*
SERVICE SECTOR	*15.782*	*17.139*	*19.171*	*17.926*	*22.043*
TEXTILE SECTOR	*17.440*	*19.785*	*17.300*	*18.811*	*19.067*
Overall average	*16.472*	*17.243*	*30.092*	*15.838*	*17.700*

Source: Authors' own work.

During and after the COVID-19 pandemic, the evolution of the region under analysis was characterised by the following:

- It is estimated that, by the end of 2020, the region's economy experienced a negative growth, with a rate ranging between -6% and -7% (Cámara de Comercio de Medellín para Antioquia [Medellín-Antioquia Chamber of Commerce], 2021). As can be seen in Table 4, before the pandemic, most sectors (except for the industrial sector) were experiencing growth.

Table 4: Region's Economic Growth by Sector

YEAR/ SECTOR	*FOOD SECTOR*	*COMMERCIAL SECTOR*	*INDUSTRIAL SECTOR*	*SERVICE SECTOR*	*TEXTILE SECTOR*
2016	*1.7*	*7.5*	*-0.1*	*2.4*	*2.1*
2017	*2.4*	*1.3*	*-5.1*	*3.2*	*1.4*
2018	*2.8*	*4.6*	*1.5*	*4.7*	*2.7*
2019	*3.2*	*5.4*	*-0.4*	*5.1*	*4.8*
2020	*4.2*	*-4.4*	*-9.5*	*-12,0*	*-22.5*
2021	*9.9*	*18.4*	*20,7*	*28.1*	*44.0*
2022	*4.7*	*8.0*	*10.8*	*12.5*	*17.6*
AVERAGE	*4.128*	*5.828*	*2.557*	*7.828*	*7.157*

Source: Authors' own work based on data from the Medellín-Antioquia Chamber of Commerce and FENALCO.

- In the year of the pandemic (2020), only the food sector showed a positive growth; the others experienced a considerable decline in growth. According to estimates, the region's economy experienced a negative growth, with a rate ranging between -6% and -7% (Cámara de Comercio de Medellín para Antioquia [Medellín-Antioquia Chamber of Commerce], 2021)
- All sectors witnessed a strong post-pandemic recovery and, by the end of 2021, showed a significant growth, surpassing 6% (Cámara de Comercio de Medellín para Antioquia [Medellín-Antioquia Chamber of Commerce], 2021). In 2022, all sectors maintained a positive growth trend.

4.2 Discussion of the Results

4.2.1 Analysis using a holographic approach

The proposed analysis outlined in the methodology is illustrated in Figure 4. This figure shows an overlay of the data using the BS values that were estimated based on the difference between the MET1 and MET2 data provided by SIGET PROS and that were compared with the growth rates of each sector in the region. As observed,

each dimension impacts the BS of the firms, and the BS of each firm impacts the BS of the sector to which it belongs, which, following the implementation of SIGET PROS, also impacts the growth of the region.

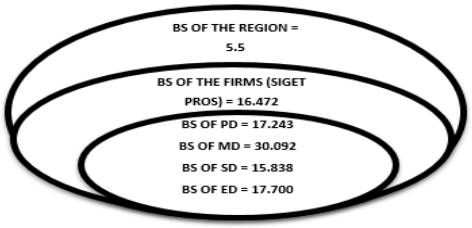
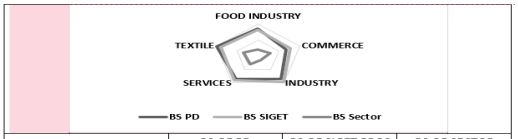


Figure 4: Analysis Strategy Using a Holographic Approach

When applying a holographic approach, the results are reflected in the relationships outlined below.

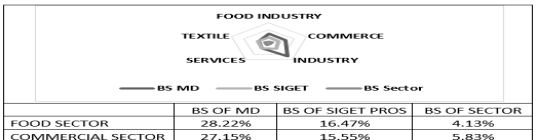
Table 5: Hologram of the People Dimension by Sector



	BS OF PD	BS OF SIGET PROS	BS OF SECTOR
FOOD SECTOR	17.07%	16.47%	4.13%
COMMERCIAL SECTOR	13.23%	15.55%	5.83%
INDUSTRIAL SECTOR	17.47%	19.46%	2.56%
SERVICE SECTOR	17.14%	18.16%	6.29%
TEXTILE SECTOR	19.79%	17.94%	7.16%
Total	17.24%	18.16%	5.19%

The BS of the PD was found to impact all firms in each sector (Table 5) and to influence the strengthening of the sectors in the region.

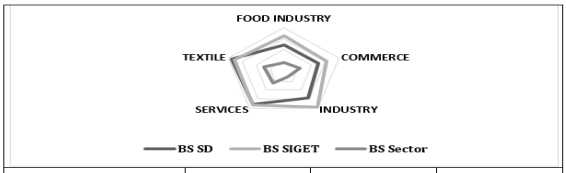
Table 6: Hologram of the Management Dimension by Sector



	BS OF MD	BS OF SIGET PROS	BS OF SECTOR
FOOD SECTOR	28.22%	16.47%	4.13%
COMMERCIAL SECTOR	27.15%	15.55%	5.83%
INDUSTRIAL SECTOR	48.17%	19.46%	2.56%
SERVICE SECTOR	19.17%	18.16%	6.29%
TEXTILE SECTOR	17.30%	17.94%	7.16%
Total	30.09%	18.16%	5.19%

The MD, for its part, showed the highest BS when SIGET PROS was implemented. It was found to significantly impact the firms in each sector, and its effects on the region are evidenced by the growth experienced in the sectors (Table 6).

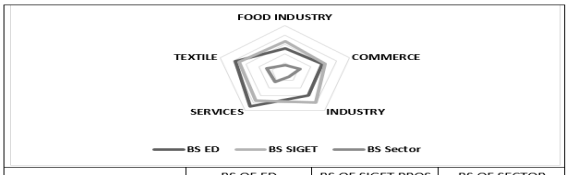
Table 7: Hologram of the Structure Dimension by Sector



	BS OF SD	BS OF SIGET PROS	BS OF SECTOR
FOOD SECTOR	12.33%	16.47%	4.13%
COMMERCIAL SECTOR	12.36%	15.55%	5.83%
INDUSTRIAL SECTOR	14.51%	19.46%	2.56%
SERVICE SECTOR	17.93%	18.16%	6.29%
TEXTILE SECTOR	18.81%	17.94%	7.16%
Total	15.84%	18.16%	5.19%

In the SD, only the service and textile sectors exhibited a BS higher than the average value of the firms in the sector. In any event, their contribution to the region's growth is clear, as their growth rate exceeds that of the other sectors.

Table 8: Hologram of the Environment Dimension by Sector



	BS OF ED	BS OF SIGET PROS	BS OF SECTOR
FOOD SECTOR	12.91%	16.47%	4.13%
COMMERCIAL SECTOR	14.70%	15.55%	5.83%
INDUSTRIAL SECTOR	14.76%	19.46%	2.56%
SERVICE SECTOR	22.04%	18.16%	6.29%
TEXTILE SECTOR	19.07%	17.94%	7.16%
Total	17.70%	18.16%	5.19%

Finally, although the majority of the variables in the ED were external, a significant BS was obtained, contributing to the BS of the firms in all sectors and to the region's growth.

4.2.2 Comparative analysis with other studies

In their study, Sucena et al. (2022) emphasised firms' need for KM and KT, which drives them to implement strategies similar to those considered in our research, such as including the PD, the SD, and the ED.

For their part, Macchi et al. (2020) highlighted the importance of measuring the continuous improvement of firms using reliable techniques. In this study, we measured BT in each dimension and in the firms across sectors by implementing SIGET PROS.

Moreover, Al Jamal (2020) used the holographic principle to analyse how the flow of information influences transformations within firms, allowing the integration of the parts into the whole. This approach is similar to the one considered in the implementation of SIGET PROS, with which we sought to integrate each variable into its respective attribute to thus impact each dimension, firm, and economic sector. As a result of this, the growth of the region's productive fabric is impacted as well.

The BS strategy developed through SIGET PROS (with its architecture structured into dimensions) shares similarities with the proposal of Sancak (2023), who underlines the need to intervene in factors such as governance (the MD), human resources (the PD), technology implementation and financial management (the SD), and customer and supplier management (the ED). In Sancak's study and in our study, firms' possibility of transitioning from their current state to a desired state is a topic of interest.

5. Conclusions and Limitations

The purpose of this study was to analyse, from a holographic perspective, a set of firms and evidence their transformations after implementing an MM called SIGET PROS. Particularly, we were able to evaluate BS through a series of measurements and its contribution to the advancements achieved in each economic sector. The analysis revealed that this is a global concern, and our findings were compared to those of other studies.

We can observe that each sector is strengthened after applying SIGET PROS (Table 3). When comparing the results obtained in the region, the measurements indicate the MM impact on the dimensions, the firms, and the sectors. This is evidence of the holographic vision in the monitoring of the transformations obtained using the MM.

Commented [JHBA1]: Added paragraph

Each transformation accomplished in the dimensions, firms, and sectors under analysis reflect the advancements in the productive fabric of the region; and the estimated measurements, the growth of the different sectors where the IUE operates. This confirms the importance of the strategies applied by universities (through KT) to impact the productive fabric in the regions of influence.

Following the (holographic) analysis approach, the impact of each dimension on the BS of the firms is evident. The BS of each firm impacts the BS of the sector to which the firm belongs, thus impacting the growth of the region.

Consequently, continued work in each of the dimensions of the firms will have an impact on the growth of the sectors, achieving a constant transformation of the regions, as evidenced in the results of each of the dimensions (PD: 17.24%, MD: 30.09%, SD: 15.84%, ED: 17.70%). In all cases, progress is above what has been achieved in the region.

Commented [JHBA2]: Added paragraphs

In conclusion, in order to consolidate the KT processes aimed at contributing to the strengthening of the productive fabric of economic sectors and regions, it would be advantageous to keep building trust relationships between universities and firms.

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KM Challenges in Small KIBS Companies: Multi-Case Analysis in two Countries

Ettore Bolisani[1,2], Tomas Cherkos Kassaneh[1], Anna Lis[3], Enrico Scarso[1], Ewa Stolarek-Muszynska[4] and Malgorzata Zieba[3]

[1]Department of Management and Engineering - University of Padua, Vicenza, Italy
[2]Venice International University, Italy
[3]Gdansk University of Technology, Poland
[4]Doctoral School of Gdansk University of Technology, Poland

ettore.bolisani@unipd.it
tomascherkos.kassaneh@unipd.it
enrico.scarso@unipd.it
mz@zie.pg.gda.pl
Anna.Lis@zie.pg.gda.pl
ewastola@student.pg.edu.pl

Abstract: Knowledge Intensive Business Services (KIBS) – i.e. companies like e.g. computer services, consulting, engineering, business communication, and R&D support - are key players in the modern economies. They stimulate the innovativeness of businesses and societies. Their competitiveness is based on knowledge, which is their key production factor and also the kind of "goods" they sell. The large majority of KIBS companies have a small or medium size, which leads to major challenges because they manage their cognitive assets in a substantially informal and undeliberate way. They face several obstacles to managing knowledge, partly due to their limited resources, but also to the knowledge-intensive and intangible nature of their business processes and outputs. Such challenges, when not successfully identified and faced, may negatively impact competitiveness. The paper illustrates the findings of a qualitative investigation aimed at exploring the main KM challenges that KIBS SMEs face. These challenges were analysed with specific reference to the key KM processes, i.e.: knowledge acquisition, knowledge documentation and storage, knowledge sharing, knowledge application, and knowledge protection. The research is a multiple-case study based on interviews to key informants of 23 Italian and Polish KIBS SMEs of different sectors. The analysis made it possible to find recurring issues and highlight differences. The study provides food for thought for researchers and practitioners willing to clarify what KM processes need proper solutions for the effective management of knowledge in small KIBS.

Keywords: KIBS, Knowledge management challenges, Multiple case-study

1. Introduction

Knowledge Intensive Business Services (KIBS) are key players in modern economies (Kamp & de Apodaca, 2017; Pina & Tether, 2016; Tuominen & Toivonen, 2011) because they can stimulate the innovativeness of the economy (Liu et al., 2019; Shearmur & Doloreux, 2019). These companies ground their competitiveness on the capability to manage knowledge (Miles et al., 2018; Palacios-Marques et al., 2011), which is the key factor of service production and the kind of "goods" they sell (Strambach, 2008). The KIBS sector includes different companies ranging from technological KIBS (for example, computer services) to professional KIBS (such as e.g. legal services) and creative KIBS (for instance, advertising and media management). The large majority of KIBS companies have a small and medium size (Zieba, 2021) and, while empirical evidence (Bolisani et al., 2022) proves that they are aware that knowledge is their most crucial resource, they manage it in a substantially informal and undeliberate way (Bolisani et al., 2016; Alexandru et al., 2020). In general small companies face several issues in knowledge management (Massaro et al., 2016; Durst et al., 2022; Shekhar & Valeri, 2023), largely due to their limited size which results in scarcity of human and financial resources, lack of time, and short-term orientation. In the specific case of KIBS, they can encounter specific challenges, mainly due to the intangible and knowledge-intensive nature of their business processes and outcomes. These challenges can negatively impact competitiveness and organisational performance.

Research about how small and medium sized KIBS companies manage their knowledge is still limited (Bolisani et al., 2022). To contribute to fill this lack of knowledge, this paper investigates the challenges faced by KIBS SMEs by means of a multiple case-study analysis conducted on 20 KIBS companies of various sectors in two countries. The analysis aims at finding regularities and differences across companies.

2. KM Challenges and Processes

It is useful to introduce what we mean by "knowledge management challenges". As mentioned earlier, the large majority of KIBS companies have a small or medium size and they face obstacles to managing knowledge, in part due to their limited resources, in part to the knowledge-intensive and intangible nature of their business processes and outputs. Research on KM in SMEs in general and KIBS in particular (Siahtiri et al., 2020; Durst et al., 2022; Zbuchea et al., 2023; Massaro et al., 2016; Shekhar & Valeri, 2023) suggests that these firms face different issues and often lack both dedicated approaches to KM and the necessary skills as well as competencies necessary to implement proper knowledge management (KM) processes. At the same time, these firms are exposed, more than others, to skill shortage and to risk related to environmental change, progressive digitalization, and increasing geopolitical risks. The term ''challenge'' is a broad term that encompasses several types of difficulties faced by companies. Thus, to have a common understanding of the term and define the scope, in this study, we define and consider ''knowledge management challenge'' as the *current or future organisational difficulties for KIBS SMEs that may require the proper application of KM processes to address these difficulties successfully.* Addressing these challenges can also lead to the discovery of knowledge gaps or risks that need to be tackled. Upon that basis, an effective KM implementation will ensure proper management and understanding of knowledge resources which will ultimately lead to organisational development and higher performances.
The study analysed these challenges with specific reference to the key KM processes. In the literature, different directories of KM processes have been published (Heisig, 2009; Edwards, 2015; Costa & Monteiro, 2016). This study considers five main KM processes, i.e.: knowledge identification and acquisition, knowledge documentation and storage, knowledge sharing, knowledge protection, and knowledge application. Knowledge identification refers to the activities that help a company to detect the knowledge necessary for its business (Durst & Edvardsson, 2012). Organisations engage in knowledge acquisition when they lack the internal resources to successfully innovate (Maes and Sels, 2014). The question of where and what knowledge to look for is often a challenge for small KIBS.

The process of documenting and storing knowledge is another critical activity, particularly in the case of KIBS SMEs due to lack of people and time. Properly documenting a company's key knowledge and managing the digital or physical documents can lead to higher organizational performance but can also require increased security, ease of retrieval or reuse, access control (Zaim, et al., 2019; Andreeva and Kianto, 2011; Ramadan et al, 2017). Knowledge sharing can be defined as "the act of placing knowledge possessed by an individual at the disposition of others within the organisation" (Camelo-Ordaz et al., 2011). It is a key activity to facilitate managing innovation and avoiding "reinventing the wheel", aligning employees to the company's business, and avoiding obsolescence of services.

Knowledge protection refers to the measures taken to limit risk of leakage in companies, like KIBS, that depend on knowledge for their competitive advantage (Liebeskind, 1996). Protection mechanisms can be applied to the technical infrastructure, but other forms of protection should also be considered that govern the behaviour and conduct of employees (Liebeskind, 1996; Yu, 1999). Finally, knowledge application refers to the proper use of knowledge to provide the right services to the market. As stated by Bhatt (2001), applying knowledge means making it "more active and relevant for the organisation in creating values".

In substance, this study is based on two main assumptions. First, small KIBS companies face peculiar challenges with their KM approaches, and identifying and analysing these recurring challenges is important so as to make companies aware and provide possible remedies that can be implemented while performing different KM activities. Second, the identification and analysis of these KM challenges can be appropriately conducted by considering that KM can be divided into a number of critical processes implying special issues and methods.

3. Methodology

The study addresses these research questions:

RQ1: What are the main difficulties that KIBS SMEs meet in their KM processes?

RQ2: What recurring challenges emerge from the analysis?

Given its exploratory nature, the research used a multiple case study approach (Yin, 2018) and consisted of a series of interviews with key informants from 13 KIBS SMEs in Italy and 7 in Poland, belonging to different sectors (ICT services, professional services, consulting services, legal and administrative services). The choice of these two countries were made only for reasons of convenient access to companies and data. The extension of the

analysis to more than one country was considered useful to check if there are recurring challenges regaredless the country of operation.

The interviews were carried out between May and September 2022 and were based on a list of questions sent in advance to the interviewed people. The interviews were recorded and then transcribed. To support the analysis, an Excel file was created in which all the answers were reported. This helped researchers compare the data, find similarities or differences, and draw conclusions, substantially by means of an application of discourse analysis (Miles and Huberman, 1994).

Table 1: Sample

Company	Sector	Size	Country
A	ICT (software)	20	IT
B	Business consulting	8	IT
C	ICT (software)	60	IT
D	Business consulting	60	IT
E	Legal/administrative consulting	60	IT
F	ICT (data management)	6	IT
G	Strategic consulting	15	IT
H	ICT (ERP systems)	150	IT
I	Legal/fiscal consulting	60	IT
L	ICT (business software and consulting)	35	IT
M	ICT (software)	40	IT
N	ICT (software)	30	IT
O	ICT (system integrator)	86	IT
P	PR & marketing, PR-marketing agency	20	PL
Q	Training company	30	PL
R	Education and training	40	PL
S	Research and development	5	PL
T	Consulting	5	PL
U	Research and development	14	PL
V	Consulting	27	PL

4. Findings

4.1 Knowledge Search and Acquisition

Italian companies affirmed that there are several challenges concerning the identification of knowledge gaps to be filled, localisation and access to the external sources from which the needed knowledge can be acquired. Challenges can be subdivided into two categories, i.e., human-related and source/knowledge-related challenges.

As for human-related challenges, lack of time is the most relevant. Although it affects all KM processes, it results particularly crucial here, since it can imply that the needed knowledge is collected too late for a client's problem. In fact, employees are usually busy with daily activities and they have little time to devote to new knowledge search and acquisition. Other human-related challenges were indicated by Italian companies, such as lack of

motivation of employees to search for new knowledge; also, many are not particularly open minded and they are confident that the ”old knowledge” is enough. Instead, young people have little experience and generally tend to simply rely on technologies for knowledge search.

As for source/knowledge related challenges, there is an increasing speed of knowledge obsolescence which calls for a continuous effort of search. Another possible issue is information/knowledge overload. Companies have to deal with an enormous amount of knowledge available in the environment and it is difficult to make a selection. Sourcing costs are increasing, both in monetary terms (if content has to be paid for) and in terms of time to absorb the acquired knowledge.

The main challenges of knowledge acquisition for Polish companies relate to the issue of adapting external knowledge to organisation's internal needs. This is because the activity of KIBS is generally based on projects, which require a wide variety of knowledge that is tailored to the needs of a particular client. Therefore, the challenge is to have diverse sources that can fill in the gaps. This is confirmed in one of the interviews: “*Challenges are project-specific. Implementing different projects requires different capabilities*”.

With regard to the expertise, there were voices regarding the discrepancy between the company's requirements and the experts' competencies, which, although formally confirmed, do not always turn out to be adequate to the needs arising from the implementation of specific projects. Another challenge that was strongly emphasised by respondents was the issue of financing externally sourced knowledge. This is especially the case of expertise in special areas which, being scarce (and thus difficult to identify and acquire), can be acquired at a significant cost.

Another difficulty faced by Polish KIBS is the lack of time. Time shortage is challenging in work management, but also in professional development, as was indicated by one of the interviewees: “*I think that such a problem may be the employee's lack of time to attend the training - because such training takes a lot of time, due to many duties it is sometimes difficult to save a few hours.*”

Additionally, the interviewees pointed to the importance of motivation and the resistance to thinking beyond the area of responsibility especially for young generations. Among other challenges reported by Polish informants there were: employees rotation and the age-old dilemma of when to invest (in terms of new employees) and how much to invest; financial challenges - hiring experts to fill important knowledge gaps is very expensive; finding good, highly qualified and willing to cooperate experts; unwillingness to share knowledge from people who have valuable knowledge; and project-specific challenges (i.e.: implementing different projects requires different capabilities).

4.2 Knowledge Documentation and Storage

Documentation is an essential activity that raises several challenges for Italian KIBS, as well represented by what was affirmed by an Italian company: “*Documented knowledge can be regarded as a library, and hence its management requires you to answer several questions, as follows: How should documentary material be organised? How to inform people about new material? How to induce people to contribute with new material? How to improve the readability of the material?*”.

A well organised and documented knowledge archive is needed to make it easily retrievable, which can be achieved by means of an efficient classification; but Italian companies agree that classifying documents is challenging, because it requires time especially to classify old materials, and different classification methods and logics may be applied even to the same document. In addition, employees need to be kept updated about the new knowledge contents that are added to the document management system and can be of their interest. Many companies affirm that it would be good to have a “librarian”, but this is very difficult given their limited size and it is hard to assign this exclusive task to an employee.

A recurring problem of Italian companies is how employees can be stimulated to document their knowledge promptly to avoid forgetting important aspects. An important factor is the time of reuse (i.e., how long it will take for a stored knowledge content to become useful for another employee). If this time is long, it is difficult to convince people to document knowledge when they feel they may not need it again in the future, because they may change companies in the meanwhile. In short, if there is no immediate return of knowledge storing, they may not be inclined to do it. In addition, most of the technical staff is generally reluctant to produce written documents about their activity, as they prefer to focus on more practical and operative activities.

A final point is about the understandability of contents. Some interviews said that young generations are less familiar with writing a formal report, and that they often use a “Whatsapp style”. In any case, it is not easy to

establish a writing standard style inside a company because every person, regardless of his/her education level, has own specific writing format. Different people also use different languages and even jargon, and this issue worsens the more areas of specialisation (and people) there are in the company. People of different educational backgrounds (e.g., business managers with computer engineers) or different application/technology areas (e.g. systems engineers and software developers) may find it difficult to communicate.

4.3 Knowledge Sharing

All Italian companies underlined that direct sharing by interactions is as essential as documentation, and they complement each other. Sharing allows people to align on common terms and perceptions of problems, which also makes the understanding of written documents easier.

Lack of time is, again, one of the most important challenges to knowledge sharing and is strictly connected with the small size of companies. A recently found challenge is the increasing recourse to remote work, which has become common with COVID. It is general opinion that the progressive replacement of face-to-face meetings with virtual meetings has a negative effect on knowledge sharing. In particular, a lower presence in the office considerably reduces the opportunities for informal knowledge exchange.

The biggest issue, however, is how to promote knowledge sharing, that is, how to build a knowledge sharing attitude of people. The common opinion of companies is that this is a cultural and personal issue concerning aspects such as individuals' characteristics (e.g., age, gender, educational background) and personal attitudes (e.g. loyalty, generosity, kindness, sincerity, mental openness); but organisational structure and managerial style also count, as well as the languages and jargon used, and the working habits and routines.

As for the Polish companies, the challenges of knowledge sharing are considered in the internal context and externally (e.g., with partners). As regards the first aspect, the challenge is to properly establish access levels to knowledge for individual employees of the organisation. As for the second aspect, sharing knowledge outside the organisation poses the danger of its appropriation by entities not authorised to do so (e.g., competitors). Many Polish interviewees indicate, again, that lack of time to share knowledge with others is a major challenge: "*The main challenge is the lack of time to share knowledge. I think it would be nice if we had regular workshops where we could verify the acquired knowledge and cascade into the team. […] This shortage of time simply means that we do not have the financial capacity to say "okay, now 15% of everyone's working time is exchanging knowledge" - this cannot be done yet."* Another important difficulty is how to stimulate knowledge sharing. There may be cases when an employee takes part in a training activity and later does not share the knowledge gained there with the colleagues.

Some of the challenges mentioned by the study participants refer to the proper adjustment of knowledge so that it is accessible for everyone, and knowledge adequacy. Another issue is when there is too late or incomplete knowledge sharing, which consequently can lead to the phenomenon of "opening an already open door". Other important issues are: the danger of sharing knowledge with competitors, the lack of formalisation of the whole knowledge sharing process, the high complexity of some projects and the difficulty in transferring knowledge to other team members.

4.4 Knowledge Protection

This is not perceived as a particularly critical issue by Italian companies. Challenges concern the protection of stored knowledge, i.e. the company document management systems, and of the knowledge possessed by employees, i.e. that is in their minds. The former is generally protected by means of technical solutions and by cybersecurity. The latter by means of confidentiality agreements. Anyway, Italian companies affirmed that the continuous innovation and extreme customisation of today's business is, itself, an effective protection from imitation by competitors. To sum up, even if knowledge protection can in principle be a problem, in reality none of the Italian companies affirmed they have suffered relevant "knowledge theft".

As regards Polish companies, relatively few challenges were identified . Perhaps this is due to the fact that they are already aware of the legal protection of intellectual property. In addition, being aware of the need to protect knowledge on the Internet, they are taking many cybersecurity measures. Nevertheless, they show constant vigilance in both areas, on the assumption that it is still necessary to look for improvement, due to the fact that knowledge as a resource is difficult to protect and easy to "grab" by the others.

Among the difficulties signalled by Polish KIBS SMEs, there is an uncontrolled leakage of knowledge combined with unethical knowledge sharing outside the organisation (for instance, the use of internal materials). An interviewee reported that a person came to work in the company for 3 months (the trial period) and when he

was offered to stay, he resigned. There was no justification for leaving the job, so he was suspected to be a "knowledge theft" by the manager. To overcome this kind of problem there is the necessity to choose the right employees and motivate them well.

4.5 Knowledge Application

For Italian companies, it refers to delivering services that can satisfy the clients' needs and solve their problems. Furthermore, since clients are directly involved in the service delivery process, very often they give a substantial contribution to its success, also because their feedback provides knowledge itself. Hence, a common problem of Italian companies is to collect from and transfer to the client all the knowledge needed for a valuable service. This raises several challenges including e.g.: fully understanding the real problem of the clients; analysing their problems at an appropriate level; establishing effective communication with the clients; synthesising the results to give the customers the "proper answers"; avoiding clients using knowledge incorrectly. Another special challenge refers to the most complex services where various pieces of knowledge, coming from different areas, must be integrated.

For Polish firms, the challenge in applying knowledge is the need to constantly update and develop it. An additional challenge is the ability to adapt existing knowledge in ongoing projects, in various aspects. A further difficulty is that in each project there is an element of new knowledge that needs to be assimilated and applied in conjunction with the existing pool of knowledge. Polish KIBS representatives identified several problems in terms of knowledge application. For instance, the insufficient acquisition of knowledge by employees (which makes the application difficult) and frustration caused by the "trial and error" process while applying new knowledge. Additionally, some other challenges were highlighted by the informants such as: no time to transform the knowledge into action, products/projects created for a specific order (they are many and must be tailored to the specifics of the client, so there is always an element of new knowledge that has not considered before and that must be now applied).

4.6 General Issues

The research shows that a major challenge for KIBS is to constantly update its knowledge base, given the speed of change in various industries. This entails constantly monitoring the market and acquiring up-to-date knowledge. As the respondents emphasized, the difficulty in this area is not at all about technology, but about human resources - experts with knowledge and skills that are relevant at a given time. Linked to the above is a second challenge pointed out by respondents, namely the need for knowledge-sharing partnerships, which could be key to constantly updating the knowledge package. Cluster cooperation, which was cited by respondents, could be a good practice.

Another issue that came up in the survey is the need to take a holistic view of the knowledge resources held in terms of identifying gaps and sources of knowledge (both internal and external). A major challenge is to ensure knowledge continuity in the face of high employee turnover. This raises serious problems especially in those companies that do not have developed practices for knowledge codification.

The informants were asked to indicate the biggest knowledge-related challenges that their companies meet on a daily basis or have coped with in the past. As the findings suggest, for Polish KIBS, the biggest challenges are: "transition from the old to the new", leaving the company by the employee and loss of their knowledge, and time. Some informants also stated that keeping the knowledge in the employees' heads (with accompanying lack of knowledge exchange) and insufficient internal communication were the issues their companies struggled with in the past. Among other important difficulties, the participants also mention: cooperation with external experts (their knowledge, skill level, commitment, etc.), managing current knowledge (continuity of knowledge, updating knowledge, etc.), technology development, cloud solutions.

5. Discussion

The findings of this study point out some differences but also several recurring situations between the Italian and Polish KIBS companies. We will explicitly focus on these similarities, which show that there are some common traits of small KIBS, regardless of their country of operation. A shared point is the lack of time, which was signalled to be one of the key factors affecting the effectiveness of KM processes. Both Italian and Polish KIBS specifically indicated that this problem is crucial for the process of knowledge search and acquisition. Another common issue in this KM process is the lack of motivation or experience to acquire new knowledge – some employees might be prone to stick to the old solutions, which used to work in the past. Also, there is an issue of employees leaving the company and "taking away" their knowledge. Another issue is related to

technological solutions – they might be too excessively used and also, cause some overload with information and knowledge one might need to obtain.

As for the process of knowledge documentation or storage, Italian companies, which perform such activities on a large scale, signal the problems to define the right classification system and to make it used by all the employees who need it. The same was indicated by Polish firms. Another common issue is the quality of language used in documenting knowledge and the different jargons/specific languages that may be used by different professionals.

Knowledge sharing is another important KM process. There are some recurring issues there, too. For example, how to encourage people to share knowledge or how to keep this process alive in the era of remote work, after it was extensively introduced with the COVID-19 pandemic and is now commonly used in companies. At the same time, there is a problem with potential knowledge theft or loss when knowledge is improperly shared with external partners, as indicated by some Polish firms. Knowledge protection does not seem to be a challenge, nor for Italian and neither for Polish firms. Perhaps this is because KIBS companies are often aware of the risks related to the use of the Internet and they try to protect themselves. Also, services are so customised that their application to specific clients requires the use of localised knowledge that can't be easily imitated by competitors.

Finally, knowledge application is supposed to help in delivering knowledge to the customer according to their needs. This can be problematic when there is no common agreement and understanding of the problems and the prospective solutions between the customer and the KIBS firm. This was indicated by both Italian and Polish companies. Also, there is a problem with lack of time for absorbing new knowledge and then applying it in the context of new projects and challenges.

6. Conclusion

This study aimed to illustrate the key KM challenges of small KIBS companies. These challenges were identified by means of extensive case study research focusing on the main KM processes.

An interesting finding is that companies signal some recurring challenges, regardless their sector and even their country of operation. This means that small KIBS have common traits and characteristics. A primary problem in KM is the lack of time, which affects the effectiveness of KM processes. This clearly depends on the small size and the limited resource of companies, but can also signal that, although companies are aware that knowledge is their critical resource, KM is still not considered a really core strategic activity for the management of the business. This provides interesting insights into a topic that has not been studied in detail so far.

The investigation has the typical limitations of a case study methodology, and especially the difficult generalisation of the results. In addition, the study examined KIBS companies of two countries only, namely Poland and Italy. As a case study research, its results cannot be statistically generalised for the whole groups of KIBS firms in those two countries, even though the large number of companies in the sample makes it possible to get useful lessons as regards the potential recurrence of KM challenges in KIBS companies. In any case, there is an opportunity for future research to confirm the preliminary findings of this analysis, for example, by means of quantitative surveys at national or international levels. Another important line of research can consist of an analysis of differences or similarities across companies of different specialisation (i.e., Professional, Technical, or Creative KIBS).

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Instrumental and Integrative Ethics in the Context of a Knowledge Management Policy

Manfred Bornemann
Intangible Assets Consulting GmbH, Graz, Austria

bornemann@ia-consulting.at

Abstract: Governance structures and Knowledge Management Systems standards such as ISO 30401 and ISO 9001 ask for policies for knowledge management but leave open, how such a policy might be detailed. Depending on the preferences of owners, management or more extensive stakeholder groups, the assumptions about what is good and can therefore be considered as ethical, vary substantially. In the German literature, two authors represent two extremes of a wide spectrum of business ethics: Peter Ulrich and his Integrative Economic Ethics (Ulrich, 2007), positioning ethical behavior above all other corporate objectives on the one (politically left) side and Karl Homann with the Instrumental Ethic (Homann, 1999) and the general idea to maximize shareholder value on the other (politically right) side. Both European continental authors are distinct from the Anglo-American tradition of "business ethics" represented by Solomon (1994), Donaldson and Dunfee (1999) or Freemann (1984), who are, in general, less focused on principles, but suggest procedures that avoid risks for organizations (or their top managers) of being framed as unethical. Knowledge as an intangible asset and different to tangibles such as money, goods, or infrastructure, is usually not controlled by investors, but by employees of an organization and thus affects problems of agency (Jensen, 1976) or stewardship (Donaldson, 1982) in corporate governance. Questions of ownership, modes of sharing and transferring knowledge to development of new knowledge and strategies of utilizing knowledge to create value need to be answered in a way to attract the best knowledge professionals. The answers might help formulate a formally consistent policy for knowledge management that considers either position – or come up with a more balanced approach, which could be implemented with established governance structures or ethic management systems (Wieland, 2014). This paper discusses two qualitative positions of Homann and Ulrich in the context of knowledge management systems and knowledge as a corporate resource with the ambition to suggest recommendations to formulate a knowledge management policy that delivers on the formal requirements of ISO 30401.

Keywords: Knowledge management, Policy,lintegrative ethic, Instrumental ethic, ISO 30401

1. Introduction - Collaboration Versus Competition in the Knowledge Economy

Deciding between two alternatives is the daily business, not only of top management, but of most knowledge professionals. Allocating time of experts is the one genuinely limited resource. Usually, it is easy to decide, thanks to clear preferences and priorities regarding e.g., minimizing costs, delivery time or maximizing quality. However, a dilemma situation is interesting. The prisoner's dilemma and its implication on corporations was discussed extensively (March, 1962, Cyert and March, 1993 or Kreps, 1990) and delivered a standard solution. "Collaboration" turned out to be a risky but cost-minimizing strategy in the game. In the realities of a market economy and when pushed to extremes, collaboration shows negative consequences as it counters the market-inherent element of competition. It is not desired to collaborate and to create an oligopoly or monopoly situation, as this would leave consumers no choice, allow for excessive profits and is therefore in most developed markets regulated.

Behaving collaboratively or competitively is usually a consequence of values and beliefs of decisionmakers (Sen, 1977, Becker, 1996, Kahneman, 2003). It is therefore established good practice for most large and mature organizations to reflect on their values and publish a value statement at least internally. Smaller organizations who have not yet reached maturity usually have implicit values and depend on their leadership. On a local level this works fine. It becomes a challenge, once the orientation shifts from local to global with its huge diversity of values and behaviors, sometimes causing frictions and frustrations, potentially even substantial conflicts. From a business perspective, this adds costs or weakens competitiveness. It is therefore reasonable to reflect on the links between values, explicit policies, and corporate governance to minimize unnecessary costs.

Corporate values impact all functions of an organization. It is therefore not surprising that policies for quality management, risk management or corporate social responsibility, to name a few, refer to these foundations. The same request is outlined in the current standard for knowledge management (KM), ISO 30401 (2021). However, as a norm-paper suggesting a management system that is applicable in a general context, it remains vague how to do this. Most of the established literature supports culture development processes and provide advice on continuous monitoring but abstains from specific recommendations because of the individual nature of organizations (Kotter, 1992; Collins, 1996; Garvin, 2008, Schein, 2010; Edmonson 2018). It remains

interesting to investigate the fundamental beliefs and how concepts from business ethics might be useful for orientation when searching for a policy on KM.

The second section of this paper gives a short introduction to KM and the standards suggested for professional implementation of a KM system. It relates to the problems of agency theory and the two antagonistic positions of principal agent theory and stewardship theory. Special emphasis is given to the requirements for a KM policy. These foundations lead to a short introduction to some concepts of business ethics and the relationship to KM.

The third section advances the requirements of a KM policy and contrasts the positions of Karl Homann, the main proponent of instrumental ethics with the positions of Peter Ulrich and his integrative ethic. These two authors represent the outer limits of a wide spectrum of ideas on business ethics and are therefore attractive as points of reference when searching for a policy on KM. The fourth section summarizes the discussion and suggests elements of a KM policy, building on requirements from the standard ISO 30401, as well as organizational theory.

1.1 Marginal Costs and Knowledge Management

While KM is covered in detail by many authors (Easterby-Smith, et al, (2019); Becerra-Fernandez, et al, (2015); Malhotra, Y. (2018); Dierkes et al., (2001)), the most important and differentiating criterium relates to its intangible nature: knowledge can be shared and reproduced with very low costs. It has falling marginal costs in contrast to all tangible goods that usually show increasing marginal costs. This characteristic requires different management approaches, as the established routines to minimize (!) the use or application of knowledge simply do not yield the optimum results. Integrating “more knowledge, skill and experience” improves the service or product without substantially changing the costs of reproduction. Once the development is complete, only very limited additional costs emerge.

This attribute of knowledge challenges traditional categories such as ownership and financial evaluation, as the “cost” of knowledge per se technically goes down to zero (costs). While costs (for application or reproduction) go down, the potential value added is substantial, which creates opportunities for free riding.

In a knowledge economy, sharing knowledge for free is well-established as good practice in academia. Golden licenses of papers are options to cover the costs for services provided by publishers, while not charging the readers. One might question the “free” access to documented knowledge, such as papers in for-profit-journals, but compared to the costs of re-creating the work, the prices seem reasonable.

Different rules apply to “applied research” or to the phase of monetization in commercial enterprices, once new discoveries of science move to the innovation stage. Business models and management practices become relevant to create a product or service. This work is done by knowledge professionals, who need to decide. Their choice could be any combination of a) share the insight or b) keep it a secret as long as possible and reap the (excess) profits until competitors find similar solutions and the field of strategic competition moves to another domain. How these professionals might behave could be subject of a corporate policy on KM.

1.2 Knowledge Management Policy and Standards

With the wide availability of textbooks for KM and the increasing awareness in industry about the dynamic value adding contribution of knowledge-based assets as well as the emergence of standards for defining KM systems (ISO 30401, DIN SPEC 91443), KM became an established function in organizations.

1.2.1 Knowledge management standards

One of the first steps to develop a KM system is to identify key stakeholders. The usual list starts with employees or knowledge professionals as the people who have the knowledge and apply it for value generation. Additionally, customers are relevant, as they benefit from these activities and decide on allocating their financial resources, which in turn are crucial to do business. A third group relates to suppliers, whose products or services are used to support the organizations business model. Selecting the “correct” inputs is obviously the difficult element. Usually, organizations integrate third parties into their value creation – so they can be addressed as “collaboration partners”. The list could be extended, but all of them clearly have “stakes” in the value creation process. They contribute knowledge and sometimes claim some form of ownership on the final product. The legal term is copyright, which is often compensated, but certainly not always.

How do these stakeholders contribute to value creation? They could see themselves as agents in the tradition of principal agent theory (Jensen, 1976) or stewards in the tradition of stewardship theory (Donaldson and

Davis, 1991). According to the principal agent theory, both follow an opportunistic approach and maximize their benefits. Because the principal usually does not have the specialized knowledge of the agent, he must invest into clarifying expectations as well as into monitoring the performance as well as the output of the agent. This increase costs. The agent is interested in delivering performance to the principal, but only to the minimum requirements (Jensen 1976). From a KM perspective, this might lead to less-than-optimal performance, but thanks to strong competitive incentives, the effectiveness, and performance of the organization, the historic record of this approach seems to deliver.

Davis (1991) suggests an alternative approach by presenting a steward modeled by the caring attitude of airline personnel. The steward follows an intrinsic motivation to serve and to create a pleasant environment for passengers, observing technical limitations of the aircraft or external disturbance, such as turbulences. Transferred to a business context, a servant leader is free from pure egoistic ambitions, but cares about the well-being of an organization and its stakeholders. From a KM perspective, a steward would focus on collaboration, corporate culture, and a shared vision to accomplish corporate goals.

1.2.2 Requirements for a knowledge management policy

The following elements are part of most other standards, but nevertheless remain essential because they need clarification. The KM system shall consider the KM culture and leadership. It shall develop policies to support the actual management of knowledge. The norm is very general and suggests (quote): "Top management shall establish a KM policy that: … *(some elements intentionally left out)* … d) sets expectations for all workers with regard to use of the KM system and the cultivation of a culture that values knowledge; e) includes a commitment to continual improvement of the KM system; f) manages the balance between knowledge sharing and knowledge protection" (ISO 30401, section 4, 2021). While the requirements seem plausible, the details remain open and are insufficient for a regular knowledge professional to draft a policy. Depending on the generic type or orientation of managers, they could be positioned somewhere in the spectrum of "agent" (Jensen, 1976) or "steward" (Davis, 1991).

1.3 Short Outline Two Schools of Ethics

„Sense making in organizations" was the title of a book by Weick (1995), in which he brilliantly connects organization theory with decision making and strategic rationality. Almost 30 years later, rationality is sometimes said to be interpreted "alternatively" by the now "young" generation of millennials, becoming active as consumers, voters, as well as employees in knowledge-based organizations. The 18th Shell Youth Study reports: "Environmental and climate protection have become top issues of concern. …Regarding the topic of fulfilment orientation, the meaning of one's own conduct in professional life is the main priority. Central aspects also include opportunities to care for others and to do something useful for society." (Shell, 2019). The established paradigm of profit maximization is challenged by a more comprehensive and balanced approach.

The assumptions about what is good, and can therefore be considered as ethical, vary substantially among age groups within one society – the Shell survey focusses on Germany – and among different countries. The implications on organizational decision making are well covered empirically by Hofstede (1984), or Ingelhart (1990). In the German literature, the concept of business ethics is established for more than five decades with two leading figures representing very different schools of thought.

1.3.1 Homann's position on instrumental ethics

Karl Homann (1984) follows the tradition of Adam Smith (1759) and his interpretation of markets as institutions that create ethical decision making, because unethical behavior will not be tolerated by other market participants. It is, therefore, necessary to regulate markets in a way that "a good life" is supported. Homann assumes people to act with utilitarian interests towards improving their situation. It is unrealistic to assume that people or organizations accept disadvantages emerging from ethical behavior which is not displayed in a similar way by competing market participants. Therefore, markets need generally accepted frameworks that create a level playing field. For reasons of wordcount, this very short introduction to the thinking of Homann shall be sufficient, more elaborated presentations can be found in the literature.

1.3.2 The concept of Integrative Ethics by Peter Ulrich

Peter Ulrich has a very different approach to business ethics. Ulrich sees the dominance of markets critically and instead suggests focusing on the life-sustaining economy (Ulrich 2001). Like Homann, Ulrich sees two

dimensions of society – markets and a just society – but does not stop there. His essential claim is to integrate these two worlds into an integrated business ethics approach (Ulrich, 2008). Ulrich sees economy as created by humans and thus prioritizes human needs – a good life, synonymous with ethics – over market requirements. Integrated business ethics in the tradition of Ulrich prioritizes ethical behavior of organizations over economic profits or growth. Critics of this position refer to the implementation problem and economic survival of organizations fully subscribing to this approach, as they must bear with higher costs compared to competing organizations not following these high standards. While some highly educated and affluent consumers might follow similar ethical priorities (Shell, 2019), certainly not all can currently afford these choices. Consequently, Ulrich suggests a society with basic income.

These rather theory heavy continental perspectives differ from Anglo-American views on ethics (e.g., Donaldson, 1982, or Weiss, 2014), suggesting complying with legal and social requirements as well as to consider stakeholder interests, but – in general - not exceed into extreme positions. Applicability of social norms and pragmatic positioning has higher priority than discussing the ideal relationship of business and ethics (Palazzo, 2000).

2. Discussing Ethical Considerations for a Knowledge Management Policy

In the context of ISO 30401, a policy elaborates on the intentions and direction of an organization. A policy is drafted and formally expressed by the top management. For KM, the general policy (as suggested and structured in many ISO documents, such as the ISO 9001) of the organization provides the ground for more detailed elaboration. There is a direct link between organizational objectives, KM objectives, KM systems and the KM policy (ISO 30401, section 4, 2018).

ISO norms follow a typical structure that includes “leadership”. ISO 30401 is no exception, and consequently asks for a KM system to “ensure that the knowledge management policy and knowledge management objectives are established. It must be compatible and aligned with the strategic direction of the organization and evaluated accordingly (ISO 30401, section 5, 2018)

2.1 Organizational fit of the Policy

Section 5.2 a) of ISO 30401 requires that top management establishes a KM policy that is “*appropriate to the purpose of the organization”.* We interpret requirement 5.2.a in the context of existing policies in an organization with potential to deviate depending on size or complexity of an organization. A general orientation should connect the purpose of the organization to the context of knowledge and clarify this link.

- The physics and security requirements in a large energy- or production plant are usually stable and do not change within a quarter. It takes years to decades to qualify for senior job profiles for good reasons. Therefore, the organization benefits from low turnover and stability.
- The essentials of a digital technology build on formal sciences but change dramatically in a short time. Thus, the organization might be more oriented towards fast adaptation to new technologies and – in several ways – adjust their knowledge base, that is: hire and fire employees.

There should be no conflict with business ethics, as both, Ulrich and Homann, as well as other authors agree that regulation should fit with the overall objectives. This does not, however, cover the ethicality of these objectives (profit maximization versus supporting public welfare as two opposing poles).

2.2 Organizational Framework for the Policy

Section 5.2 b) of ISO 30401 requires that top management establishes a knowledge management policy that “provides a framework and guiding principles for setting, reviewing and achieving knowledge management objectives” (ISO, 2021).

As discussed above, frameworks for KM are available (WMF, (2007); Dierkes (2001); Snowden (2007)). Within such a KM-framework, the KM objectives need to be articulated. The objective of KM in a business aligned context is to effectively apply knowledge to value generation. This is different to e.g., the discovery priority in a university context or the focus on transfer in the context of schooling or training.

In more specific terms, *objectives of KM could be:*

- Contributing to the competitive advantage by leveraging state-of-the-art knowledge.
- Improved decision making, based on relevant and accurate knowledge in all levels of the organization.

- Increased efficiency by avoiding duplication of efforts and empowering knowledge professionals to access the corporate knowledge base effectively.
- Supporting innovation and learning of all knowledge professionals on all levels of the organization.
- And preventing knowledge loss by smart retention, low turnover, and soft retirement strategies.
- Establishing collaboration and teamwork to encourage a culture of knowledge sharing and collaboration.

The general framework of KM seems to be aligned with business ethics. While there might be varying ideas on competition on one side and collaboration on the other, the general idea of effective flow and application of knowledge to value creation does not seem disputed in western economies. There is, however, a different interpretation possible, when focusing on transcendent priorities – which are not discussed here.

2.3 Commitment to Satisfy Regulations

Section 5.2 c) of ISO 30401 requires that top management establishes a KM policy that "*includes a commitment to satisfy applicable regulatory and other requirements"* (ISO, 2021).

While a policy document may be a great reference, it cannot secure commitment. A statement affirming the readiness to "satisfy … regulations" might serve the purpose of a symbol in very formal organizations and help to communicate the importance, top management assigns to this topic.

> *"The management of (organization) commits to satisfy the requirements of ISO 30401 for a knowledge management system and DIN SPEC 91443 for detailing knowledge management guidelines."*

From the perspective of business ethics, this is not problematic, but clarifies the priorities and helps as a reference in the case of conflicts.

2.4 Setting Expectations for Knowledge Professionals

Section 5.2 d) of ISO 30401 requires that top management establishes a KM policy that "sets expectations for all workers with regard to use of the knowledge management system and the cultivation of a culture that values knowledge" (ISO, 2021).

This element of a policy document has highest relevance for the implementation and daily application of KM, as it clarifies the expectations. These expectations have an impact on how knowledge professionals behave in an organization. An example outline of this expectation could be the following:

- "Maintaining high ethical standards is fundamental to our organization. We expect all knowledge professionals to conduct themselves with integrity, honesty, and responsible behavior in all KM activities.
- To support the high ethical standards, we actively support a stewardship attitude. A steward shows a high service orientation, highest professional standards, and long-term customer orientation. Knowledge sharing as well as providing honest feedback constitute servant leadership, which becomes visible internally as well as externally."

From the perspective of business ethics, here a clear orientation is suggested with the emphasis on "stewardship". Obviously, there are alternative approaches, such as a focus on hierarchy and expertise, division of labor or the idea of committees to search for consensus. Corporate culture and leadership will have a strong impact on the selection, but here would be the place to make the expectations explicit.

2.5 Commitment to Continual Improvement

Section 5.2 e) of ISO 30401 requires that top management establishes a KM policy that "*includes a commitment to continual improvement of the knowledge management system"* (ISO, 2021).

Like in section 5.2.c), the commitment is difficult to secure. However, a written statement that emphasizes the priority of "continual improvement of the KM system" could be crucial, once the system is implemented, but is no longer aligned with the requirements of internal or external stakeholders. How to use artificial intelligence is only one example of technology change, which might make it necessary to adjust the KM system. A simple statement could be the following:

"Continuous improvement is ingrained in our culture. We encourage all knowledge professionals to actively contribute to the identification of improvement opportunities, driving innovation, and enhancing our operational performance."

From the perspective of business ethics, improvement is usually not disputed if the changes adhere to the established standards and values and do not disadvantage stakeholders. The utilitarian view of Homann might accept shifting priorities and even laying off some experts if they could be replaced by automation or artificial intelligence. Ulrich would suggest finding less drastic alternatives but is essentially not opposed to corporate adjustments. His preference would be, of course, to avoid a crisis by generally committing to a long-term perspective that provides for a plan B in times of crisis.

2.6 Balance Knowledge Sharing and Protection

Section 5.2 f) of ISO 30401 requires that top management establishes a KM policy that "*manages the balance between knowledge sharing and knowledge protection"* (ISO, 2021).

This final requirement seems to allow for the widest interpretation, as it connects to ownership of knowledge. Ownership is considered as the best way to avoid waste and depletion of a resource. While it is obvious that exclusive knowledge secures competitive advantage for those controlling these insights, it is equally obvious that "general access to knowledge" supports innovation and development of society and mankind. A statement to address this challenge could be the following:

> *"Effective knowledge management and asset ownership are vital for sustained long term success. We highlight the distinction between personal knowledge and company knowledge. Knowledge professionals are the sole owner of their knowledge as a result of private and professional learning and development efforts.*
>
> *We emphasize that knowledge created or acquired during employment is considered company knowledge, including innovations, methodologies, and processes. We emphasize the importance of managing knowledge from external suppliers, protecting our valuable intellectual property, exploring opportunities to monetize our knowledge assets, and promoting systematic knowledge reuse and automation. "*

From the perspective of business ethics, this clarification is essential, as it relates to the freedom of people, which in turn is seen as a fundamental human right. The problem here is that it is very difficult to unlearn and not to apply knowledge acquired in an organization once the work contract is terminated. The theoretical positions of the scholars differ in this dimension only marginally. Both scholars support the idea of ownership. While Homan stresses the importance of adaptation and accepts the implications of limited work contracts, he is open to contractual consent to outline even drastic implications, such as the ban to work for a competitor or, even more drastic, in the same industry. Ulrich would suggest offering a life-time employment and finding ways to avoid separation but still being open to changes initiated by the professionals, seeking alternatives for private reasons (e.g., marriage).

From a theoretical point of view - and this is the most interesting part here - the historic element of scarcity is not applicable to knowledge. It can be shared, reproduced, applied – usually with no higher costs than necessary to compensate for time. The marginal costs of knowledge are coming closer to zero with each repetition of use and application, while the benefits of its application multiply. This attribute of knowledge suggests that the scarcity-related management procedures are obsolete and do not apply to knowledge professionals. Consequently, the idea of "assets" needs to be reviewed. Knowledge per se is no longer of value, but the application of if it is very valuable. This implication on value creation suggests that knowledge is used as excessively as possible and, additionally, is given away immediately and for free, as only the application and use generate value. The implementations on corporate governance, corporate citizenship and value generation are substantial.

3. Summary and Recommendation

Drafting a KM policy benefit from a reference to corporate values. While a superficial agreement on values seems easy to accomplish, the limitations of the "assumptions" become visible when deciding in situations of multiple constraints. In times of conflict between knowledge professionals (internal conflict) or with suppliers and customers (external conflicts), an explicit policy serves as a reference and gives orientation.

A KM policy benefits from consistency with the other instruments of corporate governance, such as transparency and accountability to stakeholders (external focus) as well as management instruments, such as bonus programs to accomplish corporate objectives or individual targets (competence development and career development).

Ethical dilemmas emerge from fundamental positions regarding ownership of assets or allowing access to strategically relevant critical knowledge. The causes can be found in the spectrum of priorities and loyalties of a knowledge professional e.g., to their field and discipline, company, or a department in the organization, or to a community of practitioners working on a complex problem. The desire to "resolve" this problem might interfere with legitimate interests of other parties involved and thus cause conflicts of interest.

Recognition and attention as critical currencies among knowledge professionals can be granted or refused and will have consequences in the repeated game of collaboration. While knowledge per se is abundant and not limited, the time and energies (motivation) of professionals are limited and constitute constraints.

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Knowledge Dynamics and Expert Knowledge Translation: A Case Study

Constantin Bratianu[1] and Alexeis Garcia-Perez[2]
[1]Bucharest University of Economic Studies, Bucharest, Romania
[2]Coventry University, UK

constantin.bratianu@gmail.com
alexeis.garcia-perez@coventry.ac.uk

Abstract: Knowledge dynamics means variation of knowledge in time and space. Over time, knowledge levels can increase through accumulation, or decrease through loss. Also, knowledge may change its quality through transformation from one form into another. In space, knowledge can move from one place to another one, generating a flow (i.e., knowledge flow). The present paper aims at analyzing the knowledge dynamics associated to the process of expert knowledge translation, present in almost all life domains. Knowledge translation is based on communication and transformation of knowledge. Among many models used to explain knowledge translation, we present in this paper the expert knowledge translation that is used whenever an expert is sharing his expertise with one or several individuals interested in that knowledge. We analyze the whole process of expert knowledge translation from a conceptual perspective and then we present a case study describing expert knowledge translation. Knowledge translation is necessary because the source and the receiver of the messages have different semantic domains and levels of understanding based on their education, background and their analytical skills. The main barrier in knowledge translation is the absorptive capacity of the receiver. If the absorptive capacity is rather small, the translation efficiency is very small. This situation can be improved if the translation process is broken into several smaller knowledge translation processes like in a cascade. The paper presents the model of such a cascade for expert knowledge translation showing how to construct it. As an application, the paper presents a case study focused on a company manufacturing gas turbines (GTM). The company is a global supplier of gas turbines and we show how engineering expert knowledge is translated in a cascade from design to manufacturing, automation, testing, installing and commissioning turbines to end users.

Keywords: Knowledge dynamics, Knowledge translation, Expert knowledge, Absorptive capacity

1. Introduction

Knowledge dynamics is a complex concept that reflects the variation of knowledge in time and space, i.e. the transformation of knowledge (Bratianu & Bejinaru, 2020; Carlile, 2004; Nissen, 2006; Nonaka & Takeuchi, 1995). The concept of knowledge dynamics implies variation in time in any kind of its manifestation, but the focus on the variation in time appears when we consider knowledge or knowledge capital as a stock in an organization or a network (Bolisani & Oltramari, 2012; Kianto et al., 2007). Variation in space is generically known as *knowledge flow* (Nissen, 2006; Nonaka, Toyama & Hirotaka, 2008). Knowledge flow is possible when there is gradient in the knowledge distribution within a given organizational context. The most complex of knowledge dynamics is the transformation of knowledge from one form (i.e., explicit and tacit or rational, emotional, and spiritual) into another form of knowledge (Bratianu & Bejinaru, 2020; Nonaka & Takeuchi, 1995, 2019).

Knowledge translation (KT) is a generic process of transferring knowledge from one person to another, or to a group of people. Although it is based on a communication process, knowledge translation is much more than communicating knowledge because it implies knowledge transformation such that the target can understand the messages received from the source (Carlile, 2004). Although knowledge translation has been developed almost exponentially in the last years in the healthcare sector, it is a generic process that can be found in almost all domains of human activity (Dal Mass, Garcia-Perez et al., 2020; Dal Mass, Cobianchi et al., 2021). Knowledge translation was conceived initially as an all-encompassing process between research and applications in the healthcare sector, creating value by embedding research findings in practical procedures and best practices (CIHR, 2016). As research into knowledge translation evolved, it became apparent that knowledge translation takes place in all processes of communications at micro, mezzo, and macro scales in any social context. The performance of knowledge translation is influenced by the knowledge dynamics in multiple forms, depending on the complexity of the domain of human activity. However, this correlation is lacking in the literature. It is a knowledge gap we try to discuss in the present paper.

2. Literature Review

2.1 Knowledge Dynamics

Knowledge dynamics influences the process of KT through different forms, from a simple variation of knowledge level over time, to knowledge transformations. As mentioned earlier, knowledge varies over time at both individual and organizational levels due to the learning and unlearning processes, as well as to knowledge loss from organizations through different forms (Bratianu et al., 2011; DeLong, 2004). That change in knowledge levels leads to a changing gradient in the knowledge field, which leads to a change in the force driving the flows of knowledge contributing to KT. Nissen (2006) asserts that knowledge flows is more than a metaphor. It is a phenomenon that happens in any organization, illustrating knowledge dynamics over time and in space, like in fluid mechanics. Knowledge flows induce changes in the knowledge distribution that lead to changes in the knowledge entropy within an organization (Bratianu, 2019). From another perspective, Blacker (1995) presents a categorization of five different types of knowledge: embrained, embodied, encultured, embedded, and encoded. They result from knowledge processing and contains in different proportions rational, emotional, and spiritual knowledge (Bratianu & Bejinaru, 2020).

From a practical point of view, knowledge can flow between two points in space within an organization if, and only if, there is a knowledge difference between the initial and the end points of the flow. By understanding knowledge flows we can understand knowledge sharing as an intra- and inter-organizational process (Balle et al., 2019; Nonaka & Takeuchi, 1995, 2019). Knowledge sharing is governed by both the knowledge deficit of the user and the willingness of the source to share their experience with other people. At the individual level, the most important factor influencing knowledge sharing is knowledge hiding, while at the organizational level it is intellectual property (Bratianu, 2022; Ruparel & Choubisa, 2020). Thus, knowledge flows are governed by the knowledge deficit and the dynamics between knowledge sharing and knowledge hiding.

The Theory of Knowledge Fields (TOKF) introduces the idea that knowledge is not a fluid but an intangible field that manifests in three basic forms: rational, emotional, and spiritual knowledge (Bratianu & Bejinaru, 2020). *Rational knowledge* is the result of our thinking and it is an explicit knowledge because it can be expressed by using natural or symbolic languages. Rational knowledge is what Aristotle (1999) called *episteme*. It is an objective knowledge about the world we are living in (Davenport & Prusak, 2000; Nonaka & Takeuchi, 1995). Rational knowledge can be easily codified and used extensively in the organizational procedures, regulations, databases, and communications. *Emotional knowledge* is created by our emotions and feelings and it is wordless (Damasio, 2012; LeDoux, 1999). Emotional knowledge is the result of experiential learning and it is about *how-to* do things. Emotional knowledge is similar to what Aristotle (1999) called *techne*. Emotional knowledge constitutes the most important component of tacit knowledge that is so important in the Japanese companies (Nonaka & Takeuchi, 1995). Emotional knowledge can be transformed into rational knowledge using natural language and metaphorical thinking. Emotional knowledge is linked to emotional intelligence (Goleman, 1995) and together influence the process of decision making (Hill, 2008). Emotional knowledge integrates in time resulting experience that is at the core of any know-how and the root of intuition and intuitive thinking (Shotter & Tsoukas, 2014). Gladwell (2005) considers intuition as valuable as any rational analysis "the task of making sense of ourselves and our behavior requires that we acknowledge there can be as much value in the blink of an eye as in months of rational analysis" (p. 17). *Spiritual knowledge* refers to the meaning of our existence, our work, and the expected happiness. Spiritual knowledge is linked to what Aristotle (1999) called *phronesis*, or practical wisdom (Pinheiro & Rocha, 2020; Rocha & Pinheiro, 2021; Rocha et al., 2021; Shotter & Tsoukas, 2014). By integrating spiritual knowledge at the organizational level we get *spiritual capital* that is "our shared meaning, our shared purpose, our shared vision of what most deeply matters in life – and how these are implemented in our lives and in our behavioral strategies. It is the capital that is increased by drawing on the resources of the human spirit" (Zohar & Marshall, 2004, p. 27).

In the TOKF knowledge dynamics means transformation of knowledge from one field into any other form of knowledge (Carlile, 2004). It is an irreversible and nonlinear transformation like in thermodynamics (Chaldize, 2000). Kahneman (2011) illustrates this influencing mechanism with a very simple psychological experiment done in a British university. In the tearoom of that university, the tradition was for students to pay according with the price list hanged on the wall just above a "honesty box". One day, next to that price list appeared a poster with many eyes staring at you, without any explanation. After one week, the eyes poster was replaced with another one showing beautiful flowers. These two types of posters were alternating for ten weeks. By the end of each day, the professor who created this psychological experiment counted the money dropped by students into the "honesty box". The daily values were higher when the students faced the eyes poster than

when they were looking at the flowers. The emotional knowledge generated by the staring eyes was transformed into rational and spiritual knowledge, and their dynamics influenced the decision to pay the right amount of money, as indicated by the price list. A very simple but convincing psychological experiment showing that decision is not a purely rational process. It is influenced by the dynamics between emotional, spiritual, and rational knowledge. This idea is supported by Shotter and Tsoukas who explain *phronesis* in relation with the ways which determine "how we see, how we hear, perceive and value particular events and experiences occurring in our surroundings" (Shotter & Tsoukas, 2014, p. 381).

2.2 Knowledge Translation

Knowledge translation (KT) is considered by Davidson (2009) "as the practice, the science, and the art of bridging the know-do gap, or the gap between the accumulation of knowledge and its subsequent use or application" (p. 75). KT originates in linguistics, as a written or spoken process of translating texts or spoken phrases from one language into another one. In this original model, KT represents a mapping function of a certain message from the source semantic domain (SSD) onto the recipient semantic domain (RSD). Thus, KT implies a combination of communication with an act of interpretation performed by the translator.

The Canadian Institute of Health Research (CIHR) scaled up the process of KT to suggest a bridge between the research domain and practice domain in healthcare. The definition formulated by CIHR (CIHR, 2004) based on this interpretation became one of the most cited definitions of KT. According to CIHR (2004), KT is "The exchange, synthesis and ethically sound application of knowledge with a complex system of interactions among researchers and users – to accelerate the capture of benefits of research for Canadians through improved health, more effective services and products, and a strengthening health care system" (p. 2). The same Canadian Institute produced a new formulation that was accepted by most of the researchers working in healthcare systems. KT is the process that "includes knowledge dissemination, communication, technology transfer, ethical context, knowledge management, knowledge utilization, two-way exchange process between researchers and those who apply knowledge, implementation research, and development of consensus guidelines" (CIHR, 2016). However, we have to remark that from a logical point of view and from the perspective of knowledge management this cannot be accepted as a definition because it demonstrates a misunderstanding of the knowledge translation and knowledge management processes. For instance, knowledge dissemination, communication, ethical context and knowledge utilization represent components of knowledge management, and knowledge management is not a component of knowledge translation (Nonaka & Takeuchi, 1995). On the contrary, knowledge translation is a component of knowledge management.

To understand the process of knowledge translation we consider a generic model composed of a knowledge source, a communication channel, a knowledge receiver, and a certain cultural context. The assumption is that the level of knowledge of the source is higher than that of the receiver. The receiver is characterized by a semantic field (RSF) that may be different to that of the source semantic field (SSF). For instance, the source and the receiver may belong to different cultures and speak different languages. To make communication possible, it is necessary a translator or an international language known by both the source and the receiver. In the case of a high knowledge difference between the two ends of the communication channel, the problem is how much knowledge can be absorbed by the receiver. Thus, knowledge absorptive capacity of the receiver becomes a limitation of the knowledge that can be transferred from the source to the receiver. The concept of *absorptive capacity* was introduced by Cohen and Levinthal (1990) as a measure of the organizational capacity to assimilate external knowledge, but it can be applied as well at the individual level. According to Carlile (2004), knowledge translation is a complex process that involves crossing the pragmatic, semantic, and syntactic boundaries. Crossing the syntactic boundary results in knowledge transfer. Crossing the semantic boundary means knowledge translation, but based on knowledge transfer. Crossing the pragmatic boundary results in knowledge transformation, based on its translation and transfer. Expert knowledge translation is successful if it is possible to cross all these boundaries.

Expert knowledge represents a high level of understanding with respect to a certain domain of activity and it is acquired after years of study and research in that domain. It is the knowledge that can be delivered by experts and consultants from consulting and research companies, by university professors, by medical doctors after many years of practice, or by engineers manufacturing complex equipment (Evers & Menkhoff, 2005). Trying to communicate that knowledge as it is directly to the end users is meaningless because the receivers cannot understand it. Their semantic universe does not contain the necessary concepts and ideas for accepting and integrating the new knowledge. The end users have a very low absorptive capacity when compared to the experts. The solution is for experts to translate their knowledge for a lower level of understanding, which

means a degradation of its initial quality as a result of increasing the process entropy (Chaldize, 2000). However, many times that expert knowledge cannot be conveyed directly without losing its meaning, and it is necessary to break it down into several translation sequences like the water flowing through a series of cascades. Thus, we propose in this paper a *cascade knowledge translation model* that can be applied in any expert knowledge translation. The model requires a knowledge source, one or several intermediary knowledge translators and a knowledge receiver as an end-user. Expert knowledge is processed by a serial translation phases, each phase decreasing the level of understanding according to the absorptive capacity of each intermediary translators, and finally with that of the end-user. This is a generic expert translation model but it can be found in many practical situations with some specific details given by the context. In order to analyze in practice how this model is operationalized, we performed a case study of expert knowledge translation within a large industrial company for manufacturing gas turbines from UK. We follow the chain of activities from manufacturing to selling and providing service to the end users of gas turbines.

3. Methodology

3.1 Rationale and Methodological Approach

We applied our generic model of *expert knowledge translation in cascade* to a complex case study that is hereby reported in a simplified manner, in line with the constraints of the conference paper. We considered a large international company manufacturing gas turbines, referred to as GTM in this paper, which has its headquarters in the United Kingdom.

Having collaborated in Knowledge Management projects with GTM over a decade (2008 to 2018), the authors had been able to identify the importance of the translation of engineering knowledge in all engineering processes at GTM. Their management board had referred to terms such as 'understanding customer needs', 'communicating product capabilities', and 'learning from customers' as some of the key issues having an impact on both costs and innovations. It had been agreed that knowledge translation was at the heart of most of those issues and it therefore affected –both directly and indirectly, all GTM efforts to reduce costs and increase their potential for innovation.

Between the September 2015 and July 2018 –the last part of their formal engagement with GTM, one of the authors held discussions with engineers to understand their methods of translating knowledge along the chain of operations through to their end-users. In our experience, both the theoretical foundations imposed by the research context and the practicalities of its implementation imposed significant challenges, including the collection and analysis of a consistent set of data relevant for the purposes of this research, as well as demonstrating the reliability, replicability and validity of our research findings. Those challenges suggested that the data collection would be an iterative process involving the authors in their role of researchers and GTM engineers, in their role as practitioners, both acting together on a particular cycle of activities that included problem diagnosis, action intervention, and reflective learning. This was later found to be in line with the principles of Action Research as defined by Tracy (2020), Yin (2018) and Avison et al. (1999). The latter argue that in order "*to make academic research relevant, researchers should try out their theories with practitioners in real situations and real organizations*".

3.2 The context to Knowledge Translation in the GTM Ecosystem

GTM designs, manufactures and commissions gas turbines. The company also provides supports to its customers in the service of the products that are being used in the field. GTM has many thousand employees including professionals from a range of engineering disciplines, and thousands of customers throughout the world with a variety of operational requirements. In their interaction with actual and potential customers, GTM engineers have developed significant expertise in the design, manufacturing and operation of gas turbines over decades. The ultimate aim of the translation of engineering knowledge in this project was the use of such knowledge for the benefit of all stakeholders within the complex GTM ecosystem.

GTM's employees and stakeholders form a large chain of actors who own and act upon different pieces of knowledge about their gas turbines. Their knowledge of gas turbines is determined by their own different roles, projects, experiences and requirements. In this context, GTM engineers' knowledge of gas turbine operation not only helps organizational actors with their design and manufacturing activities, but also helps customers' business and operations. Simultaneously, knowledge of the health and usage of gas turbines in the field (i.e. customers' knowledge) helps GTM improve existing turbine designs and innovate in the design and manufacturing of new products and services. There is therefore a need for continuous translation of knowledge of gas turbines between GTM and its customer base, with knowledge moving in both directions. In

this context, knowledge translation plays a vital role allowing knowledge to be interpreted and applied at least at three levels:

- Between GTM and its potential customer base, with sales engineers acting as the interface between them. Knowledge is captured by sales engineers in the form of customer needs. Customer needs are then translated into sets of engineering requirements. GTM sales engineers become a key stakeholder in this continuous series of spontaneous knowledge translation initiatives.
- Within GTM, with employees from different departments collaborating during a period of months in a trusted environment toward the development of a unique product that meets the business needs of a particular customer. Engineering knowledge is continuously translated as it flows between teams to enable its use within the engineering processes.
- Between GTM and is actual customers, with customer service engineers acting as knowledge translators. Customer service engineers capture knowledge from customers, turn that knowledge into engineering decisions and feed these back to GTM engineering (e.g. manufacturing, automation) teams.

3.3 The Process of Knowledge Translation Within the GTM Ecosystem

Knowledge of gas turbines flows within the company and in both directions between GTM and their customers. In the process, there are changes in the format, language and dynamics of the knowledge structures in motion, as shown in figure 1.

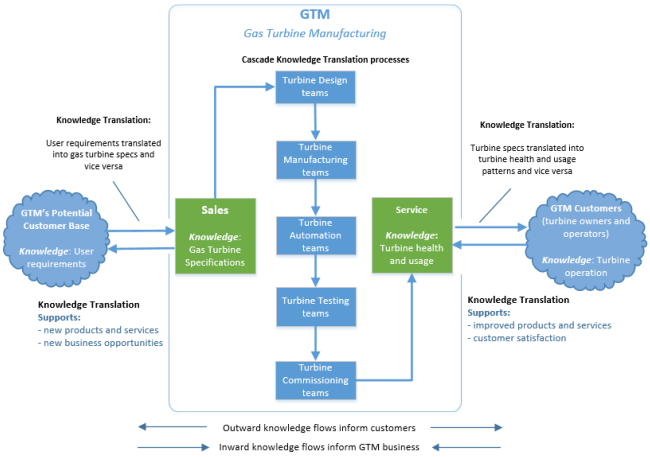


Figure 1: Knowledge Translation Within the GTM Ecosystem

The research identified two main types of knowledge translation processes within the GTM ecosystem, described by the arrows in figure 1:

- Knowledge translation between the company and its environment (double arrows) follows the approach that has been evolving over the last decades driven by research in the healthcare sector (Dal Mass, Garcia-Perez et al., 2020; Dal Mass, Cobianchi et al., 2021). Based in a significant knowledge difference between the company and its customer base, the process brings significant benefits to both the company and its potential and actual customers. Thus, knowledge from the customers is translated into turbine design requirements by the design team. The result of this translation is the input for the internal expert knowledge cascade, from the design team toward the commissioning team going through manufacturing, automation and testing cascades.
- Cascade knowledge translation within the company (single arrows). Although all teams within GTM experience of gas turbine manufacturing, each team has its most significant degree of expertise on a particular stage of the overall engineering process. As such, a cascade of knowledge translation processes allows each team to receive the knowledge that is required for the implementation of its main task (e.g. design, manufacturing, automation, testing etc.). On completion of such task, the team produces the knowledge that is required for the next phase of the project to be effectively implemented, and communicates such knowledge to the team responsible for its implementation. Finally, there is another crossing border cascade, from the commissioning team to the service team and the end user.

3.4 Results

A direct collaboration between the researchers and GTM's management board had a direct impact on the strategy of the organization.

First, it raised awareness of the importance of knowledge translation as an area for strategic development for GTM. Whilst the management board were concerned about a knowledge problem that seemed fuzzy at the time, this project reduced the complexity of the issue by providing GTM with a theoretical background and a concrete line of action. Knowledge translation became part of the vocabulary of the management board, and specific actions were put in place for the facilitation of this process.

Secondly, the research provided a justification to engage the wider GTM knowledge community into a new value co-creation strategy of the organization. By understanding the nature of engineering knowledge and where such knowledge resides, GTM created and funded new opportunities for collaborations across their value chain, including GTM engineers, customers and suppliers.

Finally, we argue that this project played a key role in preparing GTM for its transition into the knowledge economy. With this project, their management board formally started having open discussions about types or forms of knowledge, such as emotional knowledge, that had not been considered before. New collaborations with academic institutions in the region have been established and GTM is now part of a growing number of research and development initiatives with focus on engineering knowledge.

4. Discussion

Engineers working at GTM have developed over decades a valuable knowledge base encompassing all types of activities, from tendering to design, from the conceptual phase to the production one, from selling to commissioning and service. Whilst every team within GTM have access to the overall knowledge base of the product or project if required, continuous cascade knowledge translation processes make the manufacturing of gas turbines a manageable process, enabling specialization within the different GTM functions. The cascade of expert knowledge translation is based on knowledge dynamics and on the correlation between knowledge deficit and the absorptive capacity of the receiver. Cascade knowledge translation within the organization relies on every team understanding the knowledge, background and requirements of other teams. Such an understanding, combined with a common purpose across the company, leads the different teams to produce new knowledge in a format that is accessible to others over the project lifecycle. For example, turbine design teams produce turbine drawings and plans, to be used by manufacturing teams. Manufacturing teams produce hardware specifications, later used by automation teams to develop software. These knowledge outputs later inform the work of the testing and commissioning teams, and ultimately the knowledge of the customer service engineers, who represent the interface between GTM and their customers.

Although GTM has a standard diversified offer of gas turbines, it is frequently necessary to make some adaptations for each turbine to meet specific requirements coming from the customers. The context enabled by cascade knowledge translation allows specific changes to be made to original designs in an efficient and controlled way.

5. Conclusions and Limitations

This research has explored ways in which knowledge of a particular domain evolves over time and in its movement between teams. A manufacturing organization has provided the context for the study, in a 12-month action research project. The project had initially an exploratory nature, with the researchers working directly with representatives of every team to understand the gas turbine manufacturing process from the knowledge perspective. Such background helped the authors move from an understanding of communication within the organization to a perception of translation of engineering knowledge between different parts of the organization. Later on, the analysis of knowledge needs and knowledge outputs from different stages of the gas turbine manufacturing process led to a perception of a cascade of smaller knowledge translation initiatives. Interviews to different teams showed that the cascade knowledge translation processes provided both the focus and the knowledge outputs required by the different teams, which would be complemented by a wider knowledge base only when required. Alternative sources of knowledge were sought by engineers only if the outputs of the smaller translation process were not enough for their function. This perspective had become engrained in the culture of the organization, and was found to lead to closer links between specific teams and, with it, more knowledge alignments creating a knowledge chain across the gas turbine manufacturing process.

The experience from practice of knowledge translation in manufacturing contributes to the current theories on knowledge dynamics. It also confirms that knowledge translation is an increasingly relevant field within the knowledge management domain, with applications and developments beyond the healthcare sector. Despite opening new avenues for research, our focus solely on a manufacturing case study can be perceived as a limitation of the research. The main limitation of the present paper is its focus on a single case study, but it is a complex one capable to explain the model of cascade expert knowledge translation that is the contribution of the present paper. The authors encourage future research in other knowledge-driven domains, in an effort to develop appropriate theories and frameworks that enable the effective flows of knowledge within and between teams, organizations and sectors.

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Exploring Onboarding Processes for IT Professionals: The Role of Knowledge Management

Vebjørn Brødsjø[1], Benjamin Sandøy[2] and Eli Hustad[2]
[1]Lillesand Municipality, Norway
[2]University of Agder, Norway

vebjorn.brodsjo@lillesand.kommune.no
benjaminagsandoy@gmail.com
eli.hustad@uia.no

Abstract: A robust knowledge management (KM) strategy is essential for effective onboarding of new employees. Organizational knowledge plays a crucial role in helping new employees learn their work tasks and should be readily available for training purposes. This study examines how a public organization in Norway implements its onboarding process and facilitates knowledge sharing with new employees. We investigated various KM initiatives established in the organization and explored how knowledge is transferred to benefit new employees. Additionally, we examined how organizational culture influences knowledge sharing performance. The empirical data comprises 20 interviews conducted in the information technology department of the organization. The findings reveal that new employees should first receive training on specific work tasks related to their roles in the organization. Early productivity was considered significant during the onboarding process, while an overload of general knowledge about the organization was perceived as overwhelming. The public organization under study is known for its strong job security, which has fostered a collaborative environment among employees with low competitiveness. This openness encourages knowledge sharing and willingness to collaborate, as employees are not worried about losing their positions. This also results in a low threshold for seeking assistance from experienced colleagues during the onboarding process. The evidence suggests that much of the knowledge gained by employees during their employment period is acquired through informal settings, where experienced employees share knowledge with newcomers through direct communication.

Based on the findings, this study proposes practical recommendations for improving the onboarding process. Effective practices such as mentorships, new employee gatherings, and the existing technical graduate program should be maintained. Suggestions for further enhancing the onboarding process include: (1) designing a networking initiative that integrates new employees outside the graduate program; (2) tailoring the competence plan to the role of each employee; (3) improving the content of the intranet with information about role descriptions and responsibilities, making it easier to identify "who knows what" in the organization; and (4) defining the reasons for using collaboration tools more extensively. Implications for KM in onboarding processes are outlined.

Keywords: knowledge sharing, Onboarding, IT employees, Learning, Case study, Knowledge management

1. Introduction

The increased emphasis on digitalization in organizations and society as a whole has resulted in a higher demand for candidates with advanced education in information technology (IT) and related fields (Bensberg et al., 2019). As a result, there is fierce competition among private and public sectors to recruit the best graduates with digitalization competencies.

To attract and retain top talent, companies and public institutions must provide attractive working environments that offer opportunities for new employees to engage in creative and innovative work tasks to enhance their skills and knowledge further (Borowski et al., 2020). The onboarding process plays a crucial role for newcomers as they begin their new positions. Therefore, it is essential for new employees to feel welcomed and supported by their employers during this period, to receive the necessary training and support to excel in their new roles.

However, the onboarding process can be challenging for employers who aim to retain new hires for as long as possible. This period should be well-designed for knowledge sharing and competence building, ensuring that new employees are satisfied with their choice of employer and motivated to continue their employment (Kirchner & Stull, 2022). Overall, the onboarding process is critical and should be prioritized by employers by developing a robust competence development plan with appropriate training to facilitate new employees and their upcoming tasks.

During the onboarding process, new employees need to acclimate to the organization, including understanding their new role within the larger context and feeling accepted by their new coworkers. In this sense, onboarding is a form of organizational socialization that enhances adjustment through learning (Gardner et al., 2022).

Consequently, the first aim in our study is to examine prevalent practices and obstacles in onboarding processes within an organizational setting: (1) *How do organizations typically approach the onboarding process, and what are the key challenges frequently encountered in this context?*

Effective knowledge management (KM) initiatives are essential during this process to ensure that knowledge flow and retrieval occur in an efficient manner (Alavi & Leidner, 2001; Newell, 2015). However, there is limited understanding in existing research on how employers can achieve an effective onboarding process, and few studies have explored onboarding from a KM perspective. For example, it is crucial to understand how KM can play a significant role in successfully transferring relevant knowledge to new employees.

Accordingly, this study applies a knowledge management perspective to gain a comprehensive understanding of onboarding, and it explores the role of knowledge management initiatives to optimize learning outcomes:

(2) *How can knowledge management initiatives be utilized to enhance the learning outcomes for employees during the onboarding process?*

The paper is organized as follows: First, previous research is outlined. Second, the research site and method are presented. Third, the main results are outlined. Fourth, the discussion is provided. Finally, concluding remarks and implications are made.

2. Previous Research on KM in Public Sector

Organizations in the public sector operate differently than those in the private sector, as they do not prioritize profit as a business objective. This can create a distinct organizational culture characterized by less competition and more collaboration among employees (Choudhury & Das, 2021). In public institutions, job security may be higher, leading to a willingness to share knowledge with colleagues. This reduced internal competition can result in less fear of job loss and a more collaborative work environment (ibid.).

Implementing KM practices in the public sector can lead to improved working methods and processes, especially when challenges are localized (Edge, 2005). KM solutions can help organizations achieve efficiency and gain a clear overview of the knowledge available within the organization and the employees who possess different forms of knowledge. While the focus is not on gaining a competitive advantage, KM can still enhance resource utilization by localizing existing knowledge (Alavi, 2000), and avoiding unnecessary hiring of external consultants. Easy access to knowledge by employees can result in resource savings in terms of time. The competitive advantage has shifted from purely financial savings to a greater emphasis on competence, where the application of internal knowledge within organizations adds value in terms of savings, organizational development, and learning (Sambamurthy & Subramani, 2005).

A literature review by Massaro et al. (2015) presents the main contributions in the field of KM in the public sector. The article identifies enablers and barriers of KM, with enablers including leadership support, organizational culture, and technological infrastructure, and barriers including lack of incentives, resistance to change, and limited resources. The article provides insights into the factors that facilitate or hinder the implementation of KM initiatives in the public sector. Additionally, the article discusses different approaches and strategies for managing knowledge, such as communities of practice, knowledge portals, and knowledge sharing networks, and highlights the potential benefits of effective KM practices in terms of improved organizational performance, decision making, and innovation. The authors also discuss important future research directions in KM, such as the role of leadership in promoting knowledge sharing, challenges of managing tacit knowledge, and the impact of national and cultural factors on KM in the public sector.

Jain & Jeppesen (2013) focus on the role of leaders' cognitive styles in shaping KM practices. The paper reveals the relationship between leaders' cognitive styles and their KM practices, providing evidence that leaders with a higher tolerance for ambiguity are more likely to promote knowledge sharing and utilization, while those with a higher need for cognition are more inclined towards knowledge acquisition and documentation. The paper highlights the need for leaders to be aware of their cognitive styles and how this may impact their approach to KM. The authors suggest that organizations can leverage leaders' cognitive styles to design effective KM strategies and practices that align with their leaders' cognitive preferences.

A study conducted by Henttonen et al. (2016) provides insights on the relationship between knowledge sharing, social capital, and individual work performance in the context of a public sector organization. The findings inform public sector managers and policymakers on the importance of knowledge sharing and social capital in enhancing individual work performance. The study suggests that promoting knowledge sharing and fostering social capital may lead to improved work performance of employees in the public sector organization.

Choy Chong et al. (2011) focus on critical success factors for KM implementation in public sector accounting. The findings highlight the importance of leadership support, organizational culture, and employee participation in KM implementation efforts, and suggest strategies for overcoming challenges and maximizing the benefits of KM in this context.

In summary, these studies highlight the importance of leadership, organizational culture, and knowledge sharing in obtaining effective KM practices in the public sector. They also identify challenges and success factors in implementing KM initiatives in public sector organizations. The research gaps from these studies comprise KM's impact on organizational performance, factors that influence knowledge sharing among employees, the impact of knowledge sharing on individual work performance, and how organizational context and culture influence knowledge sharing behaviours in the public sector.

The abovementioned studies provide a foundation for understanding KM in the public sector. However, more research is needed to specifically study the impact of KM on onboarding processes, including knowledge transfer and organizational culture. Exploring the role of KM-supporting technologies is also important for understanding onboarding success. Additionally, investigating the social and cultural aspects of KM during onboarding, including tacit knowledge and socialization, is crucial. Our study aims to address these research gaps.

3. Research Site and Method

The ABC organization (pseudonym) is a large public organization in Norway with around 7,500 employees spread across multiple regions and locations. Within the organization, there is an IT division with over 900 employees working in a distributed setting. The IT department is divided into five sub-departments, each with its own department CIO. One of the departments focuses on portfolio management, project management, and change management processes and routines. Two other departments are responsible for developing programs and systems related to the organization's core business. There is also a department that delivers IT services to employees, including IT solution agreements, IT security, and IT support. Lastly, there is a department that handles internal platforms, cloud solutions, and databases.

New employees are assigned a supervisor who provides academic and social support, and they are introduced to the organization through training videos and gatherings for new employees. The organization also has employee programs specifically designed for new graduates, which include networking opportunities and task rotation internally.

This study utilizes a qualitative case study method (Yin, 2003), and apply semi-structured interviews as the data collection technique. An interview guide was developed and tested to ensure valid and non-repetitive questions with an appropriate interview length. The aim of this approach is to gain in-depth insight into the onboarding process for new employees, focusing on details that may be overlooked in a macro-level approach. The expectation is that the interviewees will feel comfortable and open-minded, speaking freely in a relaxed setting. Cooperation with the organization allowed access to potential interview subjects through email contacts provided by group leaders who identified willing participants.

In total, 20 interviews were conducted with IT employees. Two of the interviewees held leadership positions at the case organization for the past 10 years, while the rest were new hires who had worked there for between five and 19 months. The interviews lasted between 40 to 60 minutes and were conducted online using Microsoft Teams, with audio recordings taken. All interviews were transcribed verbatim, and audio playback tools with slow-down functions were used for accuracy during transcription.

The interview guide was used to categorize and sort quotes, concepts, and themes. Following the approach suggested by Miles & Huberman (2018), the transcripts were read multiple times, notes were made, data was reduced, and visualized drawings were used to group the data into an organized overview of the most central topics. Leader interviews and employee interviews were separated as their interview guides slightly differed. In the results section, quotes are used to emphasize specific findings. Two of the authors were responsible for conducting the interviews, and both participated in all of them.

4. Results

4.1 The Onboarding Process for new Employees and KM Initiatives

During onboarding, various formal and informal KM initiatives are established in ABC to transfer knowledge to new employees. This process begins after the employee signs the contract and includes a dialogue with their manager about start-up tasks and expectations. The manager is responsible for ensuring the new employees

receive training and a good introduction to their tasks. On the first day, new employees are assigned a PC and have a dialogue with their manager. They are also introduced to the organization through meetings, training videos, and informal conversations with colleagues. Mentors are assigned to provide support and assistance. For multiple new hires, training is done in blocks, while for individuals, team members contribute to training. After a few months, new employees attend common gatherings focusing on organizational values, vision, and interactive group tasks. There are also specific gatherings for new IT employees, such as the Tech-Graduate program, which includes training and mentorship. The program has become popular for networking opportunities. Interviewees praised the program and suggested incorporating similar elements into the regular hiring process (Table 1).

Table 1: The Onboarding Process for new Employees and KM initiatives – Sample Quotes

"The key is to establish connections across the organization through networking and professional/social meetings."
"Being part of the Tech-Graduate program provides an initial network from various parts of the organization, along with relevant training. It's a valuable program that could benefit new employees who are not part of it as well."

Digital tools for knowledge sharing

The organization utilizes several tools for knowledge sharing (Table 2), and they have implemented both Atlassian and SharePoint products. In addition, Mattermost is used as instant messaging software, mainly for development environments.

Table 2: Digital Tools Contributing to Knowledge-Sharing

Tool	Function
Intranet	An internal webpage that provides an overview of the organization for employees and serves as a learning portal.
Confluence	An internal wiki used to document analyses of needs and IT solutions, as well as work performed and experiences
Jira	A project management tool used to document product backlog and task queues for development environments
OneDrive	A file hosting service used for sharing individual files in real time
Teams	A collaboration platform that includes virtual meetings, document sharing, and instant messaging.
Mattermost	Instant messaging software used for communication and collaboration in development environments

Software applications like Mattermost, Jira, and Confluence are popular solutions used by development communities. Confluence is used as an internal Wiki for documentation and KM. The organization has also introduced SharePoint as part of their Digital Workplace initiative, offering tools for home office, meeting activities, information sharing, and communication(see Table 3). However, the purpose of these tools is unclear, leading to informal solutions that vary among teams and potential overlaps in information. This can create silos and challenges for distributed employees. Improving information architecture and synergy between tools may be a possible solution, but it requires formalization to work effectively.

Table 3: Digital Tools for Knowledge Sharing - Sample Quotes

"As far as I know, there isn't a specific purpose for it. It's not something we talk about; we just focus on documenting the knowledge we need and the knowledge we lack."
"It's not always easy to predict the direction things are heading. We have a project posted on SharePoint that may overlap with information on the Wiki."
"I think it can be challenging to locate information as it's spread out. Searching across the Wiki to find things is not an easy task."
"If we can improve our information architecture and have better synergy between the tools we use, the information across different locations will also be better organized."

4.2 Challenges in the Onboarding Process

Information overload and relevant/irrelevant knowledge

The process of learning about the organization faced challenges in balancing relevant information at the right time versus information overload (see Table4). Interviewees found the initial training overwhelming, with too much general information that was not always relevant. Some suggested that the information could have been presented in a more engaging way, and that training should be tailored and distributed over time. Many interviewees expressed a desire for a more customized learning approach, as some training events were not relevant for all participants. Informal learning through collaboration with colleagues and mentors during daily work was also highlighted as important, as there was no formal training process beyond mandatory content on the learning portal.

Table 4: Information Overload, Relevant/Irrelevant Knowledge – Sample Quotes

"Making a new employee watch videos for an entire week doesn't seem to add much value."
"The mandatory learning portal requires going through lengthy courses on topics like organizational culture, corporate social responsibility, privacy issues, etc. It's quite boring. I work with online services and user experience, so the whole thing feels dreary. It's a long list of courses and I'm trying to learn other things too, so it gets monotonous."
"While it's not irrelevant for an employee to learn about laws and regulations in the organization, it could have been presented in a more engaging way. Perhaps by making it more exciting and spreading out the learning over time."
"As a new employee, you feel unproductive. Yes, it takes time to get up to speed, but new hires are eager to learn about their actual job responsibilities as soon as possible. General information can wait until later."

Who knows what and time dedicated for learning

Interviewees suggested improvements in the training process and expressed difficulties in knowing who to contact for help (see Table 5). They mentioned challenges in finding employees with expertise and suggested having an overview of employees and their roles. Currently, finding information about competence and responsibility is not easy. Another challenge is the timing of gatherings, as new employees should participate after being employed for some months to fully benefit from them.

Table 5: Who Knows What and Time for Learning – Sample Quotes

"There were a few instances where I had to ask multiple people and was forwarded several times."
"It would greatly benefit new employees to have the ability to easily look up and access brief overviews of different team members, including their roles, locations, and areas of expertise."

4.3 The Culture of Knowledge-Sharing and Knowledge-Sharing Initiatives

The organization values knowledge-sharing and encourages initiatives. Newcomers highlight the open culture that promotes sharing knowledge. Most interviewees believe colleagues do not withhold knowledge intentionally but may do so unconsciously. Managers are positive about knowledge-sharing and aim for a collaborative environment. However, sharing knowledge across departments and upwards in the hierarchy is challenging due to lack of communication and time constraints. Knowledge-sharing happens in meetings, professional groups (communities of practice), wikis, instant message channels, and customized initiatives.

Most interviewees emphasized that meetings were the most important arena for knowledge sharing. Wiki and professional groups (communities of practice) were also considered effective for knowledge sharing. However, the effectiveness of knowledge sharing also depends on employees' initiative. Some employees mentioned other IT subject forums and arenas within the organization where knowledge could be shared. Some departments have their own schemes for knowledge sharing, aiming to help employees acquire knowledge from their colleagues. Some managers encourage employees to attend courses to acquire necessary knowledge, which can then be shared further.

Managers highlighted the importance of exchanging experiences during conversations, where informal learning often takes place. The extent of employee learning depends on their initiative. Good documentation routines were also seen as important for knowledge sharing.

There were different opinions about what works and what doesn't in knowledge sharing. Some participants believe they are good at sharing knowledge and actively offer expertise, while others share mostly when asked. Some mentioned that newcomers may have less knowledge to share, and some feel that documentation is not being used effectively. Time constraints and project assignments also impact knowledge sharing.

The flow of information and communication within the IT department was described as both positive and negative. While it was seen as informal and efficient, the size of the organization was highlighted as a challenge, making it difficult to keep track of projects and personnel. Transparency and security-related requirements were also mentioned as challenges in knowledge sharing.

Instant messaging channels, such as Mattermost and Teams, were considered important for knowledge sharing, but some challenges arose due to the use of multiple channels (see Table 6). The decision to phase out Mattermost or not was pending.

Table 6: The Culture of Knowledge Sharing and Knowledge Sharing Initiatives – Sample Quotes

"I believe people are interested in creating a positive work environment where knowledge sharing is encouraged. There is no competition or danger in sharing knowledge as it leads to a better working environment."
"We are highly focused on knowledge sharing and expertise dissemination. We aim to avoid creating specialists and encourage everyone to have a diverse skill set."
"Unfortunately, knowledge sharing is not happening enough between teams and groups, leading to silos and lack of communication. Some express a desire to prioritize sharing, but face challenges due to time constraints and the presence of many people."
"There are forums and arenas within the organization where IT subjects and other topics are presented for sharing and collaboration."
"I recently encouraged two of my team members to work together and improve their skills in a specific area. Formal documentation alone cannot solve this issue."
"My employer has supported and encouraged my attendance in relevant courses."
"We have a culture of verbal exchange of experiences and learning from each other in various settings."
"Sometimes I proactively share important knowledge, while other times people approach me with questions."
"In everyday situations, it's often easier for others to come and ask for expertise rather than proactively offering it."
"I avoid creating lengthy documents and routine descriptions as they are time-consuming and not widely sought after."
"I think overall it's positive, but managing communication with a large number of people can be challenging to ensure consistent messaging."
"As a large organization with frequent changes in personnel and projects, it can be difficult to keep track of responsibilities and roles, leading to occasional messiness."
"One strategy may not fit all situations and departments within the organization."
"While there is a transparency principle in the organization, there are also security-related requirements that limit information dissemination. Balancing these two principles can be challenging."

5. Discussion

The public sector was praised by interviewees for its positive characteristics, particularly job security, which fosters a cooperative culture by reducing competition and protecting positions (Choudhury & Das, 2021). Unlike the private sector, the public sector focuses on aspects beyond profit, such as competence building, which can provide a competitive advantage by nurturing informed, cooperative, and competent employees. This emphasis on employee well-being, motivation, and competence building aligns with the ABC's culture, particularly during onboarding where cooperation and organizational merits are valued.

Clarity on information channels and access to licenses is essential for employees, and management may need to formalize changes in channel structure and usage, such as sharing information from Mattermost in other channels for wider access. Addressing employees' concerns and leveraging their knowledge can help minimize resistance to changes and facilitate smooth knowledge sharing (Corfield & Paton, 2016).

Interviewees expressed positive attitudes towards knowledge sharing among managers and colleagues, mentioning accessible leadership and willingness to help (Choudhury & Das, 2021). However, challenges in sharing knowledge across departments and hierarchical levels, as well as time constraints in large gatherings, exist. Encouraging managers to facilitate implicit knowledge sharing in smaller settings can help employees build their competence. Overall, interviewees were satisfied with the current attitudes towards sharing, but acknowledged room for improvement.

While most interviewees claimed to document their work, some did so only occasionally or not extensively, citing prioritization of other tasks and preference for discussions with colleagues (Oliveira et al., 2015). However,

a strong culture of knowledge sharing is crucial. Despite some differences between groups, the ABC is generally perceived to have a positive culture, with an open environment that encourages asking for assistance and informal discussions.

Internal competition may hinder knowledge sharing, but at ABC, job security is prioritized over competition, fostering a culture of knowledge sharing. While some interviewees acknowledged that colleagues may inadvertently withhold knowledge due to personal traits, they demonstrated awareness of their own room for improvement in knowledge sharing (Bari et al., 2020; Halisah et al., 2021). Trust among colleagues and a positive working environment are considered crucial for effective knowledge sharing (Henttonen & Blomqvist, 2005).

The public sector can be perceived as bureaucratic, with slow processes and differing opinions, which may be viewed negatively. However, the ABC organization leverages this perception for improvement by promoting open dialogue and problem-solving during meetings and professional gatherings, which facilitate knowledge sharing and understanding of work tasks and the profession.

During onboarding, employees acquire knowledge in informal contexts through communication, indicating a positive culture of sharing implicit knowledge and an agile approach to KM (Zykov & Singh, 2020). To build on this, management can design a knowledge-sharing strategy that focuses on explicit and implicit knowledge. Interviews reveal that implicit knowledge sharing is more successful at ABC, with a low threshold for asking for help and frequent meetings for knowledge sharing. However, attitudes towards documentation vary, with limits on how much knowledge is documented and utilized.

Siakas & Georgiadou's (2006) model can guide the ABC's strategy for sharing knowledge, with steps 2, 4, and 6 being widespread, and steps 1 and 5 also showing positive signs (Figure 1). Step 8 varies among groups, and steps 3 and 6 could be improved. Measures to motivate employees to share knowledge, such as collaboration initiatives, can be introduced to enhance knowledge sharing (Corfield & Paton, 2016; Smith, 2001; Weng et al., 2020).

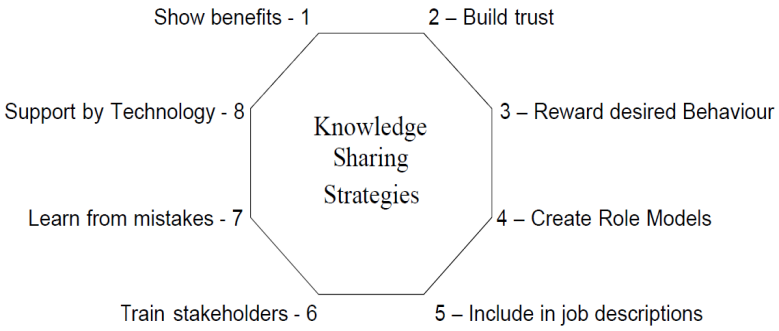


Figure 1: Guide to Develop and Utilize a KM Strategy (Siakas & Georgiadou, 2006)

Interviewees described the flow of information and communication in varying terms, ranging from positive to negative. The informal culture at ABC facilitated easy connection and communication, but also posed challenges in initiating communication when the right person was not easily accessible, especially for new employees lacking an established social network. Identifying the right people to solve a problem was often unclear and difficult, and some relied on mentors or team members for assistance. The IT division primarily used Microsoft Teams and Mattermost for communication, with Mattermost being less accessible due to license restrictions, resulting in missed information. Similar confusion existed regarding documentation channels such as Wiki, Jira, and SharePoint. To improve knowledge sharing, it is crucial to establish clear purposes for using these solutions and clarify what information and knowledge should be shared and where it should be documented (Scarso et al., 2016). Clarification among employees regarding relevant channels for specific information and assessing access to expensive licenses may require changes in channel structure and usage, while prioritizing employee understanding and reducing resistance to change (Corfield & Paton, 2016).

Participants displayed varying levels of willingness to share knowledge. Some shared willingly, while others preferred to share only when asked or when they perceived a need to improve their knowledge-sharing efforts, which is consistent with previous research (Hu & Randel, 2014). Even experienced employees were not necessarily better at documenting knowledge, as some mentioned that not everything seemed relevant to document, possibly due to motivation challenges. Additionally, interviewees had different perceptions of what it means to be proficient at knowledge sharing, with some who claimed to be good at it not necessarily being better than those who acknowledged room for improvement (Scarso et al., 2016; Shih & Farn, 2008).

Managers and colleagues generally exhibited a positive attitude towards knowledge sharing, with a willingness to help and an accessible and informal leadership style (Choudhury & Das, 2021). However, challenges arose in sharing knowledge across different departments and hierarchies, mainly due to time constraints and difficulties in sharing in large gatherings. Implicit knowledge sharing outside of meetings may enhance employee competence. While interviewees expressed satisfaction with prevailing attitudes towards sharing, they also acknowledged the need for further improvement. Most interviewees did not believe that employees intentionally withhold knowledge, but a competitive internal climate can negatively impact knowledge sharing (Halisah et al., 2021). At ABC, employees tended to feel job security rather than competition for positions, fostering a positive environment for knowledge sharing. However, some interviewees suggested that colleagues may unconsciously retain knowledge due to personal traits such as reservation, which can affect the amount of knowledge they share (Bari et al., 2020). Perceiving lack of knowledge sharing among colleagues can reduce trust and negatively impact the work environment (Kähkönen et al., 2021). However, interviewees also acknowledged that lack of knowledge sharing may not always be intentional and admitted to needing improvement in their own knowledge-sharing efforts and observing similar behaviour in colleagues.

6. Conclusion and Implications

We conducted a case study to explore the role of KM in onboarding processes. Our findings highlight the potential of KM initiatives to positively impact onboarding by fostering knowledge sharing and collaboration, facilitating learning and development, and enhancing organizational culture and performance. KM can promote a knowledge-sharing culture within the organization, which can effectively support onboarding of new employees. This can be facilitated through knowledge-sharing platforms, communities of practice, and social media tools that enable access and sharing of relevant information, expertise, and experiences (Henttonen et al., 2016; Kirchner & Stull, 2022). In addition, KM can support learning and development by providing new employees with access to training materials, resources, and best practices. Creating a learning organization that values continuous improvement and innovation can enhance the onboarding experience for new hires (Yang, 2007). Furthermore, KM can contribute to organizational performance by promoting knowledge reuse and leveraging expertise across the organization. This can help new employees quickly integrate into the organization and understand its core values, goals, and processes, thus enhancing individual and team performance (Massaro et al., 2015).

Based on our findings, we recommend that ABC continues its effective initiatives such as the mentorship scheme, new employee gatherings, and the Tech Graduate program. However, we also suggest designing additional initiatives to integrate new employees beyond the Tech Graduate program, allowing them to build a larger network early on. Tailoring the training plan to be more role-specific and disseminating general information broadly could also be beneficial in enhancing onboarding effectiveness.

Considering the challenges of locating relevant resources in a large organization like ABC, we propose enhancing the intranet page to include comprehensive role descriptions and responsibilities, facilitating easier access to resources for new employees. Additionally, establishing clear guidelines for the purposeful use of collaboration tools within the organization can enhance collaboration and productivity among employees. The recommendations are summarized in Table 7 and can also be valuable for onboarding processes in other organizations.

Table 7: Practical Implications – Recommendation for Onboarding

	Recommendation for onboarding
1	Continue implementing the mentorship scheme, new employee gatherings, and the Tech Graduate programme as part of the organizational strategy.
2	Ensure new employees are integrated into informal networks early on.
3	Provide tailored training that allows new hires to focus on learning their job duties at the beginning, so they feel productive from the start.
4	Extend the videos with general information about the organization throughout the employment period.
5	Enhance the intranet page with an overview of employees, including role descriptions and responsibilities, to make it easier to find resources.
6	Define clear purposes for using collaboration tools, so that new employees can easily understand when to use them.

Moreover, we propose targeted KM initiatives that can effectively facilitate the onboarding process and facilitate knowledge transfer. These recommendations are derived from our own research findings as well as existing literature and are generally regarded as beneficial for organizations in onboarding processes aiming to enhance their focus on KM (Table 8).

Table 8: Suggested KM Initiatives Supporting Onboarding and Knowledge Flow

KM initiative	Description
Knowledge sharing platform	Establish a centralized digital platform or intranet where employees can share and access knowledge resources such as best practices, guidelines, templates, and lessons learned (e.g., enterprise social media platform). This platform can facilitate collaboration and encourage knowledge exchange among employees (e.g., Rode, 2016).
Communities of practice	Cultivate the formation of communities of practice (CoPs) within the organization. CoPs bring together individuals with shared professional interests and expertise to foster knowledge sharing, problem-solving, learning and innovation (Brown & Duguid, 1991). These communities can be organized around specific topics and issues in the organization as well as in relation to ongoing projects (e.g., Hustad, 2017).
Knowledge capture and documentation	Implement processes and communication media tools to capture tacit knowledge from experienced employees before their retirement or departure from the organization. This can involve conducting exit interviews, creating knowledge transfer plans, and documenting critical expertise through written reports, videos, or audio recordings (e.g., Cox & Overbey, 2022).
Competence management	Learning and development programs including training programs, workshops, and seminars to develop employees' skills and knowledge. Focus on areas relevant to the organization's objectives and type of organization (private or public), such as leadership development, project management, technological advancements, and public service innovations (e.g., de Vasconcelos et al., 2016).
Mentoring and coaching	Establish mentoring or coaching programs where experienced employees can provide guidance, support, and knowledge transfer to junior or new staff members. This promotes knowledge sharing, skills development, and the transfer of institutional knowledge (e.g., Lave & Wenger, 1991).
Knowledge repositories	Develop an organizational "bible" or a knowledge reservoir (Hole et al., 2017): Develop repositories that contain relevant information, policies, procedures, and templates. Ensure these resources are easily accessible and regularly updated to allow access to valuable knowledge (e.g., Levallet & Chan, 2019).
Performance evaluation and recognition	Incorporate knowledge sharing and collaboration as performance evaluation criteria. Recognize and reward employees who actively contribute to knowledge management initiatives and demonstrate a commitment to sharing knowledge and expertise. Provide incentives for knowledge sharing (e.g., Kremer et al., 2019).
Collaboration technologies	Implement collaborative technologies such as project management software, shared document repositories, and virtual communication tools and platforms (e.g., Teams). These tools facilitate real-time collaboration, information sharing, and efficient teamwork, regardless of employees' physical locations (e.g., Dingsøyr et al., 2018).
Organizational learning culture	Foster a culture of continuous learning and knowledge sharing within the organization. Encourage employees to seek new knowledge, participate in professional development opportunities, and share their expertise with others (e.g., Sorakraikitikul & Siengthai, 2014).
Leadership and KM	Be aware of leadership support involving clear communication, and ongoing evaluation to ensure successful KM initiatives (e.g., Von Krogh et al., 2012).

As a suggestion for future research, it is recommended to conduct similar studies within other large public organizations to account for potential organization-specific findings. Exploring different sectors, such as the municipal sector, could offer valuable insights due to the unique cultural dynamics influenced by local politics. Additionally, broadening the research scope to encompass large public organizations beyond Norway would provide a more comprehensive understanding of the impact of culture on the onboarding process. To further enrich the understanding of organizational culture and effective KM initiatives, incorporating qualitative data through interviews with long-term employees, as well as observations and group interviews to assess cultural dynamics, would be beneficial in future research endeavours.

Furthermore, to investigate the role of organizational context and individual differences in onboarding processes deserves additional exploration. With the rapid advancement of technology, organizations are increasingly adopting digital tools and platforms for KM purposes. Therefore, exploring the potential of advanced

technologies, such as artificial intelligence-driven knowledge repositories, in facilitating onboarding processes and enhancing knowledge transfer is worth investigating. Moreover, it is crucial for future research to investigate the long-term impacts of KM practices on fostering competence development, facilitating knowledge retention, and promoting continuous learning among employees.

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Online Patient Account: A Tool to Support Older Adults or Digital Exclusion?

Magdalena Bsoul-Kopowska
Częstochowa University of Technology, Poland

m.bsoul-kopowska@pcz.pl

Abstract: One of the conditions for the efficient operation of the healthcare system in Poland is the well-functioning information system, which for several years, has been moving towards full computerization. The application of new technologies in serving older adults is aimed at ensuring safety and extending and increasing their independence. The Online Patient Account (Internetowe Konto Pacjenta - IKP) is an electronic application in Poland that any patient can log in to view their health history free of charge. The aim of the present paper is to answer the question of whether the introduction of the Online Patient Account service in Poland leads to the elimination of barriers related to the dysfunction of the healthcare system, or to the secondary exclusion of older adults. The study used a diagnostic survey method based on a questionnaire technique that was addressed to older adults living in Poland. The survey was conducted in late 2022 and early 2023. The results obtained suggest the problem of digital exclusion of older adults, which may consequently exacerbate disparities in access to medical care. The results of the survey helped illustrate the specific situation of older adults and develop important recommendations for the inclusion of older members of society in the market of healthcare services. The research conducted shows that the IKP service, despite its potential to address inequalities in healthcare for older adults, is still in the development stage.

Keywords: Older adults, Digital exclusion, Society 5.0, New technology, Healthcare

1. Introduction

According to the European Commission, “eHealth is the use of ICT in health products, services, and processes, combined with organisational change in healthcare systems and new skills. [...] eHealth covers the interaction between patients and health-service providers, institution-to-institution transmission of data, or peer-to-peer communication between patients and/or health professionals" (EC, 2012). The digital health marketplace is expected to enable the use of information and communication technologies (ICT) to maintain and improve patients' health, and contribute to improving the accessibility and quality of health care. The concept of Society 5.0 is expected to help in this field, and it is hoped that it can overcome the problem that arises in aging societies, in which an increasing number of people require additional medical care. Therefore, it is important to skillfully and fully exploit the opportunities brought by the development of ICT to acquire new knowledge and create new quality by developing relations between people and objects in the real world and virtual reality (Harayamaa, 2017). The purpose of the present paper is to discuss the possibility of adapting new technologies in serving older adults in the area of e-health, using the Online Patient Account as an example.

2. Background and Literature Review

2.1 Aging Society and the Concept of Society 5.0

Healthcare and the entire medical sector are going to face big challenges in the next few years. As numerous social studies indicate, in modern societies, population aging has become a problem that cannot be ignored (Almeida, Matos 2005). It is a global and universal process. According to the United Nations, for the first time in history, the number of people aged 65 and over worldwide outnumbered the number of children under 5, and by 2050, one in six people worldwide will be over 65. Furthermore, in 2019, the UN also evaluated that people aged 65 and over accounted for 9% of the world's population of global residents. The percentage is estimated to grow steadily, reaching 12% in 2030, 16% in 2050, and up to 23% in 2100, respectively. Furthermore, 2019 UN projections suggest that by 2050, one in four people in Europe and North America will be 65 or older (UN, 2019).

An aging population and low birth rates mean that the balance between the number of people of working and post-working age may be disturbed. Another problem is the increasing singularization of old age, i.e., the increase in the number of older adults who form single-person households, are on their own, and have no one to support them (according to projections by Statistics Poland (GUS), 53.3% of one-person households in Poland in 2030 will include people aged 65 and over, with 17.3% aged 80 and over). This process negatively affects the economy because it increases health and medical expenses, especially for older adults (Wiener, Tilly 2002; Bloom, Canning, Sevilla 2003; McMorrow, Roeger 2004; Kotlikoff, Burns 2004; Lee, Mason 2011; and others). Polish researchers also noted that for the first time in the history of mankind, there are as many as two

generations of older adults, that is, people over 60 who still have living parents aged 80 and older (Migdał-Najman, Najman, Badowska, 2020). The demographic situation in these terms in Poland is special. According to Statistics Poland, the population of Poland in 2019 was 38.38 million, of which people aged 60 and over accounted for 25.3%, while in 2050, the percentage of people aged 60 and over will be 40.4% (GUS, 2021). According to UN projections (UN, 2019), by 2050, the number of Poles will have reduced to 33.30 million inhabitants, with 31.12% of the population over 65 years of age. According to the UN, Poles will be the world's tenth oldest society in 2050. Such an emerging demographic structure will directly generate changes in consumer market segments, with a growing role of older adult consumers. Therefore, efforts are being made around the world to improve the quality of life of older adults, especially since the problem of aging does not only affect rich but also developing countries.

The Japan Business Federation, in its 2016 document Toward Realization of the New Economy and Society, pointed out that the time for great reform has arrived, and that Japan, as a forerunner in finding solutions to emerging problems, is committed to promoting economy-wide and society-wide innovation (Japan Business Federation, 2016). The concept of Society 5.0 defines society as human-oriented, in which economic progress containing solutions to social issues is balanced by a system that offers high integration of digital and real space. Therefore, in recent years, there has been an increasing number of studies devoted to the use of new technologies in the care of older adults (Sixsmith 2006; Nygård, Starkhammar 2007; Robinson et al. 2009; Topo, Östlund 2009; Mountain 2013). In practice, the solution to the above problem is expected to be Society 5.0 and the 5G network, while the use of information systems and mobile technologies is expected to form the basis for a change in the approach to the management of processes in the area of decision-making in healthcare. Therefore, e-health services belong to the group of services that have the greatest potential for growth in the coming years under the conditions of the modern economy. e-health is expected to improve various aspects of healthcare (quality, efficiency, accessibility, etc.), provide consumers with better access to healthcare services and health information, and stay physically and mentally fit. This, in turn, will require digital competencies, which on the one hand, can be an enabler, and on the other hand, can be a hindrance to coping with the digital world (Harayama, 2017). The above-mentioned digital competencies become a key factor for people who faced the digital revolution at the end of their professional careers and had far less to do with new technologies than younger members of society. According to S. Serpa and C. M. Ferreira, society 5.0 is expected to "promote further development of the potential of the individual-technology relationship, and improve the quality of life for all people through a super smart society "(Serpa and Ferreira, 2018, item 1).

A survey by Statistics Poland (GUS, 2021) conducted in Poland in 2019 showed that only 34.1% of people aged 65 to 74 used computers in the past three months. Although people of this age are increasingly using computers at least once a week, the percentage of regular users remains at a lower level than in younger age groups. In 2019, 37.0% of people aged 65-74 used the Internet (CSO, 2021), 33.3% of people regularly connected to the Internet in 2019, and already in 2020, this percentage was 40.4% (CSO, 2020). On the other hand, 64.6% of those aged 65 and over have never used the Internet. Access to technology and the knowledge and ability to use new technologies can contribute to better and more open acceptance of digital solutions in the healthcare market, while limitations in this area are a major barrier to the spread of digital services. These results suggest that although more and more older adults in Poland are using the Internet, there are still large differences in access between different age groups. It is also possible that the problem is the lack of access to adequate infrastructure, and inadequate education on how to use the Internet, especially for older adults, who usually have not had contact with new technologies before.

A few years ago, a new term of ‘digital divide’ emerged in public discourse, meaning unequal access to new technologies (van Dijk, 2006). Digital divide can be observed both on a macro scale, in which case it manifests itself, for example, in differences in Internet access between different regions of the world, and on a micro scale, for example, when differences in media competence are observed among members of a household (Vu, 2011). A review of the literature shows that groups affected by digital divide certainly include older adults. Older adults use the Internet for a variety of reasons. In the case of e-health services, it is most often used to obtain health information, check medical recommendations, lab results, and general recommendations to improve health-related quality of life (Martin-Hammond et al., 2019, Bolle et al., 2016, Shim et al., 2018). On the one hand, using the Internet as a source of health information has many advantages, including offering quick, easy, timely, and inexpensive access to information and thus allowing you to control your health status, provided that the information is reliable. Despite the numerous benefits of e-health for older adults, many do not know how to handle the use of new technology (Santana et al., 2011).

2.2 Online Patient Account

In 2011, the National Center for Health Information Systems announced a tender for an Electronic Platform for the Collection, Analysis, and Sharing of Digital Resources on Medical Events. It is one of the largest e-health projects in Poland. Online Patient Account (IKP) is a digital collection of health information. Once a person's account is authorized without leaving home, the patient can use many of the health system's services because the system allows them to collect all health information in one place. With the system, doctors are supported in making therapeutic decisions, while patients can manage their health records. The advantage of the IKP system is that patients can enter their medical data or receive notifications about medical appointments or the need to take medication. Patients have also the option to receive medical services remotely. IKP does not need to be set up, as IKP is available to any citizen with a PESEL (PESEL i.e., Polish Personal Identification Number, is an 11-digit number assigned to every person with registered residence in Poland containing information on gender, date of birth, place of birth, and document issue series number) number, but to make full use of this system, the account must be authorized. The problem arises here because the authorization must be done by a bank using iPKO or Inteligo online accounts, ePUAP, with Trusted Profile (Profil Zaufany, PZ), or an electronic identification card. The account can be accessed using the website and cell phone apps (Internet Patient Account, 2023). Unfortunately, the first authorization to the system is quite a challenge for older adults.

Therefore, in the context of previous considerations, one may wonder whether IKP leads to secondary digital exclusion of adults over 65 years of age with limited digital competencies. And could the digital divide exacerbate disparities in access to medical care, especially as patients' demand for medical care increases with age?

3. Methodology

The findings presented in the paper are part of a quantitative survey conducted among older adults in 2022/2023. The study was conducted using quantitative research methods and survey questionnaire technique due to direct contact with respondents. The survey covered adults aged 65 and over living in Poland. The study used a diagnostic survey method based on a questionnaire technique that was addressed to older adults living in Poland. Purposive random sampling was used, taking into account gender, age, education, and place of residence. The survey included 570 older adults. It was conducted over a four-month period (October to January) 2022/2023.

The main research tool used was a standardized survey questionnaire consisting of 28 closed questions and statements. A Likert scale was used to rate the responses, which made it possible to evaluate the relative intensity of different responses (Babbie 2004, p. 192). The research tool (questionnaire) was designed by the author and created by the author of the paper. STATISTICA software was used in the process of compiling the findings.

For the purposes of the study, the focus was on the problem of accessibility of services provided by the IKP and the needs of older adults in this regard. The article attempts to answer the question of whether the introduction of the possibility of using the IKP service offers an opportunity for older adults to overcome barriers related to access to medical care or a tool that causes their digital exclusion from the healthcare system. To this end, an attempt was made to answer the following questions:

- Are older adults open to new technologies?
- Do they think new technology will have a direct impact on their health?
- Do older adults use the IKP app?
- Are they willing to use e-prescriptions?
- Do they make an appointment for a test or with a specialist using e-referrals?
- Do they use information about scheduled appointments with doctors and specialists?
- Do they check the information about the drugs prescribed to them through IKP?
- Do older adults use the option of lab result preview in IKP?
- Did they use the access to information during the COVID-19 pandemic sent by IKP?
- For the purposes of this study, the following hypothesis was adopted:
- Online Patient Account is a barrier for older adults to access medical care.
- Online Patient Account leads to digital exclusion of older adults.

4. Results

The survey included 570 people, with 518 correctly filled questionnaires at a 91% return rate. The responses of 518 people who reported being older than 65 and using the Internet were analyzed. Respondents were men and women (with a preponderance of the former) in the age groups of 65 to 69 years (53%), 70 to 79 years (42%), and 80 years and over (5%). The survey was conducted among older adults living throughout the country taking into account demographic, social, and economic characteristics. In the study group, the most frequent characteristics were secondary and higher education, medium and large towns as the place of residence, married people, the income oscillating from PLN 2,000 to 4,999, and ended or current professional careers. Based on the survey, it can be concluded that there is a significant percentage of older adults in Poland who are characterized by openness to new technologies. Of older adults studied, 74% believe that new technologies are needed not only in the medical field but throughout the economy. They see them as an opportunity to grow the economy. This attitude is strongly related to age, place of residence, education, and material status. Analysis of the data shows that the respondents can be divided into two groups: those who are enthusiastic about new technologies (they account for 46% of the respondents) and those who have skeptical attitudes to these technologies, accounting for 54% of the respondents. The biggest supporters of new technologies are older people up to 75 years of age who are residents of large cities with higher education and satisfactory material status. In contrast, those with skeptical attitudes to new technologies are most often over 75 years old, have a high school education and lower income. This may be due to the fact that 76% of those aged 75+ have trouble using new technologies. In this case, the research shows, neither education nor place of residence plays a significant role, as the problem affects the entire population aged over 75 years.

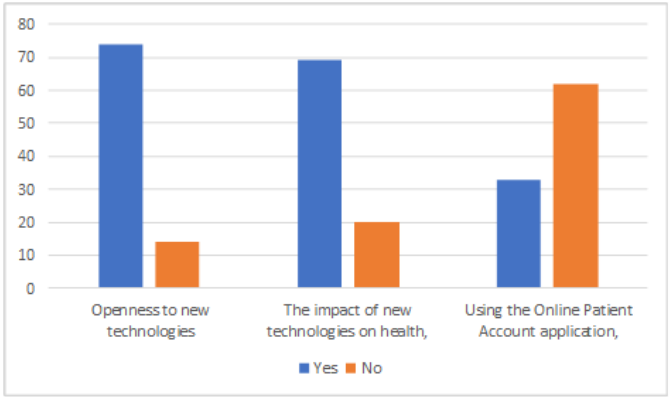
Table 1: Older Adults' Attitudes to new Technologies

Criteria	Definitely yes	Rather yes	Neither yes nor no	Rather not	Definitely not
Openness to new technologies?	38	36	12	8	6
The impact of new technologies on health	23	46	11	12	8
Using the IKP app	12	21	5	23	39

Source: Own elaboration

The survey also found that 69% of older adults agreed with the statement that new technologies will have a direct impact on their health and 20% hold the opposite view. The answer "Definitely not" or "Rather not" was marked by 20%. The statement about the impact of new technologies on health is met with the most opposition among men aged over 75 years with secondary vocational education and average incomes. According to the survey, the place of residence does not matter in this regard.

Of older adults surveyed, 86% had heard of the Online Patient Account, the most popular online medical service, but only 33% said they had used the IKP app.

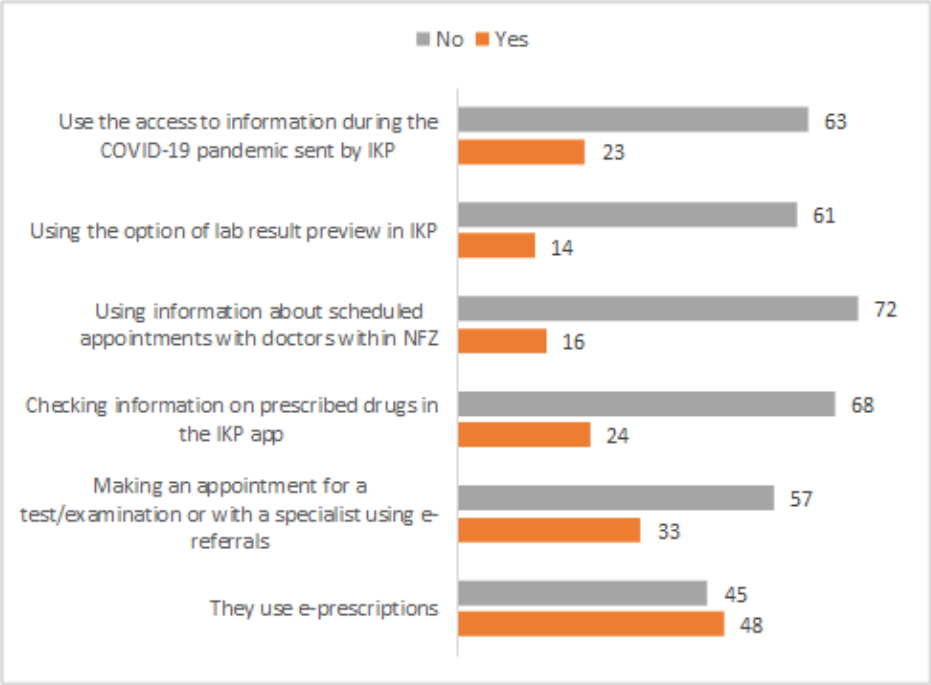


Source: Own elaboration.

Figure 1: Seniors Towards new Technologies

For most of them, the main reason for actively using the app on a daily basis is to use e-prescriptions (48%) and to make appointments for a test or see a specialist (33%). Almost all older adults surveyed (91%) had heard of e-prescription but almost half (45%) said they did not use it. Only 24% of respondents used the IKP app to get information about appointments and only 14% of them checked lab results through the app and 16% sought information about their prescribed medications. This is most likely due to their difficulties in accessing and navigating the Internet and lack of skills in using new technologies. Only 23% of the older adults surveyed had used information on disease incidence during the COVID-19 pandemic.

Interestingly, almost half of the respondents (44%) justified their decision not to use the IKP app by a lack of trust in the government app, 26% of respondents did not believe the government in the information provided about the pandemic and 8% of respondents did not believe the pandemic actually existed.



Source: Own elaboration

Figure 2: IKO Services Used by Older Adults

Taking into account the IKP app and the demographic and social characteristics of the respondents, their profile was created (Tab. 2). The results were processed using two-tailed tests, with a significance level set at 0.053. The tests are adjusted for all pairwise comparisons within each internal subtable using the Bonferroni correction (Krzych, 2007).

Table 2: Profile of Respondents by Demographic and Social Characteristics Using the IKP App; Percentage Of Highest Responses

Criteria	Use of e-prescriptions	Making an appointment for a test/examination or with a specialist using e-referrals	Using information about scheduled appointments with doctors	Checking drug information	Checking the results of laboratory tests	Access to information during the COVID-19 pandemic
Sex	Women 78%	Women 67%	Men 56%	Women 58%	Women 25%	Men 19%
Age	65-69 years, 55%	65-69 years, 81%	65-69 years, 29%	65-69 years 57%	70 years and more, 71%	70 years and more

Education	higher education, 78%	vocational education, 71%	secondary education, 57%	secondary education 68 %	higher education, 59%	secondary education, 66%
Place of residence (size)	501,000 residents and more, 43%	10,000-100,000 and 501,000 residents and more, 78% each	501,000 residents and more, 76%	10,000-100,000 and 501,000 residents and more, 77% each	501,000 residents and more, 39%	501,000 residents and more, 41%
Financial status	average and good, 15% each	average 38%	modest 68%	average and good, 15% each	good 36%	average and good, 15% each
Attitude towards chronological age	younger/ according to age 15% each	younger 54%	younger 61%	older 41%	younger 48%	younger 65%

Source: Own elaboration

It should be emphasized that high activity in terms of the use of e-prescriptions was found for women and those aged 65-69 years with higher education in the vast majority. Older adults who used e-prescriptions were those who had a good to moderate opinion of their financial status and felt younger or according to their age. Respondents from cities with more than 500,000 residents were statistically more likely to purchase prescription drugs than those from 100,001 to 500,000 residents.

Women were also more active in making appointments and examinations with specialists, checking information about drugs prescribed to them, and checking lab results. They most often represented an age group of 65 to 69 years, had secondary or higher education, and felt younger than they actually were. They rated their financial status as good or average. In contrast, men in the 65-69 age group were more active in checking information about scheduled appointments. Most had secondary education and lived in cities with over 500,000 residents. They described their financial status as modest but felt statistically younger than their chronological age. Men were also more active when seeking information on the COVID-19 pandemic. This group was characterized by age over 70, and like the above group, was distinguished by having secondary education and living in cities with over 500,000 residents. Information was sought by a higher percentage of those who felt younger than their chronological age than those who felt according to their age. Older adults used IKP services with varying frequency. The highest percentages were found in groups that used such services at least once a month (34%) and once every two/three months (27% each). The remaining 39% used them once every six months (23%) or less often (16%). These services were more often used at least once a month by women (47%), respondents aged 65 to 69 years (38%), and those assessing their household situation as modest (41%) and good (23%). People who felt younger, appropriate to age, and older than those who felt according to calendar age did so statistically more often (at least once a month). Women (39%) were more likely to use the IKP at least once a month than men (32%), those with secondary education (36%), those from cities with more than 500,001 residents (42%), those with modest (32%) and average financial status, and respondents who felt according to their calendar age (41%). Respondents who were very satisfied with the use of IKP were women (statistically significantly more often very satisfied than men), those aged 65 to 74 years (27%), respondents with secondary education (32%), those rating their financial status as modest (31%), those feeling younger than their calendar age (29%), statistically significantly more often than those feeling according to age.

5. Discussion

The results of the study supported the research hypotheses. Firstly, IPK is a barrier for older adults to access medical care. Secondly, IPK leads to digital exclusion of older adults. This is evidenced by the fact that only 33% of the older adults surveyed reported using IKP. Therefore, the results suggest a problem of digital exclusion of older adults, which may consequently exacerbate disparities in access to medical care. This is confirmed by research conducted by Statistics Poland (GUS), according to which, in Poland in 2020, only 11.8% of people aged from 65 to 74 years used the IKP service, while in the group of people over 75 years, the percentage was only 2.7%. Undoubtedly, the COVID-19 pandemic (Mirczak, 2020) contributed to the slight increase in the use of e-health services, including the IKP service. Among the data officially released by the National Health Fund (NFZ) and the Ministry of Health in Poland, there is no aggregate and comprehensive information to identify users of

the IKP service in terms of age. According to a website of the Ministry of Health and the National Health Fund, the smallest group using IKP is people aged over 75 years, who have activated more than 108,000 accounts. Despite the relatively low percentage of people 75+ (according to the website), it is in this group that the highest relative growth of activated accounts can be observed (during the first half of 2021, the number of activated accounts of people aged over 75 years was already twice as high as in the entire 2020). This does not change the fact that people of this age still have the lowest percentage of all users (https://www.cez.gov.pl/pl/page/o-nas/aktualnosci/juz-10-milionow-polakow-korzysta-z-internetowego-konta-pacjenta-w-serwisie).

The results of the survey also helped illustrate the specific situation of older adults and formulate important recommendations for their inclusion in the health care market. The use of IKP services by older adults can additionally be inferred from the results of a survey on Internet use in Poland: in 2021, the total number of Internet users was 28.2 million, of which 4.4 million were over the age of 55 years. The largest number of its users was found in the 16-24 age group (97%), followed by the 55-64 age group (76%), and the 65+ group (54%) (Statistics Poland, 2021). Furthermore, according to a 2020 study by the Centre for Public Opinion Research (Centrum Badania Opinii Społecznej, CBOS), in Poland, 22% of people over the age of 60 years did not use the Internet at all, and in the 70-79 age group, the percentage of non-users was as high as 49% (CBOS, 2020).

Older adults usually use the Internet for communication, browsing, reading news, and watching videos. Younger people, on the other hand, are more likely to use the Internet for entertainment, games, online shopping, and remote work and learning.

Older adults are much less likely to use e-health services such as mobile apps, telemedicine platforms, or electronic medical records. According to a 2020 CBOS survey, health-related mobile apps were used by only 12% in the 60-69 age group, whereas in the 70-79 age group, the percentage was only 2% (CBOS, 2020). In the case of e-health services, the most common motivation for using them is to obtain health information, check medical recommendations, lab results, and general recommendations to improve health-related quality of life (Martin-Hammond et al., 2019, 1983-1993; Bolle et al., 2016, 710-720). Older adults use these services to check their health, prevent chronic diseases, better understand test results, and get information on how to take care of their health. For younger people, mobile apps and platforms that allow them to contact a doctor online are also popular, especially in cases of unusual symptoms or situations where it is impossible to see a specialist (Kim et al., 2017, 159-166).

Furthermore, a study by Dudkowski-Sadowska demonstrated that the survey of attitudes toward the introduction of electronic health records (EHR) outlined a profile of a potential e-health user alongside a profile of a person who has no knowledge of such services. This group included mainly older adults, retired persons, those who did not use the Internet for health purposes, those who did not have a cell phone and those who poorly evaluated their health, being a significant part of Poland's population of older adults (Dudkowski-Sadowska, 2022).

However, it should be noted that the above comparisons are general trends rather than a general rule. Use of the Internet and health e-services can vary depending on many factors, such as education, region of residence and severity of chronic diseases.

Therefore, digital exclusion of older adults leads to an increase in social inequality, reduced access to information, and online services, making it difficult for them to take full advantage of social, health, and educational resources, and negatively affecting the health and independence of this population. Therefore, it is important to take steps to close the digital divide and enable all social groups to use digital technologies.

Several measures should be taken to counter digital exclusion of older adults, such as:

- Training programs - organization of courses or workshops to help older adults learn how to use computers, Internet, and mobile applications.
- Interface customization: creating interfaces that are more intuitive and understandable to older adults and provide higher contrast, larger fonts, and other features to help them better perceive information.
- Popularizing e-services: educating older adults about the benefits of using e-services, such as e-prescriptions, e-visits, e-rehabilitation, e-referrals, etc.
- Technical support: organizing help desks for older adults to help solve problems related to the operation of digital devices.

- Involving older adults in digital transformation processes, enabling them to participate in IT and research projects that will help them engage and understand the benefits of digitization.
- Availability of equipment: providing access to computer and Internet equipment to older adults who do not have it at home, e.g. by organizing access in public places such as libraries, community centers, etc.
- Collaboration between the public and private sectors: implementation of programs that bring together the public and private sectors, and NGOs, to effectively combat the digital exclusion of older adults (World Health Organization, 2019; Kuerbis & Mulligan, 2018,).). .

These measures are aimed at increasing access to technology and knowledge, which in turn will help increase digital activity among older adults and reduce digital exclusion.

In conclusion, based on the research results of this study,the IKP service can be an effective tool for engaging older adults in caring for their health, but IKP providers need to be aware of the potential barriers causing digital exclusion of people in this age group to take steps to counteract them. Since the population of people aged 65 years and over is is steadily growing, more attention should be paid to it in terms of access to modern technologies. However, it is important not to stigmatize older adults. Initiatives aimed at improving digital competencies should be tailored to the changing needs of older adults so as to improve their quality of life and ensure better functioning in their environment. The study found that the IKP service, despite its potential to redress inequalities in health care for older adults, is still in the development stage.

6. Conclusion

Since the problem of e-health and IKP is a relatively new phenomenon, the results of the study focused on one country. Another research topic could be a broader analysis in an international collaboration, aiming to learn more about the specifics of older adults' use of digital health services in the context of the specific socioeconomic conditions of the region.

The research conducted shows that the IKP service, despite its potential to address inequalities in healthcare for older adults, is still in the development stage. Compared to younger groups, access to new technologies and digital competencies are still limited for Polish older adults and are a barrier for them to use digital health services. The study demonstrated the need for corrective measures in terms of knowledge sharing to maintain the independence of older adults and counter digital exclusion.

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Examining the Impact of Intra-Group or Inter-Group Social Capital on Innovative Climate in Enterprises of the Innovation Sector

Felicjan Bylok
Czestochowa University of Technology, Poland

felicjan.bylok@pcz.pl

Abstract. One of the significant factors that have an impact on the level of innovativeness is that of the intra-group social capital and inter-group social capital. Both of these types of social capital support the innovative climate and may constitute a key attribute in creating new knowledge and innovation, which in turn increases the opportunities of enterprises in terms of market competition. The acceptance of the assumption that social capital has an impact on the creation of the innovative climate in enterprises facilitated the formulation of the research aim, which was to search for answers to the following three research questions: What is the scope of occurrence of the intra-group and inter-group of social capital in enterprises in the innovative sector in Poland? To what extent does the intra-group and inter-group of social capital have an impact on the processes that are favourable to creating knowledge and innovation in enterprises? To what extent does the intra-group and inter-group of social capital have an impact on the creating the innovative climate in enterprises? The assumed goal was executed thanks to the application of the survey method. Empirical research, together with the use of a standardized questionnaire was conducted by means of the CATI technique in 2022. A total of 575 department heads and employees of the innovative sector participated in the research. As a result of the research, significant statistical relations were discovered between the intra-group and inter-group of social capital and the indicators of the innovative climate. Likewise, the positive impact of their attributes on the intra-organizational processes was illustrated, which are favourable towards the creation of knowledge and innovation.

Keywords: Intra-group social capital, Inter-group social capital, Knowledge, Innovativeness, Innovative climate

1. Introduction

Business entities seek opportunities to increase competitive potential in the market and are increasingly paying attention to the need for developing interpersonal cooperation skills within employee groups and organizations to increase innovativeness. Corporate innovation can significantly support social capital, which, with values and qualities such as social interaction, mutual trust, understanding, and shared vision and norms, allows the organization and its members to successfully pursue their goals(Leana and Frits 2006). Social capital, forming the foundation of interaction and cooperation, becomes essential in innovation efforts because it supports the flow of knowledge and information. Occurring in the form of intra-group and inter-group capital, it supports the creation of innovation in the organization if there is a specific organizational culture based on innovative climate, which promotes openness, freedom of action, implementation of new ideas, tolerance of risk, or openness to change necessary for the development of innovative behavior among employees. Assuming that intra-group and inter-group social capital affects the innovative climate, three research questions were formulated: What is the incidence of the intra-group and inter-group social capital in enterprises in the innovative sector in Poland? To what extent does the intra-group and inter-group social capital have an impact on the processes that are favorable to creating knowledge and innovation in enterprises? To what extent does the intra-group and inter-group social capital have an impact on creating an innovative climate in enterprises?

2. Theoretical Background

Innovation is considered imperative for an organization's success. It is defined as intentional changes and improvements to services and/or processes to achieve an expected specific outcome (Koch and Hauknes 2005). Previous authors have emphasized that it is "invention and use" involving the implementation of a new or significantly improved product, process, or service, and the commercialization of the innovation (Dziallas and Blind 2019). Related to the concept of innovation is the term innovativeness, understood as the process, results, and products of attempts to develop and introduce new and improved ways of doing things (Anderson et al. 2014). Innovativeness can be managed by building an innovative organization (e.g., a structure and climate that encourages people to be innovative) and creating networks for innovation (e.g., internal and external cooperation). (Tidd and Bessant 2014). Innovativeness is supported by an organizational culture that shapes the mindset regarding the internalization of innovation by individual members of the organization where innovation is instilled and ingrained (Kahn 2018). There is a strong relationship between organizational culture and the level of innovation (Lau and Ngo 2004). One manifestation of organizational culture is organizational climate, that is, the formally and informally shared perceptions of organizational policies, practices, and procedures (Holloway 2012). Organizational climate is seen as “an attribute of the organization, a conglomerate of attitudes, feelings,

and behaviors which characterizes life in the organization" (Ekvall 1996, 105). In general, the organizational climate is conducive to innovation at the organizational level (Jung et.al. 2008, Bylok et al. 2019). It affects the communication, coordination, supervision, motivation, and involvement of employees. (Ekvall 1996). It is of key importance for organizations to use innovation to create a competitive advantage and improve performance (Kissi et al. 2012).

The organizational climate that stimulates employee innovation behavior can be termed the organizational innovative climate. According to Isaksen and Ekvall (2010), this climate encourages creativity and change among employees and allows employees to share and build on their ideas and suggestions. The innovative climate can be described as a combination of employees' perceptions of the organizational environment that supports risk-taking behavior, allocates sufficient resources, and promotes a competitive environment conducive to innovation at work (Malibari and Bajaba 2022). The innovative climate fosters creativity, innovative behavior among employees, and efforts to discover and apply new ideas throughout the enterprise (Park and Jo 2018). Shanker et al. (2017) found that innovative behavior at work plays a mediating role in the relationship between organizational innovative climate and organizational performance.

A factor that fosters the development of an innovative climate is organizational social capital. An analysis of numerous studies on organizational social capital indicates that authors have focused on its social functions, such as trust, norms and networks (Burt 2000), social relationships (Leana and van Buren 1999), and organizational resources (Inkpen and Tsang 2005), among others. Some define organizational social capital as corporate social capital, that is, "a set of physical or virtual resources available to a corporate actor through social relationships with other actors, facilitating pursuing his or her goals". (Gabbay and Leenders 2001, 10). In general, it encompasses the form and nature of the social relationships that link the employees of a given enterprise, which influence the formation of a climate of cooperation and enable employees and the enterprise to achieve common goals.

Social capital plays an important role during innovation activities. Most studies have demonstrated a positive relationship between social capital and innovativeness. High social interaction and close relationships have a positive impact on innovation activities (Ozgun et al. 2022). The social capital of an organization's members can effectively facilitate knowledge transfer within the organization and enhance innovation performance. The results of numerous studies have shown that knowledge transfer (viewed as the mobilization, assimilation, and utilization of knowledge resources) mediates between the intra-organizational social capital of organizational members and organizational performance outcomes in terms of growth and innovation (Maurer et al. 2011). For entities in innovative sectors such as IT, social capital remains significantly and positively related to innovation performance. Digital companies with high social capital are more effective at creating innovation outcomes than those with low levels of social capital (Lyu et al. 2022).

To understand the links between organizational social capital and innovative climate, the concept of group social capital was introduced, which allows for a deeper exploration of how social relationships of employee group members within and outside the organization are related to an organizational culture based on innovative climate. Oh at al. (2006, 70) define group social capital "as the set of resources made available to a group through group members' social relationships within the social structure of the group itself, as well as in the broader formal and informal structure of the organization". Due to both internal and external dimensions of labor relations in an employee group, intra-group and inter-group social capital should be emphasized. This division is based on the concept by R.D. Putman (2000), who proposed the division of social capital according to the prevailing types of relationships into inclusive (bonding) social capital and exclusive (connecting) social capital.

In an enterprise, intra-group social capital is based largely on the personal ties that bind members of an employee team together. This helps develop cooperation, and identification with group goals, whereas loyalty to the group improves communication within the team (Łopaciuk-Gonczaryk 2008). The strong group bonds reduce the likelihood of opportunism, decrease transaction costs, and provide employees with mutual emotional support, especially important for employee effectiveness in times of crisis (Oh et al. 2004) Social capital enables team members to take collective action with consistent goals through trust and widespread recognition (Wang et al. 2021, Bylok and Kuceba 2021). Inter-group social capital, on the other hand, is based on the subject ties that are the basis for the social networks built across work teams. They ensure a flow of information and knowledge, which promotes greater efficiency. Oh, Chung & Labianca (2004) showed that external contacts of team members with leaders from other teams have a positive effect on the performance in the groups studied. Another benefit is access to group resources, engagement in joint management, facilitated collaboration, and achieving group goals (Fischer et al. 2014).

3. Methods

In Poland, research on the role of social capital in the functioning of organizational culture based on the innovative climate in enterprises is relatively rare. This study attempts to fill this research gap by conducting an analysis of the impact of intra-group and inter-group social capital on the innovative climate. The aim of the study was to analyze the degree of intra-group and inter-group social capital in enterprises of the innovation sector in Poland, the differences in the degree of social capital resources, and the extent to which they influence the innovative climate. The research tool was a standardized survey questionnaire. A computer-assisted telephone interview (CATI) was used to survey employees of enterprises in the innovation sector. Spearman's rank correlation coefficient was used to analyze the research questions. This nationwide survey was conducted in Poland. The survey frame was entities employing more than 50 people. Based on a random sampling method, a survey sample of 575 employees working in enterprises of innovative industries, i.e. pharmaceuticals (25.2%), energy (23.3%), automotive (26.4%), and IT (25.1%) was collected. The employees surveyed were white-collar (97.2%) and blue-collar (2.8%) workers with job seniority ranging from 4-8 years (10.3%), 9-13 years (23.8%), 14-18 years (33.7), and 19 or more years (32.2%). Random sampling yielded a representative sample with an error of α=4% and a confidence interval of 95%.

4. Results

A factor influencing the growth of employee innovativeness is developed intra-group social capital, known as integration capital. This type of social capital promotes group solidarity and knowledge sharing (Adler and Kwon 2002). Table 1 shows the results of the incidence of intra-group social capital in enterprises. The level of incidence of intra-group capital in enterprises of the innovation sector is high ($\bar{x}$=4.10). Analysis of indices of intra-group capital showed that its strongest attribute is a good team atmosphere (team spirit), followed by a high frequency of relations between members of the employee group and a strong influence of social norms. The weakest attribute was the frequency of employee-manager relationships.

Table 1: Indices of Intra-Group Capital

Specification	Mean $\bar{x}$	Standard deviation SD
(INTC1) Relationships between team members are frequent	4.15	0.733
(INTC2) Employee-supervisor relationships are frequent	4.01	0.764
(INTC3) Social norms (reciprocity, loyalty) in the team are strong	4.12	0.856
(INTC4) The atmosphere in the team (team spirit) is good	4.20	0.858
(INTC5) Employees identify with the team	4.03	0.908
Total capital ratio	**4.10**	**0.829**

Rating scale: 5- to a very high degree, 4 - to a high degree, 3- to a medium degree, 2 - to a low degree, 1- to a very low degree

Source: Author's own elaboration

Inter-group social capital, which supports the creation of organizational knowledge and its flow between work teams, plays an important role in the creation of innovation in the enterprise. The survey of innovation sector employees found that the level of incidence of inter-group social capital was lower compared to intra-group social capital. Furthermore, the following attributes were rated highest: high frequency and a high number of relationships with employees of other teams. The diversity of these relationships at the professional and social levels was rated relatively lower.

Table 2: Indices of Inter-Group Capital

Specification	Arithmetic mean $\bar{x}$	Standard deviation SD
(INRC1) Number of relationships with employees of other work teams is high	3.98	0.891

Specification	Arithmetic mean $\bar{x}$	Standard deviation SD
(INRC2) Relationships with employees of other teams are diverse (professional, social)	3.94	0.917
(INRC3) Employees have easy access to higher positions in the enterprise	3.96	0.915
(INRC4) Relationships with employees of other teams are frequent	4.04	0.983
Total capital ratio	3.98	**0.927**

Rating scale: 1- I strongly disagree, 2 - I disagree, 3 - I neither agree nor disagree, 4 - I agree, 5 - I strongly agree.

Source: Author's own elaboration

Social capital influences a variety of intra-group and inter-group processes that foster innovation. Among intra-group processes, respondents rated knowledge sharing ($\bar{x}$ =4.08, SD=0.883 on a scale of 1- very low, 2- low, 3- medium, 4 - high, 5- very high), employee satisfaction ($\bar{x}$=4.05, SD= 0.808), competition between team members ($\bar{x}$=4.03, SD=1.002), and reducing team opportunism ($\bar{x}$=4.00, SD=0.625). On the other hand, the lowest ratings were found for mutual assistance within the team ($\bar{x}$=3.89, SD=0.829), communication within the team ($\bar{x}$=3.93, SD=0.776), speed of performance of tasks requiring team collaboration ($\bar{x}$=3,97, SD=0.886), quality of performance of tasks requiring team collaboration ($\bar{x}$=3.99, SD=0.839), and increase of innovativeness in the team ($\bar{x}$=3.98, SD=0.900).

Among inter-group processes, the highest ratings were given to collaboration between work teams, departments in the enterprise ($\bar{x}$=3.21, SD=0.846), information flow between work teams and departments ($\bar{x}$=3.19, SD=0.852), and quality of task performance in collaboration with employees of other teams and departments ($\bar{x}$=3.15, SD=0.807). Relatively lower ratings were given to the creation of innovations in collaboration with other teams ($\bar{x}$=2.95, SD=0.824), the speed of performing tasks that require collaboration with employees of other teams and departments ($\bar{x}$=2.99, SD=0.824), and the flow and creation of knowledge through collaboration between employees of different teams ($\bar{x}$=3.01, SD=0.847).

In conclusion, inter-group processes are rated lower compared to intra-group processes. This indicates that there are significant organizational barriers to the creation of innovation because collaboration between teams and the flow of knowledge between them promotes the development of new solutions and the improvement of existing ones.

From the perspective of developing employee innovation, it is important to examine the relationships between organizational social capital and group processes. Spearman's rank correlation coefficient analysis was used to diagnose the relationship between intra-group social capital and organizational processes that foster innovation. For group processes, the strongest correlation was between the index of identification with the team and the quality of performance of tasks requiring team collaboration (r_s= 0.346, p=0.000), reducing team opportunism (r_s= 0.294, p=0.000), sharing knowledge with other employees (r_s= 0.189, p=0.013), competition between team members (r_s= 0.183, p=0.015), and communication within the team (r_s= 0.177, p=0.026). For the index of the strength of social norms (reciprocity, loyalty) in the team, the strongest correlation occurred for reducing team opportunism (r_s= 0.343, p=0.000), speed of performance of tasks requiring team collaboration (r_s= 0.298, p=0.000), quality of performance of tasks requiring team collaboration (r_s= 0.297, p=0.000), sharing knowledge with other employees (r_s= 0.187, p=0.016), and level of employee satisfaction (r_s= 0.182, p=0.019). Furthermore, the index of good team atmosphere (team spirit) was correlated with the reduction of team opportunism (r_s= 0.324, p=0.000), communication within the team (r_s= 0.292, p=0.000), and level of employee satisfaction (r_s= 0.173, p=0.023).

The index of frequent employee-supervisor relationships was positively correlated with the speed of performance of tasks requiring team collaboration (r_s= 0.327, p=0.000) and with reducing team opportunism (r_s= 0.187, p=0.016). The index of frequent team member relationships was positively correlated with knowledge sharing with other workmates (r_s= 0.312, p=0.000) and the quality of performance of tasks requiring team collaboration (r_s= 0.183, p=0.015).

In conclusion, intra-group social capital significantly influences group processes, especially, the quality of tasks that require team collaboration, sharing knowledge with other employees, and reducing team opportunism. Consequently, one of the important tasks of managers is to build this type of capital and provide favorable conditions for its development, thus increasing the effectiveness of the goals pursued.

In addition to identifying the relationships between intra-group social capital and group processes, one of the goals of the study was to evaluate the extent to which inter-group social capital influences the organizational processes that foster innovation. A feature of inter-group capital is its positive impact on processes occurring within employee groups. Tsai & Ghoshal (1998) studied a multinational electronic collaboration and showed the positive impact of social interactions among the corporation's departments on the exchange of resources among the departments and the number of innovations. The present study also examined the relationships between inter-group capital and processes in an organization and identified significant relationships. The strongest effect was observed for the frequency of relationships with employees of other teams, particularly on the increased innovation in the team (r_s= 0.302, p=0.000), competition between team members (r_s= 0.338, p=0.000), the quality of performance of tasks requiring team collaboration (r_s= 0.296, p=0.000), knowledge sharing with other employees (r_s= 0.294, p=0.000), reducing team opportunism (r_s= 0.186, p=0.015), and employee satisfaction (r_s= 0.144, p=0.019).

Another index of inter-group capital, i.e. diversity of relationships with employees of other teams, significantly influences the reduction of team opportunism (r_s= 0.340, p=0.000), communication within the team (r_s= 0.314, p=0.000), quality of performance of tasks requiring team collaboration (r_s= 0.314, p=0.000), competition between team members (r_s= 0.294, p=0.000), level of employee satisfaction (r_s= 0.189, p=0.011), and increased innovation in the team (r_s= 0.167, p=0.025).

The number of relationships with employees from other work teams is high and positively correlated with competition between team members (r_s= 0.304, p=0.000) and knowledge sharing with other employees (r_s= 0.296, p=0.000). The index of employees having easy access to higher positions in the enterprise affected only the reduction of team opportunism (r_s= 0.307, p=0.000).

In conclusion, the demonstrated positive impact of inter-group social capital is an indicator for building and developing this capital in enterprises. In particular, it has a positive effect on increasing competition between team members, reducing team opportunism, fostering knowledge sharing among employees, and improving innovativeness in the team.

In an innovation-oriented enterprise, a factor that fosters innovation is an innovative climate that supports, among other things, openness to novelty, new ideas, and knowledge creation and sharing. To determine its level, a scale of 18 statements construed on a modified scale by Krot and Lewicka (2016) was used. Analysis of Table 3 shows that the generalized level of innovative climate in enterprises of the innovation sector is above average ($\bar{x}$=4.03). A detailed analysis indicates that the innovative climate is evidenced by the belief that innovation is a key value in the enterprise. Innovation has a much better chance of success with the ability to turn ideas into profitable ventures and quick utilization of suggestions from customers or competitors to improve products and harness the creativity of employees to make a profit.

The innovative climate is improved by the right conditions created by enterprises to undertake innovative activities. The most important of these is the creation of free access to information and knowledge and optimal conditions for collaboration between departments/divisions.

Taking innovative initiatives depends on creative attitudes among employees. They are influenced by the expectation of employees to improve their skills, and increase their knowledge, which helps support innovative ventures, managers' expectation of employee initiative, and the increase in recognition within the enterprise with the creation of a new solution. It is also important to convince employees that innovation processes pose a high risk and therefore errors may occur. Innovation is much more likely to succeed if employees can express unusual and unique solutions in their everyday work.

Another important component of the innovative climate is managerial support, which manifests itself in the help of managers in breaking down barriers in the process of implementing innovation, and the support of employees who want to seek innovative solutions. It is important that the manager has a high degree of autonomy to accelerate, slow down, or completely abandon the innovative project.

Table 3: Assessment of Innovative Climate in Enterprises

Specification	Mean $\bar{x}$	Standard deviation SD
(IC1) Innovation is a key value in the enterprise	4.04	0.842
(IC2) Ability to turn ideas into profitable ventures	3.99	0.801
(IC3) The belief that innovation processes pose a high risk and therefore errors may occur	4.01	0.921
(IC4) Quickly using customer or competitor suggestions to improve products	4.06	0.877
(IC5) The project manager has a high degree of autonomy to accelerate, slow down, or completely abandon the innovation project	4.01	0.859
(IC6) Creating free access to information and knowledge	4.09	0.853
(IC7) Creating optimal conditions for cooperation between departments/divisions	4.05	0.782
(IC8) Expectations of employees to improve their skills and increase their knowledge, which may support innovative ventures	4.07	0.823
(IC9) Innovation is much more likely to succeed if employees can express unusual and unique solutions in their everyday work.	3.96	0.894
(IC10) Using employees' creativity for profit, which means using it well	3.90	0.879
(IC11) Success in the area of innovation sometimes causes envy in other employees	3.88	0.951
(IC12) Mutual help of employees in solving problems within one department or several departments	4.17	0.844
(IC13) Expecting employees to be creative, think, and act in innovative and original ways	4.18	0.793
(IC14) With the creation of a new solution, there is an increase in recognition within the enterprise	3.94	0.816
(IC15) Employees are too busy solving everyday problems to spend time thinking about the future	3.81	0.991
(IC16) Expecting employee initiative from managers	3.91	0.831
(IC17) Manager's assistance in breaking down barriers in the innovation process	4.10	0.811
(IC18) Encouraging junior managers to take a risk and seize opportunities to develop the company by senior managers	4.11	0.871
Generalized level of innovative climate	4.03	0.871

Rating scale: 1- I totally disagree, 2 - I mostly disagree, 3 - I partially disagree 4 - I neither agree nor disagree, 5- I partially agree 6 - I mostly agree, 7 - I totally agree.

Source: Author's own elaboration

One of the aims of the paper was to determine the impact of social capital on the innovative climate. The analysis of the research shows that the effect size of individual attributes of intra-group and inter-group social capital on innovative climate indices varied. For intra-group social capital, the attributes that influenced the largest number of innovative climate indices (8 indices) were: employee-supervisor relationships are frequent and employees identify with the team. On the other hand, in the case of inter-group capital such attributes were: relationships with employees of other teams are diverse (professional, social) (8 indices) and employees have easy access to higher positions in the enterprise (7 indices).

Table 4: Spearman's Correlation Coefficient Between Inter-Group Capital (INRC) and Intra-Group Capital (INAC) Attributes and Innovative Culture Indices

	INTC1	INTC2	INTC3	INTC4	INTC5	INRC1	INRC2	INRC3	INRC4
IC1		0.290 p=0.000							0,230 p=0,002
IC2		0.292 p=0.000	0.299 p=0.000	0.302 p=0.000					
IC3				0.325 p=0.000	0.297 p=0.000				
IC4						0.312 p=0.000	0.346 p=0.000		
IC5						0,193 p=0,010	0.302 p=0.000		
IC6	0.295 p=0.000	0.184 p=0.013			0.189 p=0.011	0.319 p=0.000	0.311 p=0.000	0.316 p=0.000	
IC7	0,157 p=0,036	0.295 p=0.000							
IC8		0.334 p=0.000					0.185 p=0.015		
IC9		0.332 p=0.000	0.294 p=0.000	0.295 p=0.000	0.292 p=0.000			0.310 p=0.000	0.311 p=0.000
IC10	0.306 p=0.000	0.338 p=0.000		0.293 p=0.000	0.290 p=0.000	0.182 p=0.017		0.314 p=0.000	0.319 p=0.000
IC11	0.185 p=0.0403	0.323 p=0.000				0.313 p=0.000	0.188 p=0.0339		
IC12			0.294 p=0.000						0,221 p=0,003
IC13	0.291 p=0.000		0.336 p=0.000		0.0283 p=0.000			0.255 p=0.001	0,173 p=0,021
IC14					0.310 p=0.000				
IC15							0.147 P=0.000	0.389 p=0.000	
IC16				0,171 p=0,022				0.299 p=0.000	
IC17	0,198 p=0,008						0.282 p=0.000		
IC18			0.336 p=0.000	0.302 p=0.00	0.185 p=0.0393	0.343 p=0.000	0.389 p=0.000	0.316 p=0.000	

Source: Self-analysis

5. Discussion and Conclusion

Social capital is an important factor in strengthening innovativeness in enterprises as it enables the effective use of the potential of employees and managers to create knowledge and develop innovations. The results of the present study on the incidence of intra-group and inter-group social capital in enterprises of the innovation sector indicate their above-average level, with the highest value found for intra-group capital, particularly for attributes such as atmosphere in the team (team spirit), frequency of relationships between team members, and the strength of social norms (reciprocity, loyalty). It creates a favorable environment for employees to take innovative actions.

Organizational processes related to innovation are important in the enterprise. The research shows that in enterprises of the innovation sector, the main emphasis is on sharing knowledge with other employees, competition between team members, reducing team opportunism, and the quality of performance of tasks requiring team collaboration, a collaboration between work teams and departments in the enterprise, and the quality of performance of tasks requiring collaboration with employees of other teams and departments. There is limited flow and creation of knowledge through collaboration between employees of different teams, which is a barrier to creating innovation.

Analysis of the relationships between intra-group and inter-group social capital attributes and organizational processes related to innovation creation reveals that it is important to point out the differences between the two. The former significantly affects group processes, particularly the quality of tasks requiring team collaboration, sharing knowledge with other employees, and reducing team opportunism, while the latter increases competition between team members, reduces team opportunism, fosters knowledge sharing among employees, and improves team innovation.

One of the essential factors affecting the level of innovation in enterprises is the organizational culture based on the innovative climate. The generalized index of innovative climate in the enterprises surveyed is at an above-average level and can be considered an important factor that creates a good basis for the development of innovativeness in enterprises of the innovation sector. The highest ratings were given to the importance of expecting employees to be creative, think, and act in innovative and original ways, employees helping each other solve problems within one department or several departments, and free access to information and knowledge.

Analysis of Spearman's correlation coefficients between intra-group or inter-group social capital attributes and innovative climate indices revealed that intra-group capital has the strongest effect. Its attributes were shown to have the strongest effect on making good use of employees' creativity for making a profit, creating free access to information and knowledge, allowing employees to create unusual and unique solutions in their daily work, and encouraging junior managers to take risks and opportunities for the enterprise's growth. The study showed that social capital to a large extent supports the creation of innovation in enterprises of the innovation sector.

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Futurizing the Intellectual Capital Theory

Sladjana Cabrilo[1] and Aino Kianto[2]
[1]I-Shou University, Kaohsiung, Taiwan
[2]LUT University, Lahti, Finland

sladjanacabrilo@gmail.com
aino.kianto@lut.fi

Abstract: Intellectual capital theory (IC) theory, which asserts that organisational value is for the most part created with intangible, knowledge-based resources, has become a prevalent way to approach the notion of business viability. Most IC research leans on the classical tripod of IC components, laid down by the first-generation researchers in the field. This tripod divides the value-generating knowledge assets into human capital, structural capital and relational capital; or, more simply put the value vested in an organisation's personnel, internal structures and processes, and relationships. Even though this conceptualization has been challenged by some, it still remains the cornerstone of the IC-based view of the firm, and it is astutely followed by most researchers in this field. However, various large-scale technological, socio-political, and institutional changes have fundamentally changed the business environment and worklife in recent years. In this paper we argue that these changes call for a critical examination of the relevance of the classical conceptualizations of IC. It may be necessary to update the understanding concerning not only the most essential knowledge resources, but also the structure of IC and the way in which IC is related with new relevant organisational capabilities and aspects of organisational performance. The aim of this theoretical paper is to provide an overview of some of the most essential recent worklife trends that are likely to impact how IC should be understood: digitalization, remote work, gig work, open innovation, crowdsourcing, strive towards sustainability and resilience. Based on these, the paper puts forth a set of propositions concerning the needed novel perspectives for IC. In addition to constructing a novel theoretical framework and propositions for IC research, the paper functions as an introduction to the mini track on Futurizing the Intellectual Capital Theory and provides a common framework on which mini track participants can base their dialogue.

Keywords: Intellectual capital, Digitalization, Remote work, Sustainability, Resilience, Theory

1. Introduction

Intellectual capital theory (IC) theory, which asserts that organisational value is for the most part created with intangible, knowledge-based resources, has become a prevalent way to approach the notion of business viability. Most IC research leans on the classical tripod of IC components, laid down by the first-generation researchers in the field (e.g. Edvinsson and Malone, 1997; Stewart, 1997; Sveiby, 1997; Roos et al, 1997; Bontis, 2002). This tripod divides the value-generating knowledge assets into human capital, structural capital and relational capital; or, more simply put the value vested in an organisation's personnel, internal structures and processes, and relationships. Even though this conceptualization has been challenged by some (e.g. Inkinen et al, 2017; Cabrilo and Dahms, 2020) it still remains the cornerstone of the IC-based view of the firm, and it is astutely followed by most researchers in this field.

However, various large-scale technological, socio-political, and institutional changes have fundamentally changed the business environment and worklife in recent years (Hitt et al., 2021). In this paper we argue that these changes call for a critical examination of the relevance of the classical conceptualizations of IC. It may be necessary to update the understanding concerning not only the most essential knowledge resources, but also the structure of IC and the way in which IC is related with new relevant organisational capabilities and aspects of organisational performance.

To provide impetus and structure to new ideas and dialogue concerning the way in which the IC theory should and could be developed to better match current realities, this paper examines a set of recent worklife trends that are likely to impact how IC should be understood: digitalization, remote work, gig work, open innovation, crowdsourcing, strive towards sustainability and resilience. Based on these, the paper puts forth a set of propositions concerning the needed novel perspectives for IC and presents a tentative framework for a futurized understanding of IC.

2. Recent Worklife Trends and Changes and Intellectual Capital

Work life is facing many large-scale changes due to ecological, political and economic uncertainties. To remain competitive in the face of digitalization, diversifying work arrangements, and the manner in which innovations are brought about, organisations need new resources and capabilities (Colbert et al., 2016; Habraken and Bondarouk, 2017). In the following, we discuss trends that are likely to have an impact on IC: digitalization,

remote work, gig work, open innovation (OI), and crowdsourcing—and strive toward sustainability through ethical leadership, green IC, and organisational resilience.

2.1 Digitalization

In Industry 4.0, also referred to as Smart Industries, digital technologies have increasingly changed the organisation and nature of work (Colbert et al., 2016; Habraken and Bondarouk, 2017). Technological developments create greater work flexibility and mobility, which can benefit both workers and organisations (Ludivine, 2017). However, at the same time these present challenges, as new technologies are dramatically changing employment and work features across many fields of work (Cooper and Lu, 2019; Felstead and Henseke, 2017). Digital technology enables smaller and more isolated work units, such as virtual teams (Donnelly and Johns, 2021). In a digitized world where work is crowdsourced to freelancers via online platforms, and collaboration occurs across geographical, functional, and hierarchical boarders (Lepofsky, 2016), many aspects of IC should be updated. Increasing technologically mediated interaction, robotization and automation require workers to build digital competences and adopt new skill sets needed to work in new jobs created (Habraken and Bondarouk, 2017). Accordingly, a crucial new feature of human capital is that of digital competence. Digital competence encompasses the knowledge, abilities, skills, and attitudes we need for working in the digital age (Murawski and Bick, 2017). It is important for organisations in the digital era not only to cope with disruptive technologies and innovation, but to adapt their business philosophy and business models including mindset (organisational and individual), culture, and competences to digital way of working (Murakowski and Bick, 2017). Creating an open culture that embraces independent and on-demand workers allows organisations to benefit from their ideas and engage them in innovation and value creation (Smith, 2020). Digital organisational culture has been found to support digital capabilities and innovation performance (Zhen et al., 2021). This leads to the first proposition:

Proposition 1: In digitalized worklife, digital skills and an open digital culture are important aspects of IC.

2.2 Remote Work

The term *'remote' work*, sometimes also referred to as telework, locationally distributed work, or virtual work, can be defined as any work that is detached from traditional fixed places of work (Felstead and Henseke, 2017). Remote working is not a product of Covid-19 pandemic, but it has gained its momentum and proved its significance as a result of the Covid-19 crisis' catalytic effect (Liu et al., 2021), becoming a necessity for organisations across the globe (Donnelly and Johns, 2021). Self-leadership (Manz, 1986; Manz and Sims, 1987) is a process through which people influence themselves to achieve the self-direction and self-motivation necessary to behave and perform in desirable ways. Self-leadership theory posits that even though external contexts and activities influence behavior, actions are ultimately controlled internally by the individual, and focus on how people manage and lead themselves (Stewart et al., 2011). It includes self-imposed strategies for managing performance of tasks of low intrinsic motivational potential, and self-influence that capitalizes on the "natural"/intrinsic motivational value of task activity (Manz, 1986). While self-leadership probably is an important skill in many types of jobs, we argue that in remote work arrangements, its role is especially prevalent. Thus, we propose:

Proposition 2: Self leadership is an important aspect of IC in remote work contexts.

2.3 Gig Work

In today's digital economy, the traditional full-time employed labor force seems to be decreasing, and a growing number of workers, especially high-skilled professionals, prefer to work as autonomous and independent self-employed, freelance contractors (Vaiman et al., 2011). *Gig work* is made up of short-term jobs (gigs) and presents a type of contingent work that typically falls outside the boundaries of the organisation. In this new economic system workers are not engaged in 'jobs' and have no long-term connections with a company but are hired on demand for 'gigs' under very flexible arrangements as independent contractors, working only for a defined time to complete a particular task and after completion they have no more connection with their 'employer' (Friedman, 2014). As gig workers have no traditional employment relationships with organisations, they have typically been left out of IC accounts. However, an increasing amount of the human intellect working for a firm may come from outside of the realm of its fully employed human resources (McDonnell et al., 2021; Williams et al., 2021). Therefore, we argue that no matter their formal employment status, workers that create value for a company should be counted as its human capital. We propose:

Proposition 3: Gig workers should be acknowledged IC providers.

2.4 Open Innovation

Open innovation (OI), as introduced by Chesbrough (2003), is an innovation practice that strives to provide much richer knowledge flows and make innovation quicker, easier, and more effective through exchanging knowledge and ideas by collaborative and open network environments (Curley and Salmelin, 2018). There is a successive change in the way in which innovation has been viewed through time. The innovation paradigm has shifted from the 'closed innovation' to the 'open innovation' and the 'networked innovation' models and now to participative innovation, which is an integral characteristic of Open innovation 2.0. (Chesbrough, 2003; Curley and Salmelin, 2018). As innovation is the most typical performance variable in IC research (Inkinen et al., 2017), this novel innovation paradigm should also entail changes for the IC field. For IC theory, this means that knowledge-based value creating resources relate not only with intra-firm resources and capabilities, but also with those over and across the organisational boundaries.

Proposition 4: External IC resources are crucial for open innovation.

2.5 Crowdsourcing

Crowdsourcing, with its multidisciplinary nature, is a complex phenomenon (Cricelli et al., 2021). It is consistent with the open innovation paradigm (Bogers and West, 2012), as it basically refers to the use of outside sources for ideation, and crowd wisdom or collective intelligence in value creation (Brabham, 2013). Crowdsourcing indicates the practice to open the process of getting ideas or performing tasks up to the public and ask a body of people (the crowd) to share its knowledge as users in order to improve its own experience (Buettner, 2015).

The adoption of OI strategies asks for reorganisation of how processes are carried out, that need to be linked to a new and more open and entrepreneurial culture, a cooperative behavior, and a collaborative mindset of the people involved (Cricelli et al., 2021).

Proposition 5: Open and entrepreneurial culture is an important facet of structural capital that supports crowdsourcing and use of collective intelligence.

2.6 Sustainability

Sustainability is a crucial issue for the future of the planet and humanity. With growing global concerns regarding the scarcity of natural resources, economic viability, social inequity, poverty and human rights violations, climate change, and rapid environmental degradation, sustainability and knowledge issues have become increasingly relevant in the literature (Reboredo and Sowaity, 2022; Mutuc and Cabrilo, 2022). While there is a shift in factors of production and knowledge-based transformation around the world, at the same time there is a demand for sustainable development among organisations. Therefore, organisations have to balance their economic growth with social and environmental concerns (Jain et al., 2017). The productive force behind companies is what they know, i.e. their IC (Subramaniam and Youndt, 2005) that may change the nature and strength of CSR effects on organisational performance.

Green IC refers to the sum of existing knowledge and skills that are used within a firm in organisational and environment-oriented processes and activities and that give the firm an opportunity to maximize its economic, social, and environmental performance and achieve a sustainable competitive advantage (Chen, 2008; Chang and Chen, 2012; Liu et al., 2021). In the knowledge economy, knowledge-based resources and capabilities are the leading drivers of environmental and social innovations (Chen, 2008). Thus, the process of accumulating green IC is a process of promoting sustainability within organisational operations and business value creation (Liu et al., 2021).

Proposition 6: There is a linkage between (green) IC and sustainability.

2.7 Ethical Leadership

A facet of IC-relevant social sustainability, ethical leadership involves the demonstration of high moral values in personal actions and interpersonal relationships and the promotion of such behavior to followers through open, trustful, and two-way communication as well as encouragement and empowerment in decision-making (Brown et al., 2005; Ullah et al., 2021). Ethical leadership supports moral activities and attitudes toward business and generates trust among internal and external stakeholders. Ethics and trust shape an organisational culture of honesty and ethics and create an ethical climate that boosts open communication with employees, teamwork, knowledge sharing, creativity, and better organisational problem solving, enhancing organisational IC (Maletič et al., 2018). The trust generated by ethical behaviors enables superior relationships, leading to increased relational capital. Ethical leadership and followership attract and retain talents, which can further lead to better

human capital (De Hoogh and Den Hartog, 2008). In summary, ethical capital entails leaders to be liable for humankind in general, not just for their firms, and enables leaders to build an ethical corporate culture and to be accountable for humanity (Ullah et al., 2022).

Proposition 7: Ethical leadership should be acknowledged as an element of IC.

2.8 Organisational Resilience

Organisational resilience, as a relatively new term in the management literature, indicates a much broader concept of resilience as a value driver for an organisation (Pereira et al., 2020). It refers to organisational viability over the long term under varying conditions (Tengblad and Oudhuis, 2018). Resilience enables organisations to harness experience and embrace opportunity in order to prosper in today's dynamic, interconnected and uncertain world (Pereira et al., 2020). Despite its growing importance, the mechanisms through which organisations develop resilient capabilities are still well under-researched (Kossek and Perringino, 2016).

External changes require renewal and reassembly of resources through both adaptation and innovation, and therefore organisational resilience is created through holistic management of resources and capacities. While many tangible traits and processes for resilience have been well researched, it is important to develop new perspectives on resilience and include intangible capabilities and resources in resilience models (Tengblad and Oudhuis, 2018). For example, Pareira et al. (2020) have confirmed that human capital is an extremely important dimension to overcome surprising, uncertain, and unstable situations and become resilient over time. We thus propose that understanding the impact of knowledge resource reservoirs, passageways and crossover provides a framework for further research to promote resilience in organisations.

Proposition 8: IC is the major source of organisational resilience.

3. Conclusion

This paper argued that to remain relevant in the face of the recent large-scale changes in companies' operating environments, such as digitalization, sustainability crisis, as well as the pandemic and related forced move to remote working, the IC theory would benefit from updating. We reviewed a set of recent worklife trends and changes and based on them, put forth the following propositions concerning related modifications to the existing IC models:

Proposition 1: In digitalized worklife, digital skills and an open digital culture are important aspects of IC

Proposition 2: Self leadership is an important aspect of IC in remote work contexts

Proposition 3: Gig workers should be acknowledged IC providers.

Proposition 4: External IC resources are crucial for open innovation.

Proposition 5: Open and entrepreneurial culture is an important facet of structural capital that supports crowdsourcing and use of collective intelligence

Proposition 6: There is a linkage between (green) IC and sustainability

Proposition 7: Ethical leadership should be acknowledged as an element of IC

Proposition 8: IC is the major source of organisational resilence.

We hope that our ideas contribute to the topicality and relevance of IC research by inspiring new thinking and offering ways forward to revise the research models that are developed and tested within this important field of study.

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Intellectual Capital for Enhancing Sustainable Industrialization: Towards the Sustainable Development Goal (SDG) 9

Maria do Rosário Cabrita[1,2], Lina Užienė[3], Alexeis Garcia-Perez[4,5] and Jose Maria Viedma[6]
[1]UNIDEMI, Department of Mechanical and Industrial Engineering (UNIDEMI), NOVA School of Science and Technology, NOVA University of Lisbon, Portugal
[2]Laboratório Associado de Sistemas Inteligentes, Guimarães, Portugal
[3]Kaunas University of Technology, School of Economics and Business, Lithuania
[4]Centre for Business in Society, Coventry University, UK
[5]Georgetown University, USA
[6]Polytechnic University of Catalonia, Spain

m.cabrita@fct.unl.pt
lina.uziene@ktu.lt
ab1258@coventry.ac.uk
icms.viedma@telefonica.net

Abstract: Intellectual Capital (IC) has played a major role in driving growth, competitiveness, and sustainability over decades, improving people's well-being and the economic performance of businesses. At the same time, the United Nation's Sustainable Development Goals (SDGs) have emerged as an integrated approach to sustainable development principles of people, planet, prosperity, peace, and partnership, which represent one of the most urgent challenges in our times. The industrial sector is particularly challenged to adopt a sustainable approach to solving development issues by addressing the SDGs. Sustainable Development Goal 9 (SDG 9) is built on three interconnected pillars: infrastructure, industry, and innovation, all of which are strongly interconnected, sharing the common mission of achieving socially inclusive and environmentally sustainable economic development. By adopting SDG 9 and its related targets, the global community can benefit from an industrial development that is inclusive and sustainable, with an impact on all other SDGs. From a strategic perspective, IC is predominantly studied as a bundle of intangibles that creates value, thus embodying a set of resources that are decisive in sustaining competitive advantage, which is necessary for sustainability and for ensuring people's well-being and economic growth, in line with SDGs. Despite an increasing number of studies exploring the links between IC and sustainability, a major gap emerges in what concerns the influence of IC on achieving SDGs in specific or interconnected goals. Based on the relevant literature, the aim of this paper is to explore how the characteristics of the IC can foster the 2030 Agenda for Sustainable Development, specifically, the sustainable and innovative development of organizations by adopting Goal 9 and its targets. This paper contributes to the literature on IC as a driver for SDGs. In more detail, it opens some avenues for future research on strengthening capabilities to solve development challenges, involving different actors, stakeholders, sectors, and regions.

Keywords: Intellectual Capital (IC), Sustainable Development (SD), Sustainable Development Goal9 (SDG9), Sustainable industry, Innovation, Resilient infrastructure

1. Introduction

The concept of Intellectual Capital (IC) has its roots in the early 20th century when economists began to recognize that knowledge and information are important drivers of economic growth, productivity, and prosperity. However, only in the 1990s did the term "intellectual capital" become widespread. Since then, IC has been predominantly studied as the foundation for competitiveness and sustainable competitive advantage, representing a potential for long-term business profitability. Initially addressed in a microeconomic context, IC studies have also proliferated in a macroeconomic perspective, which emphasizes the association of knowledge and city/region, underlying the transition from an industrial to a knowledge society (Januškaitė, and Užienė, 2018). Knowledge-Based Development (KBD) paradigms and the concept of knowledge cities or smart cities encompass technological, academic, cultural, scientific, and innovation capabilities in cities and regions as engines of economic growth. According to Carrillo (2015), KBD concerns the continuity of human civilization, involving the capacity to balance production, consumption, distribution, and vital sources of matter and energy, which requires a set of common value dimensions for ethics, politics, economics, and culture. The author still adverts that "The continuity of human civilization might depend upon human capacity to grasp such principles and redesign coexistence terms, across nations as well as with the planet" (Carrillo, 2015:10). This view aligns with the United Nations (UN) action plan prepared to perform the deep transformation essential to achieve the SDGs outcomes, announced in the 2030 Development Agenda and implemented by all countries and stakeholders working in collaborative partnerships with the UN. Within the different aims of this Agenda, SDG 9 relates to Industry, Innovation, and Infrastructure and aims to "Build resilient infrastructure, promote inclusive

and sustainable industrialization and foster innovation". Even though innovation has been seen as key to achieving economic growth, SDG9 reinforces this significant role in building sustainable economic prosperity for all societies. The Lima Declaration, adopted at the fifteenth session of the General Conference of the United Nations Industrial Development Organization (UNIDO), in December 2013, deepened the commitment towards achieving Inclusive and Sustainable Industrial Development (ISID). Poverty eradication remains the central imperative, and it was recognized that this can only be achieved through strong, inclusive, sustainable, and resilient economic and industrial growth, and the effective integration of the economic, social, and environmental dimensions of Sustainable Development (SD). Industrialization is a dynamic economic process that generates employment, improves living standards, facilitates trade, and promotes efficient resource use.

Assumed as a bundle of intangibles that create value, the strategic view of the IC theory can help us to identify core intangibles that, operating together, drive organizations to achieve ISID goals and targets. Although the concept of Sustainable Intellectual Capital (SIC) or "green IC", integrating IC with environmental concerns, was introduced by Chen (2008), it has been explored very little in IC literature (Yusoff *et al*., 2019). In the same vein, very few studies (Alvino *et al.,* 2019) address the relationship between IC and SD. To the best of the authors´ knowledge, there are no studies on the role of IC in achieving SDG 9. Moreover, IC initiatives carried out by companies in terms of SD must be in line with the expectations of the 17 Sustainable Development Goals (SDGs), which encourage them to contribute to creating a competitive advantage aimed at preserving environmental sustainability and community well-being. This paper, theoretical by nature, explores the IC attributes that drive SDG9, strengthening resilient infrastructure, promoting inclusive and sustainable industrialization, and fostering innovation. Based on the literature review we develop a framework for managing Sustainable Intellectual Capital (SIC) to attain SDG 9. This research contributes to the existing body of IC and SD literature and suggests useful implications for practicing managers and practitioners. The literature review has been carried out aimed at identifying the variables under study: SDG9 and IC, using the SCOPUS research analysis, and 8 results were obtained between the years 2016 and 2023. From this procedure and given the very little research on the combination of two topics, the summaries of the content provided the argumentative support for the development of the research. Despite the evident interrelation between IC and sustainability, the comprehension of its impact on achieving SDG goals is still under-researched and analyzed from different perspectives. This raises a need to better understand how each SDG can be achieved and enhanced through the strategic role of IC. The structure of this paper is as follows. The first section presents the aim of the research and introduces some IC and SD concepts to be developed in the next sections. This is followed, in section 2, by an exploration of the characteristics of IC that make it a key driver of sustainable value. After outlining the role of IC in exploiting business opportunities to achieve social, economic, and environmental benefits, the concept of Sustainable Intellectual Capital (SIC) is developed, in Section 3. Next, Section 4 examines the universal and indivisible nature of SDGs is examined. Section 5 develops a framework for managing SIC to achieve the targets of SDG 9. Section 6 formulates conclusions.

2. Intellectual Capital: The Key Driver of Sustainable Value

Although there is an agreement in the literature that IC is a source of organizational value, there is still a lack of consensus over definitions of it owing to the diversity of disciplinary and interdisciplinary perspectives – strategy, economics, human resources, finance, accounting, reporting, and intellectual capital – from which it can be examined (Marr, 2005). From a strategic perspective, Cabrita *et al.* (2011) define IC as the knowledge that creates value and gives the organization a sustainable competitive advantage. From the accounting point of view, the focus of IC is twofold: external reporting of IC and measuring and visualizing IC for management decision-making. All definitions of IC in the literature emphasize that IC is an intangible asset, that contributes to the production of goods and services that create a competitive advantage for organizations. From all definitions, we can assume that the core element of IC is its intangibility and the potential to create value or wealth. While IC is recognized as a key intangible resource for entrepreneurial success (Crupi *et al*., 2020), stakeholders heavily pressure organizations to effectively implement corporate strategies that improve sustainable performance (Alvino *et al*., 2021) and minimize environmental issues arising from production activities. San *et al*., (2022) found that IC positively influences organizations' sustainable performance in social, environmental, and financial aspects, and emphasizes the role of IC in exploiting business opportunities, encouraging innovativeness, and taking risks for transformation to achieve social, environmental, and economic benefits. Figge and Hahn (2005) introduce the concept of "sustainable value" as the value created by a hyper-efficient use of all forms of capital. The IC concept is linked to the concept of long-term value and the literature (Dwianika and Gunawan, 2020) shows that sustainable value creation can significantly contribute to the deceleration of climate change and the reduction of negative economic impacts (Hariastuti and Lukmandono,

2022). Therefore, the development potential of the IC is linked to the 2030 Agenda for Sustainable Development (SD).

3. Sustainable Intellectual Capital: A Source of Sustainable Value

In line with the cleaner production methods to reduce environmental impact, research has begun mainly focusing on the integration of green practices in the general management systems of organizations, in which Sustainable Intellectual Capital (SIC) becomes part of the development subject, despite very few studies have addressed the concept. Chen (2008) refers to SIC as the sum of all intangible resources, capabilities, knowledge, and relationships that relate to environmental protection, although it can also incorporate social and economic concerns. In the same vein, López-Gamero *et al*., (2011:21) describe SIC as "the sum of all knowledge that an organization can leverage in the process of conducting environmental management to gain a competitive advantage". Several authors (Alvino *et al*., 2021; Popescu, 2020) found that IC management practices have a crucial role in the environmental and ecological goals of promoting SD. Likewise, Yusliza *et al*., (2020) show that SIC (and its dimensions) and sustainable performance (environmental, social, and economic) are closely related. Therefore, organizations create and add value to their products or services by offering environmentally friendly products or services (Hahn *et al*., 2007). This study argues that SIC refers to the bundle of intangibles that operating in a combined and interconnected way, produce sustainable value in support of economic growth, people's well-being, and environmental protection, in line with the Sustainable Development Goals (SDGs).

4. Sustainable Development Goals: A Universal and Indivisible Approach

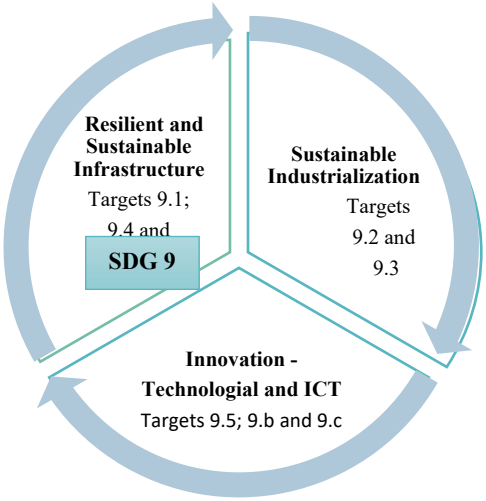
Historically, the concept of SD first appeared in a document entitled ''Our Common Future" provided by the United Nations World Commission on Environment and Development (WCED) in 1987 (United Nations, 1987). One of the most recent initiatives for SD is the set of 17 United Nations Sustainable Development Goals (SDGs), with 169 associated targets and more than 230 indicators for monitoring their progress (United Nations, 2015), which were agreed upon by 195 States that aim to move the world to sustainable economic development, environmental sustainability, and social inclusion. Adopting a holistic approach, the 2030 Agenda addresses five critical areas for humanity and the planet: people, planet, prosperity, peace, and partnership.

The literature presents several studies on the synergies (levers) and trade-offs (hurdles) among the SDGs (Moyer and Bohl, 2019; Dörgő *et al*., 2018; Pradhan *et al*., 2017) and supports the finding that most SDG interactions may act as levers (Anderson *et al*., 2022). Central to the 2030 Agenda, and a distinguishing feature as compared to other sustainability initiatives, is that it is intended to be treated as universal and indivisible. Universality means that the 2030 Agenda applies to all nations and individuals around the globe, regardless of the current level of income, culture, or sustainability challenges. Indivisibility intends that the implementation of the 2030 Agenda should be based on integrated approaches, and not through a silo mentality. Achieving SD faces many ecological and social challenges that are interlinked and addressing them requires a concerted international and interdisciplinary collaboration beyond independent or specialized programs.

Within the different aims of the 2030 Agenda, SDG 9 relates to Industry, Innovation, and Infrastructure and aims to "Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation". This SDG encapsulates three key drivers of SD: infrastructure, industrialization, and innovation. Infrastructure provides the basic physical systems, assets, and structures, which are essential for the maintaining of vital societal functions, health, security, and economic or social well-being of people. Industrialization is the engine of economic growth and employment, reducing poverty. Innovation advances the technological capabilities of the industry and the development of new skills. The literature notes the importance of industrialization as a driver of economic and social development. The industry takes a vital role in achieving SDGs, with Agenda 2030 emphasizing the relevance of sustainable industrial development as the basis for sustainable economic growth. Industry acts as a driver of resources that can potentially create sustainable value and achieve the sustainable industrialization envisaged by Sustainable Development Goal 9 (SDG 9). However, there is a consensus in the literature that the complexity of these interactions leads to complex decision-making processes.

SDG 9 operates as a pivotal factor in other SDGs impacting many of them in different ways, such as job creation (SDG 8), women's employment (SDG 5), health (SDG 3), environmental protection (SDG 7), clean water and sanitation (SDG 6), food security (SDG 2), green technologies (SDG 9) or resilient cities (SDG 11). The literature (Coenen *et al*. 2021; Kroll *et al.*, 2019) stresses SDG9's synergistic characteristics, advocating its importance in improving the performance of the other SDGs. Nevertheless, according to Pradhan *et al.* (2017), SDG 9 is one of the SDGs involved in additional trade-off situations, which means that, sometimes, the improvement in one target of SDG 9 harms another SDG. The UN defined five key targets (9.1, 9.2, 9.3, 9.4, and 9.5) and three

additional targets (9.a, 9.b, and 9.c), comprising twelve indicators to facilitate actions toward achieving SDG 9. Summing up, we can categorize SDG 9 targets into intervention areas, as depicted in Figure 1.



The three elements of SDG 9, resilient infrastructure, sustainable industrialization, and innovation, reinforce each other.

Figure 1: SDG 9 Targets Categorization

Resilient Infrastructure

Adequate infrastructure is closely connected with the achievement of social development, economic growth, and environmental goals. Poor access to basic infrastructure implies reduced access to a job, education, and health care, compromising the quality and well-being of living standards and creating barriers to making business. Infrastructural progress in railways, roads, water systems, irrigation systems, electrical power, sanitation, and information technologies is visibly linked to economic growth and enables many other goals that depend on it. In times of intense uncertainty, a resilient infrastructure system is understood as a situation that reduces its vulnerability, minimizes the consequences of threats, accelerates responses and recovery, and facilitates adaptation to disruptive events (NIAC, 2009). This is particularly relevant in the context of continuous digital transformations driven by technological developments. A combination of knowledge-intensive activities, innovative actions, and technological advancement has resulted in innovative products and services, supported by digital-centered strategies (Sallos et al., 2019). As society and an increasing number of economic sectors engage in digital transformation strategies, we all face a new type of risk related to digital assets and services. Risks derived from digital incidents are not only disruptive but difficult to predict or avoid and may have major implications for the resilience of businesses and societies. Building resilient infrastructure, therefore, requires thinking and acting for future generations. The UNDRR (2022) establishes a set of six interconnected principles for resilient infrastructure: i) continuously learning, which highlights the challenges to understanding infrastructure resilience due to the internal complexity and external hyperconnectivity of related systems and sectors; ii) proactively protected, which means being prepared for hazards in the recognition that infrastructure is exposed to various hazards both known and unknown, and the nature of hazards is constantly changing; iii) environmentally integrated, recognizing the importance of working in a proactive and positively integrated way with the natural environment: biological (flora and fauna) and physical (land, air, water); iv) socially engaged, aiming to actively engage with people and communities so that they have a better understanding of how they can help to prevent and respond to disruptions; v) shared responsibility, which means that a collaborative approach must be encouraged for the sharing of data, knowledge, and expertise; and vi) adaptively transforming, referring to the ability to change the ways in which infrastructure systems are run, or to change the desired outputs of these systems.

Industrialization

"Industrialization" is a generic term for a set of economic and social processes related to the discovery of more efficient ways for the creation of value. Industrialization is an indirect effect of adequate and resilient infrastructure, promoting jobs with a positive impact on social and economic life (Cammarano et al., 2021). We all know that the impact of the manufacturing industry on the environment is a growing concern, as the industry is being reported as the highest contributor to environmental issues. While Industrialization has brought

economic prosperity, it is also responsible for adverse ecological effects, such as pollution (land, water, and land), forest degradation, and biodiversity loss.

Innovation

Innovation and technological progress are the keys to achieving economic and employment growth and finding lasting solutions to environmental challenges, such as increased resource and energy efficiency. The use of new technologies supports the development of a knowledge economy and the creation of subsequent inventions which contribute to the improvement of living conditions connected with such domains as medicine, transportation, production, or the use of energy. Innovation and creativity are vital to driving more efficient and better use of resources and a key mechanism for achieving the SDGs. As the business environments are in constant change, demanding more dynamic production and management systems for complex environments, innovation, and SDGs should work in broad and flexible manners.

5. Sustainable Intellectual Capital for Enhancing SDG 9

Sustainable Intellectual Capital (SIC) is a concept pertaining to modern economics that aims to emphasize the importance of intelligence for growth and development, where knowledge plays a key role in achieving economic SD (Meramveliotakis and Manioudis, 2021; Cabrita *et al.*, 2016). Its value resides in the identification and monitoring of intangible assets that can determine the failure or success of an organization. Managing SIC is a strategic activity that influences the performance, competitiveness, and long-term success of an organization. As SIC represents the hidden part of the organization's sustainable value, we define SIC as a bundle of intangibles that create value and favor SD. Such intangibles represent the essential conditions for a sustainable competitive advantage and for long-term development.

Based on the literature revision, a framework is proposed for managing SIC processes for SDG 9, as depicted in Figure 2.

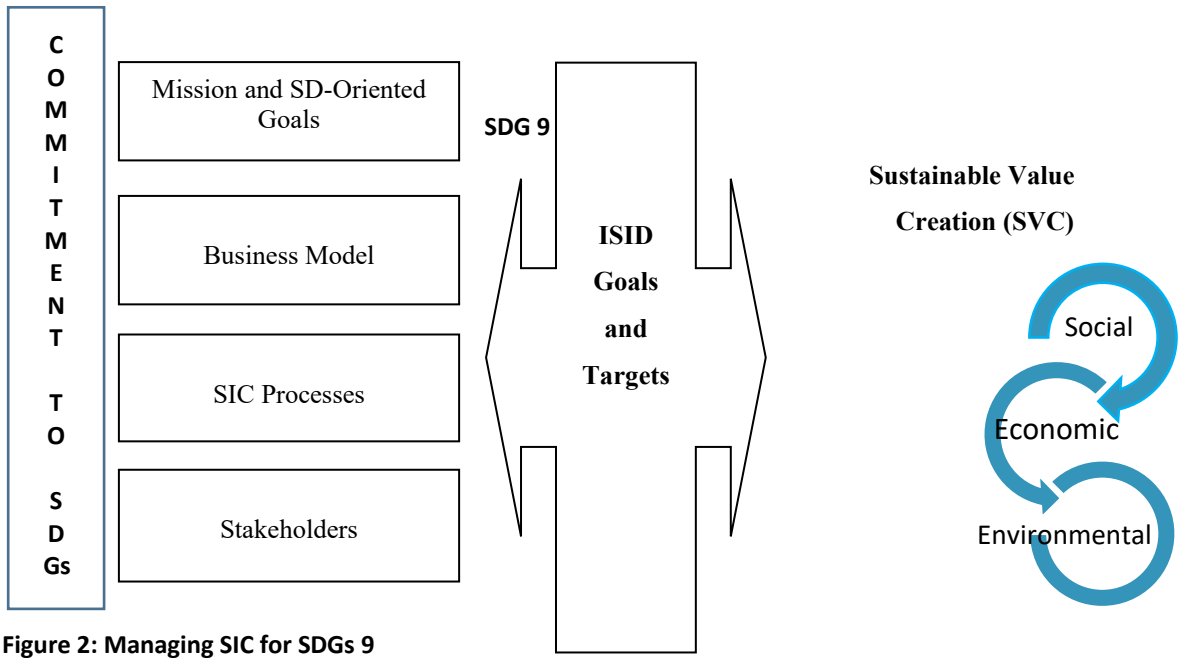


Figure 2: Managing SIC for SDGs 9

To attain the goals and targets of SDG 9 - synergic achievement of economic, social, and environmental results in the medium to long term - the commitment to SDGs needs to be integrated into managerial processes, including the SIC processes. Mission and sustainability-oriented goals define and drive the design and implementation of a business model that affects the value proposition to different stakeholders (customers, employees, providers, competitors, government, and society) (Cabrita and Duarte, 2021). The literature (Wang and Juo, 2021; Singh *et al.* 2020) reveals that to be well succeeded, such a business model, that integrates SDG 9 concerns, requires a wide set of SIC management processes – green training, life-cycle analysis, total quality environmental management, industry eco-design, development of environment-friendly technologies, green waste management, green packaging, green cooperating with customers, eco-friendly behaviors and lifestyles– that enable the exploitation of organizational resources, capabilities, and core competencies to create and

leverage value along the three dimensions (economic, environmental, and social). In this sense, fluxes of knowledge within organizations should be filtered by SDG 9 to build resilient infrastructures, promote inclusive and sustainable industrialization and foster innovation, which is incorporated into the strategy.

6. Conclusions

This work, based on the SD and IC theories explores the arguments to link these two streams of research. The aim of this paper is to explore how the characteristics of the IC can foster the ISID to attain SDG 9 targets. The strategic perspective of IC supports the integration of SDGs into decision-making processes, to create and leverage organizational value. Knowledge as the core element of IC is also the key to achieving the SDGs in every context. Organizations, as an important source of innovation, have a social responsibility to support concerns related to SD. Moreover, organizations should take a holistic view of business, with a focus not only on achieving economic performance but also on the social and environmental dimensions of SD, which aligns with the ecosystem perspective of value creation or SVC. This may be reflected, e.g. in green practices to achieve sustainable industrialization envisaged by SDG 9. Without the focus on the critical value drivers, including technology and innovation, industrialization will not happen, and without industrialization, the development will not happen.

Based on the literature revision, a framework was developed, where is proposed that IC aligned with SDG-oriented practices could help managers to consider the implications of green practices in line with the UN 2030 Agenda when managers decide to redesign and reorganize their operational practices. We show that IC is critical for not only achieving a competitive advantage but also influencing sustainable development (Dalwai *et al*., 2023). Our future depends on our capacity to adapt, detect opportunities, collect necessary skills and knowledge, and transform them into economic values, in balance with ecosystems. SIC principles and practices are the basis of knowledge-based industrialization.

Despite an increasing number of studies exploring the links between IC and sustainability, a major gap emerges in what concerns the influence of IC on achieving SDGs in specific or interconnected goals. The proposed framework produces an informative base to implement strategies committed to SDGs. Future studies can set forth toward the impact of SIC in each SDG. Several potential improvements could be considered for future research activities on the impact of SIC on knowledge-based industrialization. We believe that more research on sustainability is also needed. The focus should be a punt on interdisciplinary research, i.e. synergy of knowledge from economics, natural sciences, engineering, ecology, etc.

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Innovational Leadership and Knowledge Sharing: The Mediator Role of Self-efficacy

Delio Ignacio Castaneda and Camilo Andrés Ramírez
Pontificia Universidad Javeriana, Bogotá, Colombia

delio.castaneda@javeriana.edu.co
ramirezcamilo@javeriana.edu.co

Abstract: Innovational leadership is a set of practices and skills that leaders develop to promote innovative behaviors in their workers at the individual and collective levels. This is a novel concept focused on one role of leaders: the facilitation of the generation of new or significantly improved products and services. Previous studies with other styles of leadership have shown that transformational leadership encourages a climate for innovative work behaviors, while transactional leadership influences exploitative innovation activities. Knowledge sharing involves the transfer of experience and expertise to facilitate business development and the accomplishment of organizational objectives. Self-efficacy is an individual´s confidence in their abilities to execute a particular task. It influences learning and performance. This research studied whether innovational leadership influences two types of knowledge sharing: tacit and explicit. At the same time, the role of self-efficacy as a mediator variable was evaluated. The sample consisted of 415 workers from different sectors in Colombia. According to the results, innovational leadership positively influenced tacit and explicit knowledge, although the effect on tacit knowledge was higher. Finally, self-efficacy played a mediator role in the relationship between innovational leadership and knowledge sharing. Additional research is suggested to explore the differences between innovational leadership and other types of leadership in the process of sharing tacit and explicit knowledge. At the same time, complementary investigations about the dynamics of innovational leadership are needed to understand why it affects more tacit knowledge than explicit knowledge.

Keywords: Knowledge sharing, Innovational leadership, Self-efficacy, Knowledge management

1. Introduction

For many years, researchers have explored the relationship between different leadership styles and knowledge sharing. These are some recent examples. Goswami and Agrawal (2023) found that ethical leadership has a positive impact on knowledge sharing. Le and Nguyen (2023) revealed that trust is a mediator between ethical leadership and knowledge sharing. There is also evidence about the influence of decentralized leadership on knowledge sharing (Schewer et al., 2023), the mediated role of knowledge sharing between entrepreneurial leadership and team creativity (Mehmood et al., 2022), and the influence of relational leadership on knowledge sharing (Engelsberger et al., 2022).

This paper focuses on a new concept of leadership called innovational leadership and its influence on knowledge sharing. This style of leadership promotes an environment and a climate where workers feel comfortable interacting (Contreras et al., 2022). We hypothesize that it is an ideal style of direction to facilitate knowledge sharing. Innovational leaders are good at promoting learning processes, encouraging a safe environment for change, providing monitoring and adjustment, and orienting people. In addition, this research explores the role of self-efficacy as a mediator between innovational leadership and knowledge sharing.

2. Literature Review

2.1 Innovational Leadership

The foundation of any high-performing organization is the innovative behavior of its employees (Tidd and Bessant, 2020). Leaders influence organizational learning, knowledge sharing, and employees' innovative behavior (Alblooshi et al., 2020). There are multiple studies on the relationship between styles of leadership and innovation (Sethibe and Stteyn, 2017). Our study follows a new conceptualization that integrates those two notions and is called innovational leadership.

Innovational leadership is a style of leadership that encourages innovative behaviors in employees (Contreras et al., 2022). This style of leadership creates a work environment where employees feel free to interact and safe to share ideas. This concept proposed by Contreras et al. (2022) is different from innovative leadership, which focuses on the process of making relevant changes to solve problems and benefit people (Sen and Eren, 2012). These leaders are oriented toward innovation and work to transform ideas into assets (Alblooshi et al., 2020). Another style of leadership with a similar name is innovation leadership. This kind of leadership refers to leaders who can create a strategy and build relationships to implement something new that adds value to an organization (Contreras et al., 2022).

Innovational leadership encourages individual innovation and innovative behaviors in their employees. Innovative behavior is the intentional actions of workers oriented toward generating, applying, and implementing new ideas, products, and processes (Contreras et al., 2022). This type of leadership focuses on workers´ innovative outcomes and consists of a set of practices and skills that leaders develop to promote innovative behaviors in their workers at the individual and collective levels (Contreras et al., 2022). In this research, this type of leadership is proposed as a facilitator of knowledge sharing behavior. Innovational leadership is a new conception of leadership, and so far, no publications have evaluated its relationship with knowledge sharing. In this sense, this study is a pioneer in this matter.

2.2 Knowledge Sharing

Mohajan (2016) defined knowledge as the accumulation of experiences, practical information, and skilled perception, which offers a framework for estimating and integrating new experiences and information. Davenport and Prusak (2001) affirmed that the main source of creation of a company´s competitive advantage resides fundamentally in its knowledge, or more specifically, in what the organization knows, in how individuals use what they know, and in their ability to learn permanently.

Knowledge sharing is the exchange of knowledge among individuals. In an organizational context, knowledge sharing is the foundation for generating innovations. Knowledge sharing is a fundamental process that helps employees contribute their skills and experience on creative and organizational value dynamics. Singh et al. (2021). This behavior is a process associated with organizational improvement. It contributes to the creation, and updating of information (Ruseli et al., 2010) and adds value to the achievement of a competitive advantage (Samieh and Wahba, 2007).

Some studies report the relationship between different styles of leadership and knowledge sharing. For instance, Kim et al. (2021) found a positive influence of transformational leadership on knowledge sharing. According to Khassawneh et al. (2022), knowledge sharing has a positive effect on creativity, and the openness of a leader mediates the willingness of workers to share information. Based on the study of Zehir and Celebi (2022), empowering leadership has a positive effect on explicit knowledge sharing. Finally, Al-Husseini et al. (2021) reported a positive relationship between transformational leadership and knowledge sharing. In the present study, for the first time, the relationship between innovational leadership and knowledge sharing will be evaluated.

2.3 Self-Efficacy

Human behavior is extensively motivated and regulated through the exercise of self-influence. Among the mechanisms of self-influence, none is more pervasive than believing in one's efficacy (Bandura, 2009). Multiple studies have been emphasizing the association between self-efficacy and organizational variables like culture and organizational empowerment (Wu et al., 2023) and organizational citizenship behavior (Magdaleno et al., 2023).

Self-efficacy is an individual´s confidence in his or her abilities to execute a particular task (Chen and Hung, 2010). Self-efficacy influences how people think, feel, and act and, therefore, their achievements. If an individual believes that it is not possible to produce results, then he or she will not act to make an event happen. Two people with the same knowledge can perform differently depending on their self-efficacy. This concept is related to the beliefs that an individual has about what he or she can do with his or her abilities in a variety of circumstances (Cisneros and Munduate, 2000). Chen and Gao (2023) found that self-efficacy was associated with higher self-esteem.

Self-efficacy beliefs determine people´s goals and aspirations. Individuals with high self-efficacy tend to expect favorable results. In the same way, this concept also influences how obstacles are faced. People with low self-efficacy focus more on risks and costs than on opportunities (Bandura, 2002). Brown et al. (2005) stated that individuals with high self-efficacy focus their attention and motivation on the tasks necessary to achieve expected performance levels and persevere with the goal, despite obstacles. Stadkovic and Luthans (1998) stated that self-efficacy changes over time when the person obtains new information and experience in performing a task. Individuals with high self-efficacy set goals that are more ambitious and tend to perform better (Wood and Bandura, 1989).

According to Bandura (1977), self-efficacy beliefs are constructed from four sources of information: enactive mastery experiences, vicarious experiences, verbal persuasion, and psychological states. Leadership has an

impact on followers´ self-efficacy by showing models how to perform a task effectively and giving objective feedback about why it is possible to perform it.

There is a positive relationship between self-efficacy and knowledge sharing (Bilginoglu and Yozgat, 2018; Castaneda et al., 2016). Safdar et al. (2021), based on a systematic review, concluded that self-efficacy is a predictor of knowledge sharing. Cabrera et al. (2006) found an association between breadth of role self-efficacy and knowledge sharing. There are some studies in virtual communities in which an association between self-efficacy and knowledge sharing behavior has been found (Hsu et al., 2007; Tseng, 2007).

Kim et al. (2020) indicated that individual characteristics, such as self-efficacy and knowledge-creation self-efficacy, significantly predict knowledge sharing. Shao et al. (2015) found that hierarchical cultures that focus on efficacy were positively related to employees' explicit knowledge sharing. In addition, group culture that focused on trust was positively related to employees' tacit knowledge sharing, and their relationship was fully mediated by employees' computer self-efficacy. Runhaar and Sanders (2016) showed that some human resources practices strengthened the relationship between occupational self-efficacy and knowledge sharing.

Brooke et al.´s (2017) findings indicate that individual-related and environmental-related factors have a significant influence on knowledge sharing behavior. The results also reveal that self-efficacy mediates the relationships between prior experiences, social support, trust, and knowledge sharing behavior. Lee et al. (2022) stated that self-efficacy positively mediated the association between knowledge sharing and sustainable happiness. Kim et al. (2021) stated that members with higher self-efficacy are more likely to share knowledge with their teammates.

Naan et al. (2019) concluded that self-efficacy had a strong positive influence on employee job performance, perceived environmental support, and knowledge sharing, while perceived environmental support and knowledge sharing positively influenced employee job performance. Mshaly and Al-Azawei (2022) showed that knowledge acquisition, knowledge sharing, and online self-efficacy were determinants of performance expectancy, and online self-efficacy was a predictor of effort expectancy. Yilmaz (2016) working with university students, found that self-efficacy positively affects knowledge sharing.

We propose that a new conception of leadership, innovational leadership, influences knowledge sharing. Leaders may persuade workers´ beliefs. In this sense, it is expected that innovational leadership relates to knowledge sharing and that self-efficacy is a mediator variable.

3. Methodology

3.1 Participants

The sample consisted of 415 workers from different sectors in Colombia. In the sample, 249 were women (55.6%) and 199 were men (44.4%). About the level of the position, 6.92% were technical, 66.07% were professionals, 9.38% were advisors, and 17.63% were directives. The demographic characteristics of the sample are presented in Table 1.

Table 1: Demographic Data of the Sample

Characteristics	Number	Percentage (%)
Gender		
Male	199	44.42%
Female	249	55.58%
Position		
Director	79	17.63%
Adviser	42	9.38%
Professional	296	66.07%
Technical	31	6.92%
Educational level		
Postgraduate	214	47.77%
Professional	205	45.76%

Technical	29	6.47%
Time of experience in the company in months		
0-12	162	36.16%
13-24	48	10.71%
25-36	40	8.93%
37-48	37	8.26%
49-60	28	6.25%
61-72	23	5.13%
Over 72	110	24.55%
Time of experience in the position in months		
0-12	120	26.79%
13-24	49	10.94%
25-36	54	12.05%
37-48	32	7.14%
49-60	34	7.59%
61-72	28	6.25%
Over 72	131	29.24%
Total	448	

3.2 Instruments

To measure innovational leadership, the scale designed by Contreras et al. (2022) was used. The scale has 16 items. The Cronbach´s alpha reliability of the instrument was 0.96. The instrument used in this study for evaluating tacit and explicit knowledge that workers share was the one designed by Castaneda et al. (2015). The instrument measures perceived evaluations of workers using a Likert scale with five levels of response and has 12 items. The validation of this instrument obtained a Cronbach's alpha reliability score of 0.94. A scale designed by Castaneda et al. (2016) evaluated self-efficacy. This instrument has four items and uses a Likert scale with five levels of response. The reliability of the instrument is 0.92.

4. Results

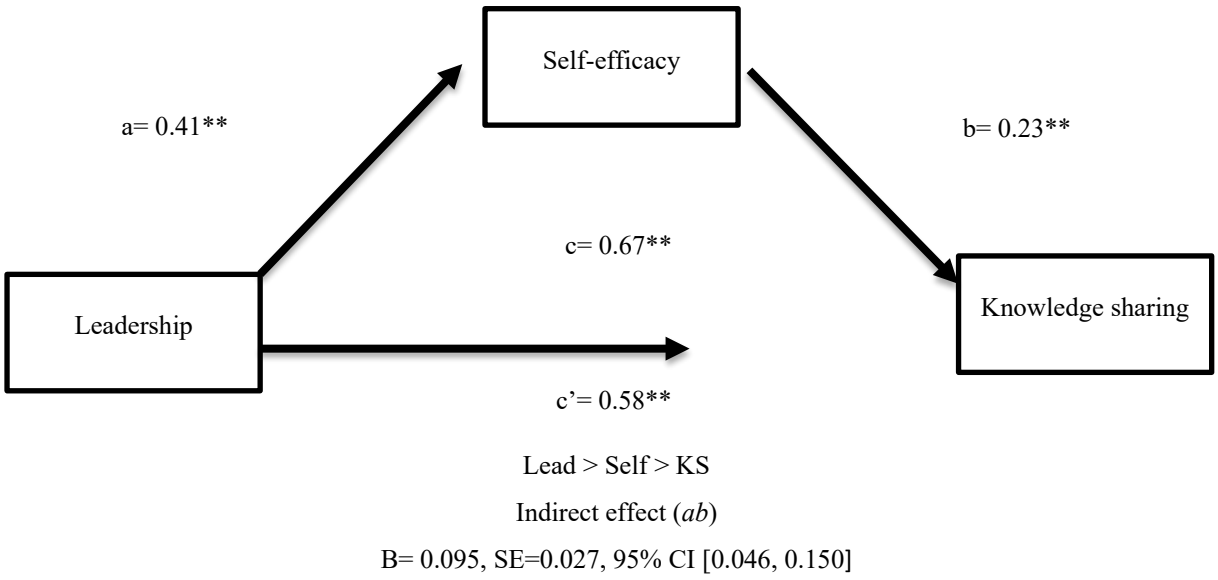
To evaluate the model, a simple measurement was taken with a single mediator variable using process regression analysis, which performs three regression analyses with the variables of the model (Fernández-Muñoz and García-González, 2017; Hayes, 2018), being leadership (lead) the independent variable, knowledge sharing (ks) the dependent variable, and self-efficacy (Se) the mediating variable. The analysis was performed with information from 448 subjects. The confidence level for the construction of intervals was 95%.

The first regression analyzed the influence of the independent variable on the mediating variable (coefficient *a*). The influence of leadership on self-efficacy was statistically significant (BKS= 0.4161, p= 0.000). The second regression analyzed whether the mediating variable predicted the dependent variable (coefficient *b*) and the direct effect of the independent variable on the dependent (coefficient *c'*). The influence of self-efficacy on knowledge sharing (coefficient *b*) is statistically significant (BLead= 0.2272, p=0.000). The direct effect of leadership on knowledge sharing (coefficient *c'*) is statistically significant (BKS= 0.5785, p= 0.000). This allows for the observation that the effect of self-efficacy on knowledge sharing is significant, as is the direct effect of leadership on knowledge sharing.

Then, the total effect was analyzed, which corresponds to a regression analysis with a single predictor, the independent variable over the dependent (coefficient c). Thus, the effect of leadership on knowledge sharing was analyzed, and it was significant (BKS= 0.6731, p= 0.000). The total and direct effects presented in the coefficients c and c´ measure the total effect of leadership on knowledge sharing (B= 06731, p=0.000). Lastly, the indirect effect of leadership on knowledge sharing was evaluated, taking into account the role of the mediating variable (ab coefficient) (BSe= 0.0946; BootSE= 0.0268; BootLLCI= 0.0462; BootULCI= 0.1505). Given that the value in the coefficient ab is positive and the values of the lower limit (BootLLCI) and upper limit

(BootULCI) of the confidence interval did not include the value of 0, it can be affirmed that the indirect effect is statistically significant and that there is a positive relationship between leadership and knowledge sharing. In this way, the self-efficacy of a worker influences knowledge sharing. This analysis is presented in Figure 1 through the mediation model.

Figure 1: Model of Mediation of Self-Efficacy Between Leadership and Knowledge Sharing



Note: ** significance P<0.01. SE means standard error via Bootstrap. CI means interval confidence.

5. Discussion

The purpose of this research was to evaluate if a new conception of leadership called innovational leadership influences knowledge sharing and the mediator role of self-efficacy in the relationship between innovational leadership and knowledge sharing.

According to the results, it was found that innovational leadership has a positive relationship with both types of knowledge sharing: tacit and explicit, although the effect on tacit knowledge was higher. There is also statistical support to state that self-efficacy is a mediator between innovational leadership and tacit and explicit knowledge sharing.

This is the first article that relates innovational leadership to knowledge sharing. Results were equivalent to what was found with other styles of leadership, for example, transformational (Kim et al., 2021; Al-Husseini et al., 2021) and empowering (Zehir and Celebi, 2022).

This research went a step further, evaluating if innovational leadership impacted tacit and explicit knowledge in the same way. It was found that the positive effect was higher with tacit knowledge. A possible explanation is that the innovational leadership style creates a safe work environment where employees feel free to interact and share ideas (Contreras et al., 2022). What people share when interacting with others is mainly tacit knowledge. This opens a line of research where the differential impact of leadership styles on tacit and explicit knowledge may be studied. For example, it may be hypothesized that transactional leadership, which is focused on tasks and agreements on results, may impact explicit knowledge better than tacit knowledge.

In this research, support was also found for the role of self-efficacy as a mediator variable between innovational leadership and knowledge sharing. Self-efficacy relates to the beliefs that an individual has about what he or she can do with his or her abilities in a variety of circumstances (Cisneros and Munduate, 2000), and it can be influenced by vicarious experiences and verbal persuasion (Bandura, 1977). Innovational leadership has an impact on followers´ self-efficacy by showing models of how to perform a task effectively and giving objective feedback about why it is possible to perform it. Self-efficacy may change depending on context variables, so a worker with low self-efficacy to share knowledge may change it with a leadership style that supports the worker and incentivizes him or her to share knowledge through interaction.

6. Conclusion and Recommendations

It may be concluded that innovational leadership facilitates workers´ knowledge sharing, especially the tacit one. It is also concluded that self-efficacy is a mediator in the relationship between innovational leadership and tacit and explicit knowledge sharing.

From a theoretical perspective, this article contributes to the validation of this recently created construct called innovational leadership. Likewise, it is the first time that this construct has been contrasted in the field of knowledge management. From an applied point of view, the article guides decision-makers to strengthen actions that contribute to worker knowledge sharing.

It is recommended to do additional research to understand why this style of leadership impacts tacit knowledge better. Considering that the concept of innovational leadership is new, maybe study its advantages over other styles of leadership in different processes of knowledge management and innovation.

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Linking Institutional Voids with Blind Spots Through Counter-Knowledge in the Spanish National Healthcare System

Juan-Gabriel Cegarra-Navarro[1], Aurora Martínez-Martínez[1], Raghda El Ebrashi[2] and Anthony Wensley[3]
[1]Universidad Politécnica de Cartagena, Spain
[2]German University in Cairo, Egypt
[3]University of Toronto Mississauga, Canada

juan.cegarra@upct.es
aurora.martinez@upct.es
raghda.elebrashi@guc.edu.eg
akpwensley@gmail.com

Abstract: The current study suggests the presence of counter-knowledge to spread misperceptions or misunderstandings arising from the existence of institutional voids. Blind spots may be partly caused by such counter-knowledge that triggers the knowledge gaps of the actors in the face of the new information and knowledge society. Find or instance, when we talk about blind spots in the Spanish National Healthcare System (SNHS), we refer to the presence of incorrect stereotypes among the different actors, the feminisation of the profession even though the elderly population they serve continues to associate the figure of the doctor with the masculine role, the lack of awareness about the importance of data protection or cyberattacks. This study suggests that counter-knowledge is likely to result in the lack of clear vision after suffering from blind spots. Such counter-knowledge hinders people from things that most of us take for granted, which creates difficulties for engagement among multifaceted stakeholders with diverse expertise and specialities to overcome blind spots.

Keywords: Institutional voids, Blind spots, Counter-knowledge, The Spanish National healthcare system

1. Introduction

Blind spots refer to things that people in general and knowledge workers, in particular, fail to perceive, even though they may appear obvious to others (Meissner et al., 2017). Such failures may lead to misperceptions or misinterpretations of what is perceived (Wiegand, 1999; Zajac & Bazerman, 1991). This concept of blind spots is related to the idea of "institutional voids" incorporated by Ebrashi and Darrag (2017), in which the lack of institutional agreements can prevent community actors from participating in market activities. Like "institutional voids", blind spots describe the absence of knowledge structures, for instance, institutions or intermediaries, which should generally facilitate economic transactions (Palepu & Khanna, 1998).

Even though Spain is the third largest beneficiary of European funds, expenditure dedicated to healthcare in Spain during 2022 fell by 9.88% compared to 2021. For the citizen, this means institutional voids of out-of-pocket spending and access to different quality benefits depending on the coverage type and geographic location. This study identifies in the literature three major institutional voids of the Spanish healthcare sector: the lack of a clear and shared vision between the educational and health authorities about health necessities which prevents a national education policy and medical training; the ageing of the population and moderate economic growth are issues expected to add pressure to the form of public financing of the SNHS; and political and social inequalities that exist in society partly due to the delegation of powers to the autonomous communities. Identifying and actioning on institutional voids in the healthcare sector can contribute to mitigating or correcting their negative effects on the system. For example, it can contribute to being more efficient in the allocation and use of public resources and increase the positive effect of these public resources on end users.

It is well known that the healthcare sector presents misinformation that can have serious consequences for public healthcare. It is important to understand the relationship between institutional voids and counter-knowledge. In this vein, the knowledge management literature maintains that when human beings do not have access to adequate knowledge structures, counter-knowledge is generated that manifests itself in the form of misinformation, misunderstandings, ignorance, the presence of obsolete knowledge, or hiding knowledge (Bolisani et al., 2019; Bolisani & Cegarra-Navarro, 2021; Cegarra-Navarro et al., 2021; Martelo-Landroguez et al., 2019; Thompson, 2008). Previous studies suggest that there is no positive counter-knowledge; in fact, any counter-knowledge has a negative effect on the relationships between the different actors (Bolisani & Cegarra-Navarro, 2021).

Besides, in this context, we are studying the creation of counter-knowledge to three forms of learning myopia: spatial myopia, temporal myopia, and myopia to errors with the purpose of finding blind spots between the

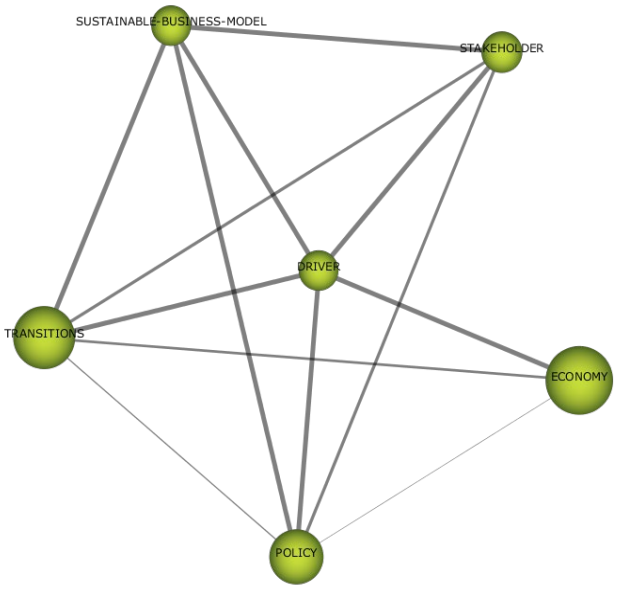
different actors involved. This study focuses on those cases where counter-knowledge prevails over knowledge, giving rise to the so-called blind spots (Wiegand, 1999). SNHS blind spots would be those manifestations of counter-knowledge at the actor level in such a way that, although users do not observe them directly, they can perceive them informally and indirectly. It is important to point out that blind spots can endanger not only the actors that generate them but also those whom they can influence. This study identified the most significant blind spots which form the basis of the SNHS and which should be followed very closely by healthcare authorities, from three perspectives: users, doctors and nurses, and administrators.

The main purpose of this study is to link institutional voids with blind spots through counter-knowledge in the Spanish Healthcare System. The structure of this work to achieve this objective is as follows: the proposed theoretical framework is presented in the 2 and 3 sections. Section 4 is the concluding remarks and the conclusions, managerial implications, and limitations are discussed in section 5. This study has theoretical and managerial implications.

2. Finding Institutional Voids in the SNHS

The concept of institutional voids is associated with the absence of suitable intermediaries in emerging markets and the transaction costs and operational challenges that this entails (Palepu & Khanna, 1998). According to(Palepu & Khanna, 1998), there are three causes for institutional voids: 1) the lack of information needed to connect consumers and producers; 2) political entities that place their political interests above economic efficiency; and 3) an inefficient judicial system. Under the influence of institutional voids, product markets, capital markets and labour markets are affected by the lack of intermediaries (Ebrashi & Darrag, 2017; Luiz et al., 2021).

Figure 1 shows the drivers related to institutional voids for analysing the most frequently treated themes from 2000 to 2023. The drivers are associated with circles, and the size of the circles is related to the number of citations connected with them. In other words, it was modelled using the centrality and density measures. Centrality estimates the degree of network interaction by analysing the links between keywords inside and outside the network. Density considers internal thematic coherence by examining the links between keywords inside the network. As can be seen in Figure 1, there are five research themes related to drivers within an operating context of institutional voids during this period.



Note: [Density=85.66; Densisty range=0.92; Centrality=209.03; Centrality range=0.46]
Source: SciMAT analysis of institutional voids from 2000 to 2023

Figure 1: Drivers Related to Institutional Voids

As a result of institutional voids, there are many ways that the SNHS can fail or not work effectively. Based on this preliminary study of 293 papers published in the Web of Science (WoS) Core Collection database, we can conclude that the three most analysed aspects involve transactions between institutions, economic issues, and political aspects. Considering this SciMAT classification and attending to the work of Sánchez-Polo et al. (2019),

this study proposes three major institutional voids of the Spanish healthcare sector: 1) the lack of a clear and shared vision between the educational and health authorities about health necessities which prevents a national education policy and medical training; 2); the ageing of the population and moderate economic growth are issues expected to add pressure to the form of public financing of the SNHS; and 3), political and social inequalities that exist in society partly due to the delegation of powers to the autonomous communities.

3. Linking Institutional Voids With Counter-knowledge

Considering the peculiarity of the health sector where misinformation can have serious consequences for public health. It is important to understand the relationship between institutional voids and counter-knowledge. In this vein, the knowledge management literature maintains that when human beings do not have access to adequate knowledge structures, counter-knowledge is generated that manifests itself in the form of misinformation, misunderstandings, ignorance, and the presence of obsolete knowledge (Bolisani et al., 2019; Bolisani & Cegarra-Navarro, 2021; Martelo-Landroguez et al., 2019; Sánchez-Casado et al., 2015; Thompson, 2008). Previous studies suggest that there is no positive counter-knowledge; in fact, any counter-knowledge has a negative effect on the relationships between the different actors (Bolisani & Cegarra-Navarro, 2021).

Several researchers refer to counter-knowledge as the result of weak signals perceivable when people look beyond their core knowledge base and day-to-day business activities (Cegarra-Sanchez et al., 2017; Day & Schoemaker, 2004, 2006; Haeckel, 2004; Pina e Cunha & Chia, 2007; Thompson, 2008). For example, information against vaccination, the so-called "miracle cures", "magic cures", or "superfoods", among other elements in which many of us are not experts, are sources of misinformation that can lead us to counterproductive decisions (i.e. counter-knowledge). From this point of view, institutional voids could be considered sources of weak signals among the actors that have access to them. It is important to point out that while counter-knowledge occurs at the individual level among the affected actors, institutional voids occur at the institutional level.

The existing literature has pointed to weak signals as somewhat negative in that can pose a threat to our comfort zone (Ansoff, 1975; Day & Schoemaker, 2004b, 2006a; Ilmola & Kuusi, 2006; van Veen & Ortt, 2021). In the following paragraphs, we consider some examples of how institutional voids detected in the previous section end up manifesting as weak signals at the user level:

- Regarding the possible differences between educational and health authorities, they may give a weak signal or wrong impression to the different actors (e.g., students, physicians, health managers, etc.) that the only important thing for such authorities is to determine who and in what circumstances is possible to produce more "health" at a lower cost(Pedrero-Garcia, 2017), which promotes unfounded rumours (i.e., counter-knowledge) about the options available for either education or healthcare (public/private).
- The deficit of the SNS and the economic crisis have prompted healthcare institutions to gravitate toward patients (beyond their direct and indirect taxes, now even more charged) part of the payment for medical care through the co-payment of medicines (Gallo & Gené-Badia, 2013; Ortuzar et al., 2021; Prieto-Herraez et al., 2020), which again it sends confusing signals about the final price of the drug, whom to claim the difference in price, etc. (Ortuzar et al., 2021).
- Although article 43 of the Spanish Constitution recognises the right to health protection, there are health differences depending on the community in which one resides (Prieto-Herraez et al., 2020). For example, the Autonomous Communities dedicate 46.1% of their budget to health, with a difference that oscillates between 35.7% in Catalonia and 58.8% in Aragon(Ortuzar et al., 2021). Once again, the wrong message transmitted with these differences between communities is that political and economic interests prevail over social and civil ones(Cegarra-Navarro et al., 2021).

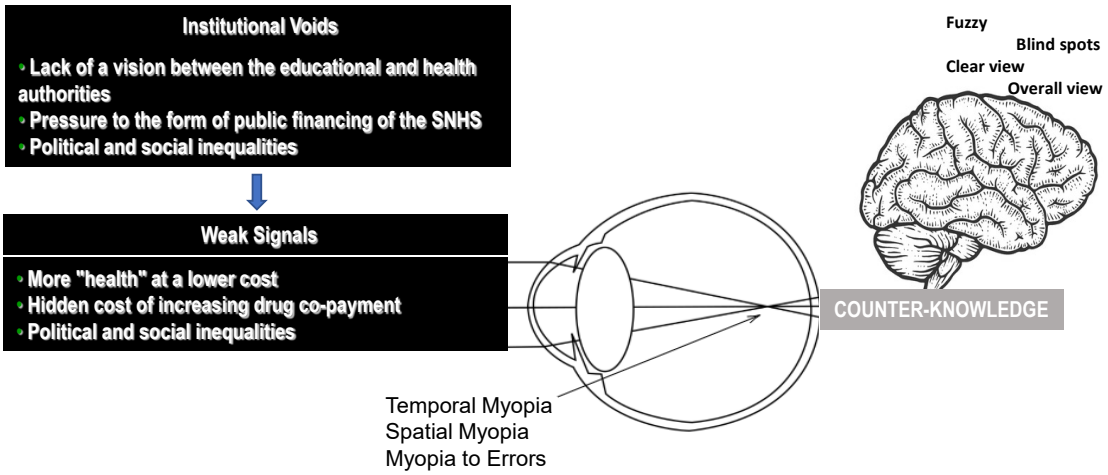
The literature on the myopia of learning maintains that when managers perceive the weak signals described above, they tend to interpret them influenced by three different scenarios: a) the wrong contexts: b) at inconvenient times; and c), under previous prejudices that prevent them from seeing reality (Czakon, 2022; Larwood & Whitaker, 1997; Levinthal & March, 1993; Seo et al., 2020; Smith et al., 2010). Extrapolating these three scenarios to the case that affects us, the present study relates the creation of counter-knowledge to three forms of learning myopia:

1. “Spatial Myopia” happens when looking into an empty visual field without frames of reference. In this case, the youngest people are the most vulnerable. Let us think about the case of people without previous experience exposed to weak signals in a new context for them. When faced with weak

signals, they will respond with more credulity and innocence in the face of misinformation or fake news.

2. "Temporal Myopia" is something like what happens when we have been using near vision for a long time, and we look up, we need some time to adapt our vision. In this case, counter knowledge would be influenced by a lack of flexibility or adaptation of the user to the above weak signals. Although older people are especially affected by this issue, the good news is that it is temporary.
3. "Myopia to Errors" is associated with a previous anomaly that prevents us from seeing correctly from a distance. For example, people suffering from glaucoma or colour blindness see different colours from those an emmetrope perceives. Something similar will happen to people with religious, political, ethnic or social prejudices; they will interpret the signals conditioned by their beliefs and experiences.

Figure 2 shows the summary of the process described above. It is important to emphasise that one thing is what the eye perceives, and another very different thing is how the brain processes these images. Indeed, the eye receives the image vertically and horizontally inverted, with total symmetry, unlike a mirror, to the light that falls on it. In other words, it is the brain that finally processes the counter-knowledge and decides to act accordingly.



Source: Own elaboration.

Figure 2: Effect of Weak Signals on Counter-Knowledge

4. Finding Blind Spots Between the Different Actors Involved

The brain controls voluntary movements, speech, intelligence, memory, and emotions and processes the information from the rest of the senses and the images it receives through the eyes. That is, the counter-knowledge can be totally or partially counteracted through the attention and intuitive cognitive process that the brain develops(Damasio, 2010; Tulving, 2002). Given the presence of weak signals when processing the counter-knowledge that comes to it, the brain interprets or rather tries to overcome it with the knowledge that comes from the intuitive cognitive process surrounding it (Castelfranchi & Miceli, 2009; Schwenk, 1984). It is important to note that not only rational knowledge intervenes in this cognitive process, as (Bratianu, 2017) suggests, emotional and spiritual knowledge can also help to create "awareness" and "understanding" in the learning process.

Having said that, this study focuses on those cases where counter-knowledge prevails over knowledge, giving rise to the so-called blind spots (Wiegand, 1999a). SNHS blind spots would be those manifestations of counter-knowledge at the actor level in such a way that, although users do not observe them directly, they can perceive them informally and indirectly. It is important to point out that blind spots can endanger not only the actors that generate them but also those whom they can influence. For example, let's take the case of a driver who does not see a car coming from behind when he is about to overtake. When that happens, not only will he(she) be in danger but also the occupants of the vehicle that is about to overtake and the one coming from behind.

One important thing about a blind spot is that just because it is blind to one actor doesn't mean it is blind to another. For example, the fact that I do not see the car ahead does not mean that the other driver does not see me. Based on these ideas, the only way to understand blind spots is to see them as a whole and from a different perspective. To understand and overcome them, it is necessary to listen and empathise with those individuals

who have suffered them before. Given that blind spots would have different manifestations for each actor (e.g., users, doctors, nurses, administrators, etc.), Table 1 collects the most significant blind spots which form the basis of the Spanish National Healthcare System (SNHS) and which should be followed very closely by healthcare authorities.

Table 1: Blind Spots in The Spanish National Healthcare System

Users	Doctors and Nurses	Administrators
Waiting lists that exceed two weeks. A lack of doctors in primary and hospital care due to political decisions in the selection processes. Collapsed emergencies and drug co-payment systems. increasingly abusive. Low data privacy awareness	Due to the low wages received, there is great simultaneity of work in the public and private sectors. Despite the approaching retirement age of many senior doctors, the youngest have temporary contracts, promoting a high rate of staff turnover. Low data privacy awareness	The duplication of medical records and files promotes a lack of coordination between primary and specialised care. Public hospitals managed through foundations with less external bureaucratic control appear. The need for cybersecurity training

Source: Own elaboration.

5. Concluding Remarks

The present study suggests that the presence of institutional voids stimulates the presence of weak signals, which in turn manifest in counter-knowledge and blind spots. To counteract the deleterious effects of blind spots and increase the probability of achieving a balance between the different actors, it is necessary to develop knowledge structures that favour empathy and trust between the different actors involved in the healthcare sector. From the view of KM, a blind spot could be defined as that knowledge gap that an individual has and that his(her) brain has filled with counter-knowledge in response to the weak signals it perceives. For this reason, it is necessary to define knowledge structures that stimulate trust and mutual adaptation between different interest groups. Only this way will they be able to deal with the tensions that may arise due to what an actor believes he(she) knows but, in reality, does not know.

In the research literature relating to blind spots, a substantial amount of theorising has been presented dealing with the ways to overcome them (Kühl, 2020; Meissner et al., 2017; Wiegand, 1999b; Zajac & Bazerman, 1991). Although the overall idea is that knowledge workers need to ask themselves and others tough questions, in this logical way of overcoming blind spots, they need to consider three additional issues: 1) the presence of institutional voids, 2) the presence of counter-knowledge, and 3), blind-spots or knowledge gaps created as a result of counter-knowledge.

In the case of blind spots among SNHS actors, as with binocular vision, where the eyes compensate each other, healthcare authorities should establish the appropriate knowledge structures that limit singular and sectarian points of view about the received weak signals from institutional voids. Among these knowledge structures, we should include not only the decentralisation of the most important decisions according to healthcare needs but also request immediate feedback on the decisions adopted to correct inequalities between different national, regional or local institutions as soon as possible. Another knowledge structure could be avoiding unspecialised and political advice when making healthcare decisions, such as placing ministers or councillors attached to a political party but with healthcare training in responsible positions. This is a fat Spaniards suffered during the years of the pandemic, where a health minister with a degree in Philosophy and political ambitions made inefficient and harmful decisions for everyone (Cegarra-Navarro et al., 2021).

Another structure of knowledge to be considered by healthcare authorities would be to avoid group thinking and sectarianism that affect the incompatibility of public and private health (Couzin et al., 2011; Hart, 1991; Janis & Hart, 1991). For this, the first step would be to assess whether these harmful elements exist in the face of certain emergencies that require the compatibility of both forms of health management. Collaboration between public and private healthcare institutions can help correct formal defects and avoid the spread of confusing messages that encourage the spread of counter-knowledge (Cegarra-Navarro et al., 2021). This collaboration can be used specially to reduce the blind spots of end users. For example, to reduce the waiting lists of patients. This way, costly and inefficient decisions such as hiring non-EU doctors by public healthcare institutions without

the required knowledge could be avoided (e.g., language proficiency or qualifications that cannot be recognised).

This study makes another valuable contribution as it postulates "weak signals" either as a result of institutional voids or as a trigger to counter-knowledge. In fact, weak signals are perceived by actors and therefore, what happens at the user level is a mismatch between the provided information and needed information, which lead healthcare actors to misinformation or lack of information. This situation led to the spread of misinformation by healthcare actors, spreading rumours and creating situations where healthcare actors believe and propagate fake news (i.e., counter-knowledge). To avoid this situation, users should check the veracity of the information before disseminating it. In doing so, health institutions should enable tools such as free contact telephone numbers.

6. Conclusions

The main purpose of this study is to link institutional voids with blind spots through counter-knowledge in the Spanish Healthcare System. Our research highlights some of the key factors that help create a competitive advantage through the incorporation of practices related to counter-knowledge. The contributions made by this study present both theoretical and practical findings.

From a theoretical point of view, the research has shown the linking between institutional voids, blind spots, and counter-knowledge in the Spanish national healthcare system. From the view of KM, counteracting the detrimental effects of blind spots, institutional voids, and counter-knowledge presents opportunities to achieve a balance between the different interest groups and it is a theoretical contribution but also a managerial implication to implement in healthcare systems.

The main practical implication is for the users, doctors and nurses, and administrators they can develop knowledge structures that favour empathy and trust between the different actors involved in the healthcare sector. From a KM perspective, it is necessary to define knowledge structures that stimulate trust and mutual adaptation between different interest groups. Another practical implication of this study is that it can contribute to the better use of public funds. It is necessary in a crisis situation, such as the current pandemic context, wars, high unemployment, and weak economies, for the efficiency of public resources (for instance, European funds).

Despite its valuable insights, the research is limited because it study is only from a theoretical perspective and only analyses the case of one country. Future research could also be an opportunity to do quantitative research. Finally in future research, more countries should be included in the study.

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The Role of the Intellectual Potential of Employees in Creating the Goodwill of a Teaching Hospital

Jolanta Chluska
Częstochowa University of Technology, Poland

jolanta.chluska@pcz.pl

Abstract: Hospitals are medical entities providing health services to patients. The dominant share of labour costs in the cost structure of the healthcare entity is evidence of the critical role of employees in a hospital's activities. Specialized medical staff provide medical services and educate future medical staff, while also conducting clinical trials and supporting the development of medical technologies. The article aims to recognize the impact of the intellectual potential of employees on creating goodwill in a teaching hospital. The inference was made based on the financial data available on hospital employees' income and labour costs as factors in the development of the goodwill of a teaching hospital. The following research questions were posed: whether the existing legal regulations regarding the financing of the activities of teaching hospitals in Poland, including the costs of medical staff, are conducive to the creation and development of goodwill of teaching hospitals; whether the ratio of the value of operating revenues to labour costs can be considered as a determinant of the increase in the goodwill of a teaching hospital. The research was conducted based on reporting data for 2018 - 2019 involving selected teaching hospitals as the basic units associating high-class medical specialists. The research was empirical and based on quantitative and qualitative data. The analyses were of an expert nature, from the perspective of a statutory auditor and a long-term researcher of the problems of the functioning of medical entities - hospitals. The preliminary findings indicate that the intellectual capital of teaching hospitals is crucial in creating and developing the goodwill measured by the ratio of the value of operating revenues to labour costs. The considerations undertaken in the article are an essential voice in recognizing the conditions for developing hospitals as entities with intellectual capital that is helpful in solving health problems on an international scale. The article is a continuation of the author's research on the development of intellectual capital of employees of teaching hospitals in Poland.

Keywords: Intellectual potential of hospital employees, Salaries of physicians, Hospital management, Knowledge workers in hospitals, Goodwill

1. Introduction

Ownership transformations in healthcare entities pose new challenges in the valuation of assets, liabilities, costs and revenues. The Polish legislation provides for the transformation of medical entities, including the liquidation of an entity, merger of several entities, and transformation of an independent public health care institution into a capital company. If the transformation of a medical entity into a capital company is carried out in accordance with the Law on Medical Activities, the closing balance sheet of the independent public healthcare institution becomes the opening balance sheet of the company, with the sum of equity equal to the sum of the founding fund, the establishment fund, the revaluation fund, and the retained earnings for the period of operation of the entity before the transformation. Teaching hospitals operating as independent public healthcare institutions may also be transformed into capital companies. However, this requires the approval of the minister of higher education and science and the minister of health. Goodwill is disclosed in buy-sell processes, business mergers, and consolidated financial statements. These events are possible in medical entities after their transformation into capital companies.

Medical entities in Poland provide health services by employing high-class specialists (doctors). Their education and the obligation of continuing education make the intellectual potential of employees of medical entities, especially hospitals, their most important resource.

Revenues obtained from providing health services and other tasks contribute to the development of the hospital, increasing its importance in the health care system. By employing staff with high intellectual potential, the hospital can apply for contracts with the payer (Narodowy Fundusz Zdrowia - NFZ). The increase in the value of contracts is associated with higher hospital revenues. It can also make it an attractive place of employment and education for future medical staff, thus increasing the organisation’s value.

2. Goodwill of a Hospital Literature Review

In the era of globalization, with the economy increasingly based on knowledge, the concept of goodwill has changed its meaning. While defining goodwill, it is necessary to take into account several factors and microeconomic and macroeconomic determinants, while also the conditions of the functioning of business entities. Goodwill is perceived differently. Selected opinions and definitions are shown in Table 1.

Table 1: The Essence of Goodwill

Source	Characteristics of goodwill
Accounting Act	The difference between the purchase price of a specific entity or its organized part and the lower (than this price) fair value of the net assets acquired.
IAS 38	Differences between an entity's fair value and the balance value of its net assets identifiable at any time may result from a number of factors that affect the entity's fair value.
Pratama, Pangiarti (2023), p. 30	Goodwill is the difference between the payments made to the company and the net fair value of the identified acquired assets.
Chelba, Melega, Grosu (2023), p. 526	Goodwill is seen as the ability of the entity to produce a profit, which derives either from specific factors capable of contributing positively to the generation of income (being obtained over time, for a consideration, not having an independent value) or by increasing the value of the whole set of assets that the entity owns in relation to the value of each individual asset.
E.A. Hendriksen and M.F. van Breda (2002), pp 635-636	The value of intangible assets attributed to a business entity that are not reported as assets but explain the goodwill, which results from favourable attitudes toward the company (e.g., good customer relations, reputation).
Jennings, LeClere and Thompson (2001), p. 20	The difference between the value of a company's ownership interest and the fair value of its identifiable net assets represents comparative advantages that are expected to enable the company to generate earnings in excess of a 'normal' return on investment.
Kamela-Sowińska (1996), p. 9, 31	An intangible asset, independent of the cost of its production, attributed to the enterprise operating on a going concern basis, which does not exist outside the enterprise.

Source: Self-analysis based on literature.

Strojek-Filus argues that important sources of goodwill include the undervaluation of assets, the human factor (employee qualifications), social factors (employee relations), market factors and technological factors (Strojek-Filus, 2013).

Similar to the definitions of goodwill, different classifications of goodwill have been used. From the point of view of the subject undertaken in the present study, it is important to divide goodwill into the following:

- acquired goodwill (disclosed in balance sheet assets) and
- internal goodwill (not disclosed in a financial statement).

Acquired goodwill can be considered from the point of view of its type as personal goodwill, goodwill from a collection of assets, while also goodwill on consolidation (Ignatowski, 1995).

The absence of buy-sell transactions in independent public healthcare institutions justifies a greater emphasis on the identification of goodwill internally generated in hospitals as the sum of the components that determine the strength and quality of a healthcare entity in the healthcare market.

The biggest theoretical and practical problem in medical entities is the determination of the structure of goodwill and linking it to other assets. These problems concern not only the identification of goodwill but, more importantly, its valuation.

Reilly states that a prerequisite for the valuation of intangible assets is to understand the reason for their creation (Reilly , 2015).

The timing of goodwill is also difficult to determine. It cannot be unequivocally identified as a long-term factor in creating company success. The assessment of an entity's ability to achieve economic benefits on a goodwill basis can change. According to IAS 38, internally generated goodwill is not recognized as an asset because it does not meet the basic conditions for such separation (identification, valuation, lack of control) (IAS 38, item 49). An unquestionable factor in creating internal goodwill is a highly skilled staff, which constitutes intellectual capital. It is a source of competitive advantage and determines the company's reputation. This is confirmed by the opinions of such researchers as Falk, Gordon (1977), Low, Kalafut (2006).

The intellectual capital of a hospital's employees can be defined as an intangible resource, the potential of employees, resulting from their education, knowledge, experience, and talent. Recognising the impact of intellectual capital on creating a company's value in teaching hospitals can affect conscious and effective talent management (Mitosis et al., 2021; Ingram, Glod, 2016; Stuss, 2021; Bonneton et al., 2019). Selected definitions of intellectual capital related to its relationship with goodwill are presented in Table 2.

Table 2: Selected Definitions of Intellectual Capital

Author	Concept/Definition
Ayatollahi, Zeraatkar (2020), p. 100	In healthcare organisations, KM processes can be represented as three subprocesses: knowledge generation or creation, knowledge codification or storage and retrieval, and knowledge transfer/realisation or knowledge transfer/application.
Chang, Chen, La (2008), p. 300	Intellectual capital represents the knowledge-related intangible resources of a firm and consists of three essential elements: structural, human, and relational capital.
Herman (2008), p. 41	Intellectual capital consists of three elements: human capital, structural capital, and customer capital, also known as relational or social capital.
Bontis et al. (1999), p. 397	Intellectual capital has attributes that contribute to the value of the company. It is a set of intangible resources and methods of their transformation. Intangible resources are all factors related to the processes that contribute to the growth of the company's value.
Nahapiet, Ghoshal (1998), p. 245	Intellectual capital is knowledge and its associated potential and social capabilities such as organisation, intellectual community, skills, and work experience.
Roos, Roos (1997), p. 415	Intellectual capital is the sum of a company's hidden assets not included in its financial statement, including what is in employees' minds and what is left when they leave.

Source: author's study based on literature.

Various researchers have commented on the impact of intellectual capital on company value (Luthfiani, Suryani, 2022; Fołtys et al., 2021; Kucharska, 2022; Scafarto et al., 2023). However, they did not propose specific measures to quantify this impact. Instead, their focus was on the role of human capital in fostering innovation and competitiveness. With its employees' high intellectual potential, the teaching hospital secures numerous health and other specialised services contracts. These contracts increase revenues from the hospital's primary operational activities.

New, increasingly larger contracts and tasks lead to an increase in employees' salaries. The fact that revenues are growing more rapidly than salaries suggests increased work efficiency, which can be regarded as a company value source. These relationships are considered in the author's attribution of the increase in the teaching hospital's value, as presented in this article.

3. Methodology of the research Characterization of the Research Object

The aim of the paper is to assess the effect of the intellectual potential of employees on the creation of goodwill in a teaching hospital. Inference was made based on the financial data available on the formation and growth of incomes and labour costs of hospital employees as factors in developing the goodwill of a teaching hospital.

The following research questions were asked in the study:

- Are the existing legal regulations on financing the operations of teaching hospitals in Poland, including the labour costs of medical staff conducive to the emergence and development of the goodwill of teaching hospitals?
- Can the ratio of the value of operating income to labour costs be considered a determinant of the growth of goodwill in a teaching hospital?

The research process consisted of the following steps:

- analysis of legal acts on the rules of operation of teaching hospitals,

- assessment of the role of the intellectual capital of employees of teaching hospitals in the creation of competitive advantage in the market of health services (literature review, review of the websites of teaching hospitals, synthesis),
- obtaining data from financial statements from the National Court Register (selection of data from profit and loss accounts, additional information, other reporting data),
- compilation and selection of selected data that characterize the costs of human resources (labour costs), revenues from the sale of health services,
- the use of selected measures of structure and dynamics to characterize the relationship between the analyzed revenues and costs of human resources; expert analysis of data from financial statements.
- analysis of conclusions of selected areas of research conducted by the author in previous years on the financial statements of hospitals and the intellectual capital of hospital employees,
- conclusion of the study.

Of the 29 teaching hospitals in Poland, 10 were selected for analysis. The founding bodies of these hospitals are medical universities or local governments. There is one teaching hospital in Poland in the form of a limited liability company, while other teaching hospitals are independent public healthcare institutions. The entities were included in the study based on the possibility to obtain complete financial data on the entity in the form of financial statements, particularly the profit and loss account and additional descriptive information in 2018-2019. The choice of the period of the study was dictated by the operating conditions of teaching hospitals. In subsequent periods, teaching hospitals carried out tasks aimed at combating the COVID-19 pandemic. Basic activities were limited as hospital resources were used to treat COVID-19 patients. Revenue from operations during these periods was also spent on treating patients with COVID-19. The choice of such data as labour costs of employees and revenues from the sale of medical services for the analysis resulted from the fact that the parameter of the increase in goodwill in the form of financial performance, due to the generally low profitability of medical entities and negative net asset values, was considered to be not very precise.

Teaching hospitals are distinguished among medical entities not only by the type of specialized health services but also by important tasks of training medical staff, teaching, research, consultation, opinion-forming and other tasks assigned by scientific institutions, local government units, or central authorities. Hospitals are allowed to conduct business activities if they do not impede the basic tasks for which they are established. Such a wide range of activities and educational, research, and scientific tasks determine a very high level of knowledge and skills of medical staff, which was the reason for choosing this group of medical entities selected as subjects of the study. Teaching hospitals provide a knowledge management environment for intellectual capital (Bose, 2003). Employees at teaching hospitals are constantly developing their intellectual potential. This is a long-term strategic activity.

4. Results: A Proposal for a Teaching Hospital's Goodwill Growth Attribute

The Polish legal regulations stipulate both the rules of practicing medical professions, education of doctors, acquiring certificates to be licensed to practice a profession, professional responsibility, but also the working time and ways of calculating salaries in medical entities. For this reason, explicitly linking the labour costs of doctors to the creation of goodwill is difficult. Salaries and other labour costs of medical employees of teaching hospitals depend on the level of education, specialty training, titles and degrees, and managerial and administrative functions. With employment contracts, there is a significant relationship between the creation of intellectual capital of employees and the increase in goodwill. As the practical experience of selling medical practices in the United States shows, the personal goodwill transferred as part of the transaction has significant value. It stems from the doctor's specialized knowledge, specialization, reputation, and professional standing. Personal goodwill can reach a significant level in the sales value structure. Appraisers utilize three approaches to value the personal goodwill of selling physicians. The two primary approaches are the "with and without method" and the multi-attribute utility model. The third method is the residual method, in which the other assets of the practice, both tangible and intangible, are identified and valued, with the residual value representing personal goodwill (Levin et al., 2022).

The analyses performed in the present paper are in line with the concept of the “Multi-attribute Utility Model” as a complement to valuation attributes.

Teaching hospitals in Poland earn revenue from the sale of health services based on contracts with the payer, namely, the National Health Fund. The contract is contingent on having qualified medical staff and specialized equipment. Medical staff requirements mean that the professional competence and intellectual potential of

medical staff determine the increase in revenue from core activities. Complementary sources of financing operations include the implementation of paid health services, separate business activities, grants, while also funds from the European Union, among others. The salaries of medical employees and their mode of work are regulated by several legislative acts. These regulations stipulate both the rules of practicing particular medical professions, education, acquiring certificates to be licensed to practice a profession and professional responsibility, but also working time and ways of calculating salaries, including the way of calculating the lowest salaries of employees working for medical entities. The managers of teaching hospitals increased employees' salaries during the 2018-2019 period under review. In the nine hospitals analyzed, the increase was more than 10%. Other labour costs were also increasing similarly. Operating income and labour costs at teaching hospitals are presented in Table 3.

Table 3: Revenues and Labour Costs in Teaching Hospitals

Teaching hospital	Revenues (thousand PLN)		Labour costs (thousand PLN)		Increase in revenue (%)	Increase in labour costs (%)
	2019	2018	2019	2018	2019/2018	2019/2018
1	109,944	100,751	78,158	65,672	109	119
2	89,029	77,044	76,357	64,323	116	119
3	126,898	111,147	71,974	59,970	114	120
4	287,437	264,773	129,147	115,176	109	112
5	447,366	402,110	253,600	219,827	111	115
6	535,304	458,222	239,707	204,411	117	117
7	122,235	101,584	71,357	59,813	120	119
8	713,598	631,781	341,513	302,696	113	113
9	474,342	447,044	252,661	205,019	106	123
10	447,862	413,487	199,613	173,665	108	115

Source: Self-analysis.

During the periods studied, 8 hospitals showed an increase of 1-10% in the number of employees. As the data in Table 3 shows, revenues from the sale of healthcare services and labour costs were on the increase. The rate of this increase can be considered in a similar way. Using the ratio of revenue from the sale of health care services to total labour costs as an indicator for measuring labour cost efficiency, these costs in the teaching hospitals studied are shown in Table 4. Trends in changes in the value of revenue per employee are also presented.

Table 4: Labour Cost Efficiency Indicators

Hospital	Labour cost efficiency Revenue to labour costs (%)		Increase (%)	Revenue per employee (thousand PLN)		Increase (%)
	2019	2018	2019/2018	2019	2018	2019/2018
1	141	153	92	104.31	100.45	104
2	117	120	97	89.66	82.40	109
3	176	185	95	137.19	126.59	108
4	223	230	97	175.48	164.56	107
5	176	183	96	154.96	140.55	110
6	223	224	100	175.91	154.54	114
7	171	170	101	137.03	114.78	119
8	209	209	100	207.38	229.49	90
9	188	218	86	187.71	140.71	133
10	224	238	94	140.97	162.85	87

Source: Self-analysis.

A greater increase in the ratio of revenue per employee than in the ratio of revenue to labour costs means that there was a significant increase in labour costs in the period under study. The increase in revenue per employee confirms the motivational effect of the salary increase and, at the same time, the increase in the effectiveness of employees whose work and competence affected the increase in revenue.

In the hospitals studied, the mean salaries were higher than for the entire healthcare system in Poland. This fact showed that managers of teaching hospitals appreciated the increase in the professional competence of employees and motivated for further professional development of the staff.

A positive trend of the analyzed processes is the simultaneous increase in salaries and operating income. This demonstrates the development of the intellectual potential of the medical staff of teaching hospitals and the ability of this potential to stimulate revenue from providing health services.

As the data in the tables demonstrate, the efficiency of labour costs remains relatively consistent, indicating that revenue increases proportionally with the rise in labour costs. This scenario benefits all involved: the employees see their efforts duly compensated, the company's value rises, and the institution as a whole develops.

It would be detrimental if salaries were to increase while revenues remained static. Equally unfavourable would be a situation where revenues grew faster than salaries. This would imply that the efforts made by employees to generate increased revenues are not being rewarded appropriately. Such a situation could potentially result in employees being less inclined to engage in activities promoting the development of the entity and their professional growth.

The trends observed in the teaching hospitals studied and in other hospitals were similar with respect to the scope and type of operations, education of the medical staff, and legislative basis of hospital activity.

5. Discussion on Results and Implications for Practice

Linking goodwill to the intellectual capital of teaching hospitals must take into account the legal regulations of the health care system in terms of financing health services and the practice of the medical profession. Systemic conditions limit the legibility of the relation in terms of the development of human capital, goodwill, and the impact of these factors on the financial status of medical entities. This is due to the limited financial resources of the health care system, the limitation of the working time of medical personnel, and the statutory method of calculating the minimum wages of medical entities. Macroeconomic determinants also affect trends. These include globalization, pandemics, the development of information technology, while also national and international health policies.

Observation of the organizational and legal transformations of the health sector in Poland reveals a trend of restructuring aimed at reducing the employment of medical staff to save labour costs or change forms of employment. Such measures result only in short-term savings. This does not have the expected effect of improving the financial status of entities in the long term.

One example is the effects of the change in the legal forms of medical entities in Poland between 2011 and 2014. Most independent public healthcare institutions were transformed into capital companies by 2014. At the time, 174 hospitals, accounting for 16% of their population, changed their legislative forms. Of the 49 hospitals studied, 38 reported a net loss, while the remaining 11 recorded a profit. The total revenues of the companies increased by 9.06% from 2011 to 2013. Total costs increased by 7.19% during this period, whereas salary costs increased by 2.85%. The ratio of salary costs to total costs decreased to 43.32%. To reduce the costs of hospital companies, the form of employment of medical staff was changed by abandoning employment contracts in favour of civil law contracts. The average employment in hospitals decreased by 6.25%. Reducing the number of employees and changing the form of employment was motivated by lower employment costs, flexible working hours, improved productivity and increased staff independence. The transformations did not guarantee an improvement in the financial status, and the improvement in financial performance recorded in 2011-2013 was similar to that in the non-transformed entities.

Cost savings due to layoffs of medical personnel and changes in hiring rules indicated that these measures were ineffective. The intellectual potential of employees is an important resource for the profit generation and development of entities. (Działalność szpitali, 2014, pp 14-30)

6. Conclusions and Future Directions

Analysis of data from the financial statements of teaching hospitals allowed for the identification of the determinants of the impact of the intellectual potential of employees on the increase in revenues from providing health services. As reliable, commonly available, and comparable parameters for assessing the possibility of developing this potential, this data is an important tool for analysis. However, they are characterized by significant limitations in teaching hospitals in Poland. Current legal conditions, the averaged nature of reporting data, and the lack of possibilities for individual analysis of a specific employee represent major barriers (Chluska 2021, 2022). This makes analysis of the development of goodwill of teaching hospitals possible, yet difficult. This is not conducive to identifying the formation and development of goodwill in teaching hospitals.

However, the effects of rational human resource management are noticeable. Attention to maintaining and developing the intellectual potential of employees results in an increase in the economic potential of teaching hospitals by increasing contracts for providing health services. This confirms the effect of the intellectual potential of employees on the creation of goodwill of teaching hospitals.

As a motivating factor to improve efficiency and increase goodwill (especially personal goodwill), the increase in salaries (labour costs) opens up new opportunities for providing health services and generating higher operating income. It can be considered that the ratio of revenue to labour costs, indicative of cost efficiency, can be considered an attribute of an increase in goodwill of teaching hospitals. The conclusions of the analyses show that the aim of the paper was achieved and the research questions posed were addressed.

Further research and analysis should determine the ratio of the revenue to labour, trends of its changes, and expected values in the economic policy of the medical entity. Answers to a number of questions in this regard can be provided by the development strategies of teaching hospitals and the decision-making processes of both teaching hospitals and the health sector as a whole.

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The Influence of Relational Intellectual Capital and Information Technology on Hospital Efficiency

Andrzej Chluski
Czestochowa University of Technology, Poland

andrzej.chluski@pcz.pl

Abstract: Knowledge management and building intellectual capital are essential for effectively operating healthcare entities. Modern information and communication technologies have an increasing impact on the activities of healthcare entities, which is attributable to the relationship of ICT and purely medical technologies with the use of ICT in knowledge and intellectual capital management. Proper management of the areas of hospital activity mentioned above significantly impacts its effectiveness and efficiency. This paper aims to present and verify a model for determining the impact of the level of relational intellectual capital and the degree of maturity of information and communication technology on the quality and effectiveness of medical services provided by hospitals in Poland. The research model was created using structural equation modelling (SEM). The basic structural model consists of four constructs corresponding to the phenomena studied and the relationships between these constructs. Each construct, as a latent variable, has its measurement model. The measurement models use a survey conducted among the management staff of Polish hospitals. The questionnaires contain carefully selected questions that are indicators of SEM measurement models. The estimation of the model parameters and accuracy was assessed using the partial least squares structural equation modelling (SEM-PLS) methodology. The hypotheses proposed in the paper were verified positively. The model meets the required quality criteria, and all parameters are statistically significant. The level of relational intellectual capital and the degree of maturity of information and communication technology positively and significantly impact the quality and effectiveness of medical services provided in hospitals. The research findings may be helpful for hospital management at the strategic management level.

Keywords: Healthcare management, Information and communication technology, Knowledge management in healthcare, Relational intellectual capital, SEM-PLS modelling

1. Introduction

Modern information and communication technologies (ICT) are widely used and affect almost all aspects of human activity. Despite many years of dynamic development, medical entities are unlikely to take the lead in the development of IT, except for advanced and innovative medical technologies that rely heavily on computer-based methods. The pace of development of medical technologies and implementation of new treatment methods is much slower due to factors such as lengthy and costly clinical trials or complicated approval procedures for new technologies and treatments. As a result, hospital managers need to work closely with IT managers and create and implement a development strategy that considers the medical sector's peculiarities and changing IT trends and requirements. This collaboration will make it possible to exploit the potential of medical IT, improve the efficiency of operations and the quality of services provided, and increase the competitiveness of medical facilities in the market.

Economic efficiency is an essential aspect of managing both commercial and public hospitals. Many healthcare systems around the world fund the activities of medical entities, ranging from private to state-funded systems. Despite differences in pricing and financing of medical services, hospital performance management is based on similar principles. Measures of financial efficiency, such as classic ratios, can be used in any system and can even be adapted to the unique conditions of the activities of hospitals. Effective hospital performance management is critical to providing quality medical services to patients.

The knowledge and skills of hospital employees represent critical intangible intellectual capital. It is a particular resource from a management perspective because the organisation does not own it. It cannot be assumed that a business organisation is the owner of the knowledge of its employees because, at best, it can only be considered a leased resource.

In addition to the knowledge and experience of staff, hospitals have intangible assets that can affect their overall performance and success. Such assets include the hospital's reputation, the general perception of its quality and reliability, and patients' opinions about their experiences with its services, staff, and facilities. The hospital's reputation is improved through consistent action, positive opinions, and effective communication with patients and their families. It is often based on factors such as the quality of medical care, patient treatment outcomes, availability of advanced treatment methods and technologies, and the hospital's commitment to patient satisfaction.

Likewise, relational intellectual capital is of great importance in hospital activities. It refers to the hospital's relationship with patients, their families, and other stakeholders. Relational capital is formed by a hospital's reputation, brand image, and trust patients and their families place in the hospital. It is critical to its success, enabling an organisation to build long-term relationships with patients and stakeholders and become a trusted service provider.

The paper describes a research model created and tested using partial least squares structural equation modelling (PLS-SEM). Rigdon (2013) argued that PLS is a widely used method for testing and validating scientific theories. Multiple simulations have demonstrated that PLS effectively tests hypotheses in various research model configurations.

2. Background and Literature Review

The level of the development of relational intellectual capital (RIC) in healthcare refers to the extent to which healthcare organisations can leverage their relationships with employees, patients, and other stakeholders to create and share knowledge and improve outcomes (De Leaniz, Del Bosque, 2013).

Developing RICs in healthcare is critical to improving healthcare outcomes and patient satisfaction. Habersam and Piber (2003) examined the relationship between RIC and patient satisfaction in European hospitals and showed a positive effect of RIC. Other studies have looked at the impact of RICs on healthcare innovation. Chang, Wu and Shei (2014) examined the impact of RICs on innovation in Taiwanese healthcare. The study found that RIC is positively linked to the implementation of healthcare innovations.

Of great importance for the effective development of RIC is the patients' perceived quality and effectiveness of treatment procedures (Lardo et al. 2017). Furthermore, Lenart (2015) showed that maintaining good relations with customers and partners is a prerequisite for good organisational governance.

The development of RIC in healthcare can also lead to improved organisational performance. A study by Wu and Hu (2012) confirmed the strong impact of RIC on hospital organisational performance. These researchers found that RIC positively impacts organisational performance by facilitating communication and collaboration between healthcare professionals, improving efficiency and effectiveness in providing healthcare services.

The problems of acquiring knowledge of medical personnel were studied by Wielki, Jurczyk-Bunkowska, and Madera (2020). Based on their findings, the authors confirmed that properly aligned information technology positively impacts organisational efficiency.

Modern ICTs support hospital information systems, which are typically associated with several core areas of activity, such as a patient's stay and medical data related to this stay, healthcare delivery, administration, and other support activities (Chluski, 2018) (Golinelli et all, 2020) (Turulja, 2020).

The maturity of information and communications technology in healthcare refers to the sophistication of the technology-based tools and systems used in the healthcare sector. The maturity of ICTs in healthcare can be assessed based on various factors such as the availability of electronic health records (EHRs), telemedicine capabilities, health analytics, and mHealth apps (Carvalho, Rocha, Abreu, 2016) (Burmann, Meister, 2021).

Public funds mainly finance health services (e.g., large insurance companies or state budgets). Therefore, in most countries, healthcare entities operate in a regulated and restricted market. For this reason, employing ICTs that have been used and proven in other areas of the economy is critical. This avoids errors and helps adapt ICTs to the specifics of the healthcare sector (Feldman S., Buchalter, Hayes, 2018).

The efficiency and effectiveness of healthcare are of interest to scientists, managers, politicians, and other social organisations. Legal regulation, actions of politicians and scientists, and practical actions of managers in this area vary depending on the degree of economic development of individual countries and the type of healthcare financing system. Evaluation of the efficiency of hospital operations should consider a country's specificity (Kozun-Cieślak, 2020)(Cantor, Poh, 2018).

The efficiency of the operation of public hospitals is a complex problem. Even in the case of commercial entities, profit generation is only one of the primary goals of their operations. In addition to providing medical services, hospitals pursue several social goals, e.g., saving patients' lives, preventing and improving public health, or promoting healthy lifestyles (Pirozzi, Ferulano, 2016).

The positive impact of IT support on building human capital and the performance of Polish hospitals was presented by A. Chluski (2018). The present paper aims to complement that research.

Jameton and McGuire (2002) examined more broadly the concept of healthcare quality in the area of the quality of the healthcare services themselves (substantive dimension), in the area of patient experiences and patient perceptions of healthcare quality (social dimension), in the area of controlling costs (economic size), and the area of environmental impact. Olkiewicz and Bober (2015) discuss the role of quality in the healthcare service provision process in Polish hospitals. Krukowska-Miler (2017) demonstrated that patients seek understanding, interest, and partnership in physicians, which are soft skills that can be considered relational capital.

Habersam and Piber (2003) believe that hospitals, primarily public organisations, must be competitive while maintaining high efficiency, responsibility, transparency, and quality of services.

3. Hypotheses and Research Model

The theoretical constructs proposed below, along with the relationships between each other, form the research model presented in this paper.

Construct: the efficiency of providing medical services is identified in three dimensions. The first concerns the financial indicators of the hospital's performance, such as profit, liquidity, and repayment of financial and tax liabilities. The second is related to the perception of hospital development by managers. The third dimension deals with the staff's views on the economic development of the hospital (Cylus et al., 2016) (Cylus, Smith, 2020).

Construct: the degree of maturity of information and communication technology is identified based on the managers' opinions on the degree of use and usability of professional and specialised computer systems in both the administrative and medical parts of the hospital departments (Carvalho et al., 2019) (Gomes, Romão, 2018),

Construct: the level of development of relational intellectual capital refers to the degree of development of intangible assets that affect the relationships between the hospital, patients, and other stakeholders. The most important resources of this type are the hospital's reputation, good experiences and loyalty of patients, the reputation of individual employees, conditions and perceived quality of treatment, specialisation, and scope of medical activities of the hospital (Wong, 2019) (Chatterji, Kiran, 2017).

Construct: the quality of provided services refers to evaluating the quality of health care in various areas, such as diagnosis, treatment, and rehabilitation. It also concerns assessing the availability of services and barriers that make it difficult or impossible for patients to receive medical care, such as the lack of medical personnel, the long waiting time for appointments, and the cost of treatment (Mosadeghrad, 2012) (Upadhyai, 2019).

In the SEM methodology, the primary research model is the structural model. It is formed by theoretical constructs and the relationships that exist between each other. The constructs correspond to latent variables. Indicators are used to measure these variables. The indicators with their corresponding latent variables form measurement models. The indicators are quantitatively measured indicators, mainly utilising the interval Likert scale.

The research hypotheses are related to the relationship between the theoretical constructs. The SEM-PLS model based on path analysis allows for the verification of the hypotheses presented in the paper. It is possible to determine the fundamental relationships between latent variables in numerical form, their statistical significance, and the direction of effect.

The following research hypotheses were posed as follows:

H1. The level of development of relational intellectual capital positively affects the efficiency of providing medical services.

H2. The level of development of relational intellectual capital positively affects the quality and availability of medical services.

H3. The maturity of information and communication technologies positively affects the efficiency of providing medical services.

H4. The maturity of information and communication technologies positively affects the quality and availability of medical services.

Table 1: Constructs, Latent Variables, and Indicators for Measuring These Variables

Theoretical construct	Latent variable	Measuring model indicator
Level of Relational Intellectual Capital development	Relat	Relat-1
		Relat-2
		Relat-3
Maturity of Information and Communication Technologies	ITmat	ITmat-1
		ITmat-2
		ITmat-3
The efficiency of Providing Medical Services	Effi	Effi-1
		Effi-2
		Effi-3
Quality and Availability of Medical Services Provided	Qual	Qual-1
		Qual-2

Figure 1 shows the research model, which includes a structural model (represented by latent variables in ovals) and four measurement models (external models) for each latent variable. The arrows in the diagram correspond to the relationships between the latent variables in the structural model. The arrows in the measurement models represent the relationships between the latent variables and the corresponding indicators. The calculation results for this model are shown in Figure 1.

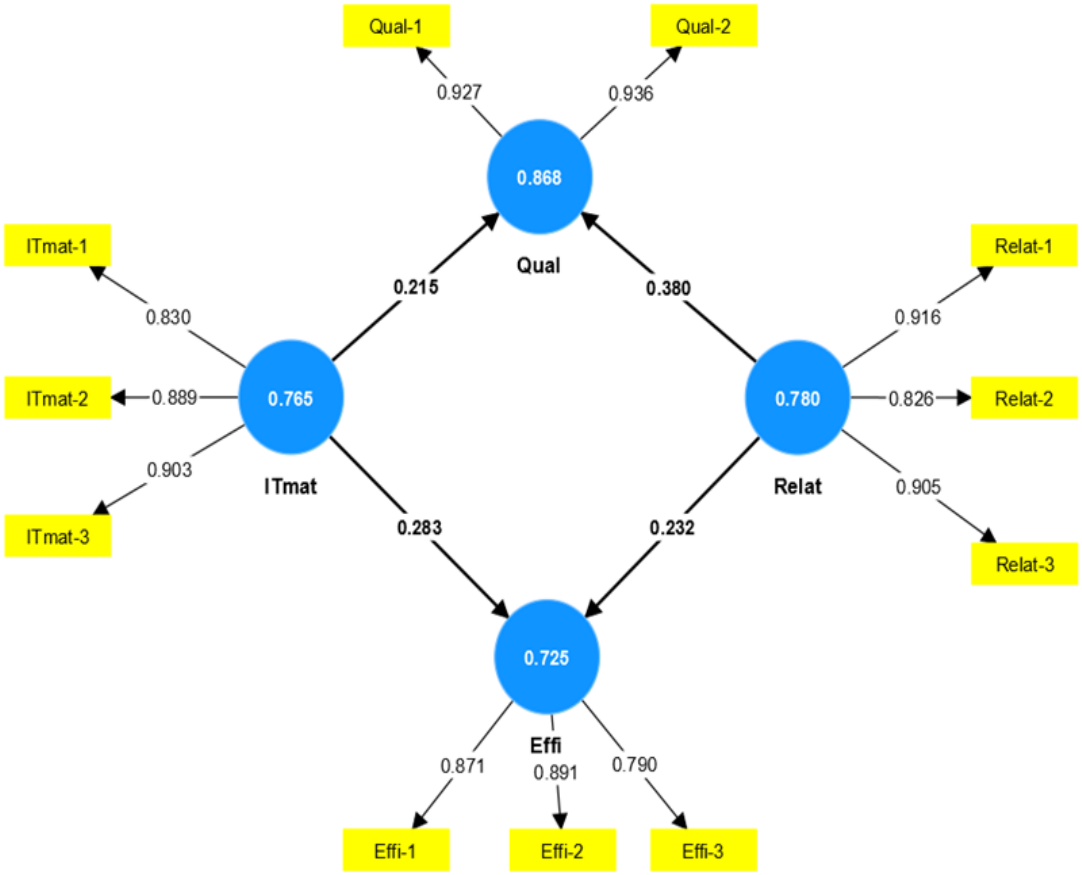


Figure 1: Structural SEM-PLS research model

4. Research Sample and Methodology

Structural equation modelling (SEM) tests hypothesised relationships between observable and non-observable variables. This applies to non-experimental correlation studies, which use passive observation as a research method. The partial least square structural equation modelling (PLS-SEM) method was used for the calculations. Goodhue, Lewis, and Thompson (2012) emphasised that, as with other techniques, there is an

increase in standard deviation and a decrease in statistical power when using PLS-SEM with small samples. Nevertheless, this method proves more reliable when the data distribution deviates moderately from the normal distribution. Bootstrapping resampling can be used to avoid the problems of non-normal data distribution and small research samples.

For the measurement of observable variables, a questionnaire was created with sentences (statements) corresponding to the indicators of the measurement models in SEM-PLSM. An interval Likert scale was used for this purpose. Questionnaires were sent to selected managers of hospitals in Poland. The distribution of hospital types in the research sample was similar to that of the entire population of Polish hospitals. Hospitals were divided into groups depending on the type of funding body (or owner) (Floyd, Fowler, 2009). Questionnaires were collected from various regions of Poland, and ninety-four correct responses were received. Poland has just over 900 hospitals (Local Data Bank, 2022).

The minimum sample size was estimated with appropriate assumptions about the test's statistical power (Kock, Moqbel, 2016). It was calculated by assuming the smallest path coefficient of 0.210, a significance level of 0.05, and a test power of 0.70.

The research sample was sufficient to yield adequate parameters of the research model for the SEM-PLS methodology. The minimum sample size for the inverse square root method was 84, while for the gamma-exponential method, it was 73 (Kock, Hadaya, 2018). The statistical significance of the results and estimation of standard errors were performed using bootstrapping. Smart-PLS software was used for the calculations.

5. Research results and model evaluation

The structural model in Figure 1 shows the latent variables and their relationships in the form of arrows with corresponding path coefficient values. The values of these coefficients and their statistical parameters are shown in Table 2. All coefficients are statistically significant ($p < 0.05$). The ovals shown in Figure 1 represent individual latent variables. Inside these ovals are average variance extracted (AVE) values for each latent variable. AVE " is a measure of the amount of variance captured by a construct in relation to the amount of variance due to measurement error" (Fornell, Larcker, 1981).

Table 2: Path Coefficients of the Structural Model and Their Statistical Parameters

	Original sample	Sample mean	Standard deviation	T statistics	p-values
ITmat -> Effi	0.284	0.298	0.087	3.255	0.001
ITmat -> Qual	0.209	0.223	0.114	1.829	0.034
Relat -> Effi	0.232	0.237	0.100	2.317	0.010
Relat -> Qual	0.415	0.411	0.118	3.503	0.000

Table 3 shows the outer loadings calculated for the original sample and those computed using bootstrapping: mean, standard deviation, T-statistic, and p-value. The path parameters of the measurement models are statistically significant and greater than 0.75.

Table 3: Path Coefficients of Measurement Models

	Original sample	Sample mean	Standard deviation	T statistics	p-values
Effi-1 <- Effi	0.870	0.860	0.067	12.974	0.000
Effi-2 <- Effi	0.891	0.882	0.058	15.406	0.000
Effi-3 <- Effi	0.790	0.789	0.076	10.392	0.000
ITmat-1 <- ITmat	0.834	0.834	0.058	14.339	0.000
ITmat-2 <- ITmat	0.885	0.880	0.043	20.605	0.000
ITmat-3 <- ITmat	0.904	0.898	0.034	26.716	0.000
Qual-1 <- Qual	0.847	0.843	0.054	15.616	0.000

	Original sample	Sample mean	Standard deviation	T statistics	p-values
Qual-2 <- Qual	0.934	0.934	0.023	41.070	0.000
Qual-3 <- Qual	0.839	0.834	0.061	13.805	0.000
Relat-1 <- Relat	0.912	0.913	0.020	45.388	0.000
Relat-2 <- Relat	0.827	0.820	0.073	11.271	0.000
Relat-3 <- Relat	0.907	0.907	0.025	35.856	0.000

The path coefficients of the measurement models presented in Table 3 are expressed in less than one relative form. Based on them, both the path coefficients of the external and external models are statistically significant, positive, and have relatively large values. The table also shows the results of bootstrapping calculations.

5.1 Quality Criteria for the Measurement Model

The SEM-PLS modelling evaluation does not use a single global indicator of model quality. In research practice, several indicators have been used to evaluate the structural and measurement models.

In the case of measurement models, verification of their parameters for model reliability and validity is required. This concerns internal consistency reliability, convergent validity, and discriminant validity for each measurement model. The internal consistency reliability was determined using composite reliability, Cronbach's alpha coefficient, and Dijkstra's rho_a coefficient. The coefficients determining the internal consistency of the research model are contained in Table 4.

Table 4: Basic Reliability Coefficients for Latent Variables

	Cronbach's alpha	Composite reliability (rho_a)	Composite reliability (rho_c)	The average variance extracted (AVE)
Effi	0.809	0.809	0.888	0.725
ITmat	0.846	0.852	0.907	0.765
Qual	0.848	0.851	0.929	0.868
Relat	0.860	0.888	0.914	0.780

The most commonly used measure of the reliability of a measurement scale is Cronbach's alpha coefficient (Garson, 2016). Cronbach's alpha values are greater than 0.8. The rho_a and rho_c coefficients assessing composite reliability are also greater than 0.8, whereas the average variance extracted (AVE) for each external model exceeds a threshold value of 0.7. Based on the bootstrapping estimation, all the coefficients in Table 4 can be considered statistically significant.

Table 5 shows the values of loadings and rotated cross-loadings. Loadings are greater than 0.8 (except for Effi-3) and significantly exceed cross-loadings.

Table 5: Values of Loadings and Cross-Loadings

	Effi	ITmat	Qual	Relat
Effi-1	*0.871*	0.239	0.365	0.305
Effi-2	*0.891*	0.243	0.252	0.228
Effi-3	*0.790*	0.345	0.177	0.194
ITmat-1	0.300	*0.830*	0.188	0.192
ITmat-2	0.258	*0.889*	0.325	0.164
ITmat-3	0.305	*0.903*	0.232	0.146
Qual-1	0.271	0.244	*0.927*	0.388
Qual-2	0.309	0.290	*0.936*	0.397
Relat-1	0.305	0.217	0.412	*0.916*

	Effi	ITmat	Qual	Relat
Relat-2	0.105	0.079	0.355	*0.826*
Relat-3	0.312	0.184	0.347	*0.905*

The Fornell-Larcker criterion was used to assess discriminant validity. Table 6 shows the correlation coefficients between latent variables. The diagonal of the table contains the square roots of AVE. The criterion is met because the values on the diagonal of the table are much larger than individual correlations (Santos, Cirillo, 2021).

Table 6: Correlations Between Latent Variables with AVE Root Values (Fornell-Larcker Criterion)

	Effi	ITmat	Qual	Relat
Effi	0.852			
ITmat	0.328	0.875		
Qual	0.312	0.288	0.932	
Relat	0.286	0.190	0.421	0.883

The following criterion that tests discriminant validity is the heterotrait-monotrait ratio (HTMT). HTML values are placed in Table 7. These coefficients are statistically significant and well below the threshold of 0.9 (Henseler, Ringle, Sarstedt 2015).

Table 7: HTMT Criterion Ratios

	Effi	ITmat	Qual	Relat
Effi				
ITmat	0.394			
Qual	0.375	0.334		
Relat	0.325	0.214	0.492	

5.2 Quality Criteria for the Internal Model

The coefficient of determination R^2 is often used to assess the quality of the SEM-PLS model. It is a statistical measure representing the percentage of the dependent variable's variance explained by the model's independent variables. R-square is a measure of model fit to the data. Table 8 shows the R^2 values for latent dependent variables. Based on bootstrapping calculations, the R^2 coefficients can be considered statistically significant (p-value < 0.01).

Table 8: Coefficients of Determination R^2

	Original sample	Sample mean (M)	Standard deviation	T statistics	p-values
Effi	0.159	0.189	0.067	2.387	0.009
Qual	0.222	0.254	0.082	2.707	0.003

The coefficient of determination (R^2) is considered a good indicator for interpreting effect size due to its slightly lower values than correlation coefficients. The effect size is considered small for $R^2 > 0.02$, medium for $R^2 > 0.13$ and significant for $R^2 > 0.26$ (Cohen, 1992) (Cohen, 1988).

Another measure of model quality is the degree of colinearity of individual pairs of model variables. The total variance inflation factor (VIF) used to estimate this colinearity should be less than 5 (Hair et al., 2022) and according to Kock (2015), even less than 3.3. Table 9 shows collinearity statistics (VIF) for the external model.

Table 9: Colinearity Statistics (VIF) for the External Model

	VIF
Effi-1	2.516
Effi-2	2.775

	VIF
Effi-3	1.398
ITmat-1	1.765
ITmat-2	2.223
ITmat-3	2.489
Qual-1	2.183
Qual-2	2.183
Relat-1	2.471
Relat-2	1.870
Relat-3	2.474

The individual internal model variables' colinearity statistic (VIF) is 1.038.

5.3 Indices of the fit of the Structural Model

Basic indicators of model quality are contained in Table 10.

Table 10: Basic Model Quality Indicators

	Saturated model	Estimated model
SRMR	0.074	0.080
Chi-squared	127.621	130.000
NFI	0.759	0.755

Standardised root mean square residual (SRMR) is the difference between the observed correlation matrix and that implied by the model. It allows for assessing the mean level of the discrepancy between the observed and expected correlations as an absolute measure of model fit. A value of less than 0.10 (or even 0.08, according to Hu and Bentler (1999)) is considered a good fit. Henseler et al. (2015) presented SRMR as a measure of goodness of fit for PLS-SEM that can be used to avoid model misspecification.

The normed fit index (NFI) indicates a good fit if it is greater than 0.8. NFI represents an incremental measure of fit. Its main drawback is that it does not penalise the complexity of the model. The more parameters in the model, the higher (i.e., better) the NFI score. For this reason, this indicator is not recommended for more straightforward and less complex models.

Another criterion of model quality is whether the coefficient d_G (from the original sample) is below the confidence interval after bootstrapping calculations. This is a bootstrapping-based test of the discrepancy between the empirical covariance matrix and the covariance matrix implied by the research model. The use of the d_G coefficient was proposed by Dijkstra and Henseler (2015).

Table 11: Results of the Divergence Test Between the Empirical and Implied Covariance Matrix

d_G	Original sample (O)	Sample mean (M)	95%	99%
Saturated model	0.218	0.213	0.263	0.295
Estimated model	0.224	0.215	0.266	0.299

The d_G values for the research model are below the 0.95 confidence interval. Therefore, the differences between the tested matrices are not statistically significant.

6. Discussion and Conclusion

The present paper confirmed the hypotheses concerning the impact of the level of development of relational intellectual capital (variable: Relat) and maturity of information and communication technologies (variable: ITmat) on the quality (Qual) and efficiency of medical services (Effi) provided by hospitals in Poland.

The path coefficients of the research model were statistically significant, confirming the validity of the relationship between the variables included in the model. Furthermore, both the measurement models and

the structural model met the statistical and qualitative assumptions that are commonly required in the social sciences for this type of research methodology. Consequently, the study's results can be considered reliable, providing valuable information on the relationships between the variables in the research model.

During the construction of the model, a path connection corresponding to the relationship of quality (Qual) and efficiency of medical services (Effi) was tested. The path coefficients corresponding to the Effi <-> Qual relationship were minimal and not statistically significant. Therefore, this relationship was not included in the research model. The model did not confirm a direct relationship between the quality of services provided and the efficiency of hospital operations.

The model presented in the paper shows the relationships between the constructs studied. In addition to the numerically expressed relative force, these relationships have a specific sense and direction (arrow in the graphical representation of the model). Some researchers equate this direction with a cause-and-effect relationship (Loehlin, 1987, p.13). However, a prerequisite for this type of relationship is demonstrating that the cause occurred earlier (before the effect), which is impossible in SEM modelling. Table 12 shows the numerical values of the relative relationships between the variables of the structural model.

Table 12: Values of Path Coefficients of the Structural Model Estimated Using Bootstrapping

ITmat ->Effi	0.298
ITmat -> Qual	0.223
Relat -> Effi	0.237
Relat -> Qual	0.411

The exploratory research presented in the paper is pilot in nature. The presented research model can inspire further research on analysing the discussed concepts and phenomena. One potential direction for future investigations is developing a hierarchical structure for the research model. This would require the creation of new theoretical constructs hierarchically linked to each other, allowing a more detailed analysis of the relationships between model elements.

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Knowledge Management in Ecolabnet Project: Practical and Theoretical Utilisation of Eco-Innovations

Grzegorz Chmielarz
Czestochowa University of Technology, Faculty of Management, Poland

grzegorz.chmielarz@pcz.pl

Abstract: The underlying objective of the paper is to analyse the process of managing theoretical and practical knowledge about eco-innovations, utilising it in ECOLABNET project. A network of project partners consisting of RDI institutions, Intermediary Organisations, and universities was established to promote exchange and dissemination of knowledge on eco-innovative solutions and services among Small and Medium-Sized Enterprises (SMEs) in the countries of the Baltic Sea Region. The paper presented the principles applied in the knowledge management (KM) process within the project with a particular stress on the research conducted on the group of European SMEs form the Baltic Sea Region (BSR), first stage of ECOLABNET project implementation. The research provided much needed knowledge on the project's beneficiaries – SMEs form the BSR region and facilitated the adjustment of the offer of the project consortium. Expert knowledge, eco-innovative products and services that have been provided by the network of partners assist SMEs in implementing and commercialising eco-innovative solutions. In this way they significantly contribute to practical application of sustainability principles by expanding the offer of project beneficiaries (SMEs) with environmentally-friendly products and services. In addition, the author also, highlights the advantages of a combined approach including expertise in the form of theoretical knowledge being supported by prototypes of eco-innovations. Their particular role in strengthening the eco-innovative capabilities of the entire network and the overall success of the project have been detailed as well.

Key words: Eco-innovative products, Eco-innovative services, Knowledge management (KM), SMEs

1. Introduction

Successfully implemented projects in the area of eco-innovations that aim to achieve their strategic objectives are increasingly taking on the form of combined efforts of various actors, frequently formal organisations. Their strategic achievements require the integration of expertise, experience and efforts of all engaged stakeholders, despite the fact that such projects tend to be temporarily joint conglomerates that are united by common goals and cease to exist once these goals have been achieved. Nonetheless, projects of this type are thought to combine knowledge and resources stimulating development of innovations by bridging actors from various geographical locations and providing in this way all of them with a possibility to achieve their individual goals thanks to functioning of the whole network (Czarniawska, 2018; Dougherty & Dunne, 2011; Nisula et al., 2018). Increasing the level of eco-innovations uptake by manufacturing Small and Medium Sized Enterprises (SMEs) was also the underlying goal of the consortium of partners from six Baltic Sea Region (BSR) countries that carried out the ECOLABNET project in the years 2019-2021 (while the duration of the project's results continues until 2025). The key intention of the ECOLABNET project was to foster dissemination of sustainable eco-innovations among the SMEs from the Baltic Sea Region, e.g. in medical diagnostics and electronics. Exploiting the joint potential of research, development and innovation institutions, universities and businesses comprising the network, the project aims to demonstrate new business opportunities for those enterprises that that would like to apply sustainability principles while developing eco-innovative services and products (Interreg – ECOLABNET, 2021). The project consortium ECOLABNET comprised academic institutions and RDIs from six Baltic Sea Region countries, namely: Design Centre MUOVA (Finland) – project leader, Centria University of Technology (Finland), Kaunas University of Technology (Lithuania), Vilnius University (Lithuania), University of Tartu (Estonia), Estrotech Ltd (Estonia), Lithuanian Business Confederation, Sustainable Innovation (Sweden), VIA University College (Denmark) and Czestochowa University of Technology (Poland).

The underlying objective of this paper is to analyse how the process of knowledge management (KM) in the ECOLABNET project combined with prototypes of eco-innovative products translated into its overall success. In brief, the paper seeks to answer the research question:

- RQ1 – Do examples of practical application of eco-innovations in the form of prototypes constitute a significant value added of a project?

In addition, the paper contributes to the literature on the subject through the analysis of the role of knowledge management in transnational projects and practical demonstration of its applicability in the eco-innovations area. The paper is organised in the following way:

First, in the introduction, the role of projects in supporting development and implementation of eco-innovations has been characterised in brief. The role and objectives of the ECOALBNET project and its participants have been presented in this context. This constituted the basis for raising the research question to be answered in further sections of the paper. Then, the literature review has been presented, which focuses in particular on the role of SMEs in the European economy. At the same time, the author emphasises the major problem for poor innovativeness of the enterprises from this sector, namely insufficient access to expert knowledge. In this part the notion of proper knowledge management in projects has been presented and the impact of the networking form of collaboration on enhancing projects' effectiveness has been highlighted. The empirical part is divided into two parts. The first one analyses the process of knowledge management in the ECOLABNET project. The second part seeks to answer the raised research question by analysing the advantages of utilising prototypes as examples of eco-innovative solutions, demonstrating in this way project's practical value. The paper finishes with the conclusions and directions of future research.

2. Literature Review – Links Between KM, Networking, and Innovative Activeness of SMEs

Despite the fact that SMEs are frequently referred to as "a backbone of Europe's economy" these enterprises do not perform equally well in the area of innovativeness as large enterprises. Partly to blame for this state of affairs are the limited capabilities and resources that are available to SMEs. However, the primary disadvantage they have to struggle with while comparing their R&D activeness with big enterprises is diseconomies of scale and also the current state of their development (e.g. start-up or established firm, niche or market producer) (Ortega-Argilés and Raquel & Voigt, 2009). The literature on the subject points out that one of the inhibiting factors to successfully scale up eco-innovations by the European SMEs is limited access to expert knowledge, which prevents them from commercialisation of eco-innovative products and services. It needs to be stressed here that it was this lack of collaboration between SMEs and research centres that was the major incentive for setting up the ECOLABNET project. The network of project partners integrates product-service system designers, bio-based material researchers, 3D print technology providers, eco-branding specialists and business developers. One of the advantages of such an approach mentioned in the literature on the subject is the observed link between implementing innovations and doing so in the networking form. This is because networks provide resources for innovation processes. When innovations are developed according to the network-based concept both organisations from the local community and from other geographies provide important tangible and intangible resources. Thus, such networks that include non-local actors are said to be very effective in gaining and diffusing knowledge. In addition, they also attract resources that have not been prior available within the locality and scale up innovations (Ferreiro and Lourenco, 2019). It is important that European SMEs are aware of the fact that they are lagging behind in terms of R&D activity. For this reason, they frequently resort to open innovations. According to Cavallo et al. (2021), open innovations refer to the strategy of seeking information through collaboration and partnerships with other organizations, institutions, and experts, which companies adopt when they are aware of their limitations. This outward-oriented process of seeking new knowledge and ideas is referred to as innovation-seeking behaviour of SMEs. It is conceptualised as a form of information-seeking behaviour, drawing also from the concept of open innovation (Lichtenthaler and Lichtenthaler, 2009). The literature on the subject is also abundant in the examples of the role knowledge plays in achieving competitive advantage by SMEs. More importantly, however, it is believed that proper knowledge management in case of project involving partners from several countries results in internationalisation and effective utilisation of knowledge. This in turn, supports organisations in achieving improved innovation and overall performance (Zia and Shafiq, 2017). Such projects are especially suited to SMEs as given their smallness, these enterprises tend to have limited capital for expansion (Roolaht, 2017). Griffith (2007), argues that scarcity of material resources in the context of small economies can be compensated for by having superior knowledge resources. This seems to be one of the stimuli for the European SMEs to engage actively in the area of eco-innovations and at the same time seek for collaboration with the academia to ensure their unique knowledge allows them to win a competitive advantage on local and global markets. In the era of globalization, SMEs can use their specialist knowledge and networking skills to facilitate international expansion despite the limited availability of other resources. This, in turn, leads to the issue of knowledge generation and its management, both in the projects that provide external knowledge to SMEs as well as the latter themselves. Generation of knowledge generation that is further transferred to enterprises seemingly is the key benefit of managing projects in accordance with KM principles. To be competitive, which frequently involves introducing innovative and eco-innovative products to the market, firms must anticipate market surprises, be flexible and adaptable to quick market changes, and overcome product development issues as part of their competitiveness strategy (Galli & Lopez, 2018). It is also stressed that KM induces innovations, and as such is of key importance in the process

of developing new products (Lazzeretti et al., 2016). Hence, the role of project supporting uptake of eco-innovations by SMEs lies with providing these enterprises with expert knowledge. This can be perceived as a major support for the managerial personnel of SMEs (which are frequently one-man firms), who being preoccupied with running the firms themselves, rarely find time to expand the knowledge about eco-innovations on their own. This in turn leads to introduction of new, frequently innovative and eco-innovative improvements in the manufacturing technology, which in turn translates into a more profound environmental and social impact. As a consequence, SMEs can become more competitive on global markets by enhancing the appeal of their offer and matching the expectations of increasingly environmentally-concerned customers by introducing products and services characterised by significantly reduced environmental impact and greater customer satisfaction. Thus, it can be stated that presently, it is necessary to stress in the area of sustainable management the importance of combing the actions of the beneficiaries of the created values – enterprises, and also intermediary organisations and scientific units, whose role is growing in importance as contemporary eco-innovations frequently require expert knowledge, which can be only provided by the RDI units (Chmielarz et al., 2020).

3. Knowledge Management Stages in the ECOLABNET Project

It was assumed at the very beginning that the process of proper knowledge management in the ECOLABNET project was going to be essential for its further success. Generally, it was agreed that KM should comprise the three subsequent stages: knowledge accumulation, knowledge processing, and knowledge implementation. In the graphic form these have been presented in Figure 1.

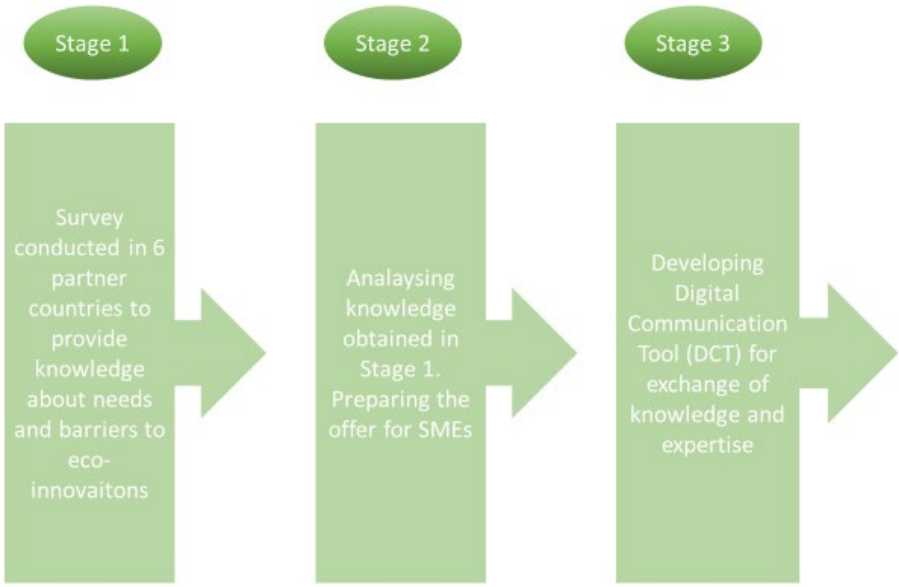


Figure 1: Stages of KM in ECOLABNET Project

As one can observe in Figure 1, the first step in the project involved, among other things, the investigation of what needs and barriers related to access to expert knowledge hinder the activeness of SME from the BSR in the eco-innovations area. This was done by means of a survey that was conducted in all six partner countries of the project with the use of the CAWI (Computer Assisted Web Interview) method. This method enabled the partners to accumulate the data necessary for further processing. This in turn resulted in drawing up a knowledge management strategy ensuring that the project goals are achieved. The survey questionnaire prepared with the use of CAWI method is displayed in the browser in the form of a web-page, so it can be reached by the respondents in different ways, the only prerequisite being access to the internet. The questions to be answered by the respondents appear on the screen while the processing of answers occurs in the background. The answers for the questionnaire are sent immediately to the main server, which allows for continuous tracking of data collection and the results (DJS Research, 2008). The survey questionnaire included 27 questions that were divided in five categories. In the graphic form they have been presented in Table 1.

Table 1: Categories of Questions in the Survey Questionnaire

Name of category	Brief characteristics
1. Metrics	Questions 1-5. Basic details about an enterprise
2. Eco-innovative engagement	Questions 6-15. Enterprise's level of current awareness and involvement in eco-innovative activity
3. 3D printing	Questions 16-21. Enterprise's acquaintance with 3D printing technology as well as potential demand for such solutions
4. Lack of expertise	Questions 22-24. Enterprise's gaps of expertise in the area of eco-innovative activity
5. Contact details	Questions 25-27. Enterprise's interest in further contact and its details

Source: Own analysis based on internal materials of the ECOLABNET project

As Table 1 demonstrates, the five questions in the first category were supposed to provide basic information about the surveyed enterprise and its profile of operation. The second category of questions (questions 6-15) was devoted to gathering information about issues purely related to eco-innovations. This pertained to knowledge about eco-innovations, existence of motivating factors as well as barriers hindering implementation of eco-innovations in manufacturing SMEs of the BSR region. The questions in the third category (questions 16-21) examined the whether the surveyed SMEs possessed any knowledge about 3D printing as an eco-friendly alternative to be applied in manufacturing processes and replacing the ones that had a negative impact on the natural environment. Then, the questions 22-24 (fourth category) were supposed to investigate the extent of the demand for expert knowledge among the surveyed enterprises. The survey questionnaire finished with the 3 questions concerning the possibility of future cooperation and address details (fifth category). The research was conducted on the group of 296 enterprises located in the six partner countries of the project, including : Estonia 69 - 23,31%, Poland 57 - 19,26%, Finland 54 - 18,24%, Lithuania 15,88% - 47, Sweden 12,84% - 38, Denmark 10,47% - 31.

Then, the knowledge accumulated in Stage 1 was processed and conclusions were drawn in Stage 2, so as to prepare the consortium's offer in a manner that will best address the indicated needs and barriers of the SMEs with regard to eco-innovative activity. The top five indicated incentives for eco-innovative activity (rated on 5-point Likert scale where 1 meant not important and 5 very important) included: satisfying customer needs – 53.19% of indications, efficient use of resources – 50.21%, strengthening the brand image – 43.40%, compliance with legislation – 42.13%, differentiation from competitors – 40.00%. On the other hand, the top most frequently indicated barriers to developing eco-innovations according to the surveyed SMEs include: lack of capital – 31.44%, lack of in-house expertise – 30.57%, limited access to external knowledge – 35.37%, lack of suitable tools and methods – 28.82%, capability to collect and process data – 35.37%. The survey allowed all the partners to analyse the level of eco-innovative advancement of SMEs in each partner country and constituted a basis for working out the final offer of the project consortium, with regard to indicated needs and barriers of developing eco-innovations. In addition, it was also in this stage that the project partners analysed their own competency gaps in the scope of providing eco-innovative services to SMEs, with a particular emphasis on the persistent problems related to lack of expertise in the area of eco-innovations. It should also be stressed here that it was Stage 2 where the offer of the project consortium was tailored to support the SMEs from the BSR in their eco-innovative efforts. The knowledge processing stage resulted in elaboration of eight categories of services to be offered to SMEs under the name of Service Packages. Each of the Service Packages includes thematically grouped services that project partners have capacity to provide. The Service Packages were elaborated based on cards of eco-innovative products and services that had been prior prepared by all the project participants. These detail their expertise in a given area of eco-innovations being also a tool that facilitates the search for particular services in the main output of the project the Digital Collaboration Tool (DCT).

Development of the DCT took place in the third stage of KM in the project. It utilises in practice the knowledge on the needs and barriers to eco-innovative initiatives indicated by the surveyed enterprises and solutions proposed by the project partners. The tool has been developed by the project partner Czestochowa University of Technology and is made available to all the remaining partners within the network. The main objective of the DCT is the dissemination of knowledge on eco-innovative products and services offered by the project

consortium to SMEs and Intermediary Organisations (IOs). Access to the DCT is free. Any business entity, Intermediary Organisation or RDI institution can register in the DCT and by doing this offer and seek for eco-innovative solutions accumulated in the tool's database.

4. Practical Demonstrators of Eco-Innovative Capabilities

One of the distinctive features of the ECOLABNET project was its utilisation of practical examples of applying eco-innovative solutions in manufacturing processes alongside with the expert knowledge about eco-innovations. This was meant to strengthen the message sent to the project beneficiaries and simultaneously increase the appeal of the ECOLABNET's offer. For this reason, the project partners were supposed to develop their proposals of eco-innovative products and services that were intended for demonstration of project consortium's capabilities in this area. Internal specification of the requirements for prototypes specified functional features they needed to possess, properties of material for their production, creation of the digital model, 3D printing trials, and final product testing. It needs to be stressed here that as the competences of the network included primarily: materials for biocomposites, product prototyping based on 3D printing, eco-product designing, designing services, life cycle assessment (LCA), eco-branding and developing business models, the underlying assumption of the project was that prototypes were produced with the use of 3D printing technology, emphasising their biodegradability and ease of production. There were five prototypes developed in the course of the project's duration, such as: optical 3D printed medical fittings made of bioresins, bio-derived 3D printable resin for medical parts, 3D printing of composite moulding tool, bio-based 3D printed chocolate box, bio-based dental 3D printing resin. Due to the limited content of the paper as well as due to the fact that the paper's author participated in the development of one of the prototypes, a biodegradable package, the process of utilising demonstrators will be presented on this example. Generally, it can be stated that the process of developing demonstrators followed the same stages. The example for the biodegradable package has been presented in the graphic form in Figure 2.

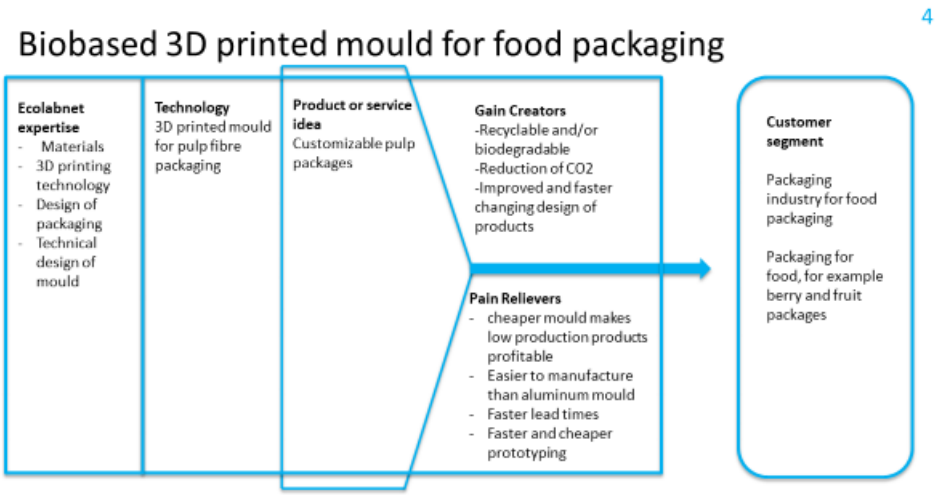


Figure 2: Biodegradable Package in the Graphic Form

Source: Internal materials of the ECOLBANET project

As one can observe in Figure 2, the first stage for developing a biodegradable package was an analysis of the expertise possessed by the project partners indispensable for manufacturing the demonstrator. The technology in the case of all the items was 3D printing. Then, the most important stage included the evaluation of the potential benefits of the item with regard to being environmentally-friendly as well as innovative in terms of production and cost. The final stage of the demonstrator's development was determination of the target customers and ideas for particular products that can be manufactured within the given demonstrator's category. Having been 3D printed, the demonstrators became an essential element of publicising the network and its eco-innovative message to the target group of beneficiaries. The promotion of the ECOLABNET's goals through demonstrators took various forms. The most important of them have been summarised in Table 2.

Table 2: Use of demonstrators in Advertising Project's Capabilities

Form of presentation	Brief description
LinkedIn platform	a group of the project was created to disseminate all the information related to the project (https://www.linkedin.com/groups/8773874/). project partners have been actively promoting ECOLABNET in their own LinkedIn profiles,
Newsletter	newsletters have been sent through the project's messaging centre, they have also been distributed to partners to use them in their own communication channels,
Presentation to different stakeholders	demonstrations conducted during personal contacts, meetings and events with different stakeholders,
Online workshops	online events for the target group of SMEs,
Scientific papers and conferences	project results have been published in conference materials and used in presentations.

Source: Own analysis based on the internal materials of the ECOLABNET project

As Table 2 demonstrates, the examples of practical application of eco-innovations in the form of demonstrators have been used extensively throughout the project. Being a showcase of project network's capabilities, they have been used the attract attention to the project's goals in the LinkedIn social platform on the project's profile as well as LinkedIn profiles of other partners. Similarly, newsletters that were distributed by partners in their communication channels spread the news of the project's capabilities. The circulation of such newsletters is difficult to measure in case of all the partners as they do not run the exact statistics. Nevertheless, it is enough to point out that the newsletter that is distributed by just one of the project partners, digital Centria News newsletter, has more than 8000 viewers. Another important issue is also the willingness of readers of social media posts and newsletter to get engaged with the content. According to extensive research in this field, just some of the results being referred to in this paper (Grönroos and Voima, 2013; Prodromou, 2015; Dong and Wu, 2015), if posts or messages are to be appealing to the target audience, the content of messages is an important element to drive engagement and reach a broader audience leading to new followers and an increase in the firm's sales potential. In this respect, it can be postulated that the demonstrators played a vital role in increasing the appeal of the project's offer and attracting the attention of the target audience, and so significantly contributed to the recognition of the project, its objectives and offer. In the case of personal meetings with various stakeholders, the demonstrators were usually used to present the practical implementation of the project's assumptions. All of these meetings have been registered and the documentation confirms that their participants expressed their further interest in utilisation of 3D printing technology especially through being eye-witnesses of its capabilities. The offer of the ECOLABNET has been presented in several online workshops and internal events of partner organisation internal events like the R&D event for the R&D Program for Creative Business and Sustainable Development in VIA. The ECOLABNET was also introduced regularly to companies in KTU Startupspace community and presented to interviewed organisation representatives and in meetings with suppliers and potential customers. In addition, the project organised an open online event Serving SMEs – Designing research, development and innovation services for eco-innovation for RDI actors and a dissemination event "Advances in developing bio-based materials and 3D printing technologies for environmentally sustainable products". During both the events the demonstrators constituted a key factor of presenting the eco-innovative potential of 3D printing technology offered by the project consortium's members as well as enhancing the pro-environmental aspect of project's goal.

In the light of the above, it can be concluded that the research question (RQ1) whether examples of practical application of eco-innovations in the form of prototypes constitute a significant value added of a project can be answered positively. This can be justified by the following reasons:

- demonstrators constituted a key element of advertising materials presenting the expertise of the ECOLABNET project consortium – the literature on the subject stresses the importance of the content of advertisements on increasing audience's engagement with the message,

- instead of just promising environmental benefits they presented real examples of working solutions in the field of eco-innovations, being therefore more credible than frequently treated by entrepreneurs as vague, lofty plans for environmental improvements in publicity materials,
- SMEs frequently indicate the issue with commercialisation of eco-innovations as they may find it difficult to assess the level of novelty and the degree of technological readiness for the commercialisation of a R&D product, how much the consumers are receptive to it, and, how the added value of the product will develop under market effects (Wang et al., 2021). Developing demonstrators alongside preparing the consortium's offer of expertise shows SMEs feasibility of leveraging the potential of eco-innovations and commercialising them on the market.
- due to the COVID-19 pandemic and restrictions introduced by all the countries of project partners the dissemination of the projects objectives, capacities adopted the form of online meetings and workshops. This meant extensive use of ICT to reach the target audience. At the time of digital revolution it is believed that interactions and relationships between organisations and stakeholders that use digital technologies to introduce new products and services that create value (Suseno et al., 2018) contribute to the development of new types of networks and create digital innovation ecosystems (Xu, 2020). As the tangible examples of an effective utilisation of eco-innovative methods of manufacturing in the form of demonstrators have become showcases of project's potential within the Digital Collaboration Tool, they played a key role in developing the ECOLABNET digital ecosystem.

In conclusion, it can be stated that the demonstrators utilised during the ECOLABNET project contributed significantly to an increase in the project's appeal both through their visual impact and power of attracting the attention of target audience. It had a measurable impact on an increase in the awareness of the managerial personnel of the SMEs from the BSR with regard to possibilities of developing eco-innovations, and what is of particular importance from the business perspective, also the way of their successful commercialisation. This in turn can lead to launch to the market of new, environmentally-friendly products and services that will be broadly accepted by the society, transforming in this way the previous lifestyle to include to a greater extent the principles of sustainability. This practical experience can be utilised in other projects to increase their persuasive message to target audiences and positively enhance the theoretical assumptions of expected project outputs.

5. Conclusions

Organisations that implement projects in the area of eco-innovations increasingly join their efforts to achieve their strategic objectives. This results in a need to combine the knowledge, expertise and experience of various stakeholders. By doing so, they stimulate development of eco-innovations not only in the local perspective, but frequently in the national or even international one. Actors that come from various geographically diverse locations bring into the project resources that would not be available otherwise. At the same time, numerous research into the innovativeness of European SMEs find out that they are unable to reach their full potential and successfully develop eco-innovations due to unsatisfactory access to expert knowledge offered by RDIs and academia. This is a serious incentive for the European Union to support projects that are meant to bridge the gap between the demand for expertise on the side of SMEs and the offer of specialist knowledge by universities and research centres. With this end in view, the ECOLABNET project united within the network of six partners from the BSR research, development and innovation institutions, universities and businesses effectively demonstrating new business opportunities for enterprises still uncertain about engagement into eco-innovative activities. Generation of knowledge that is further transferred to enterprises is believed to constitute a part and parcel of managing projects in with the use of KM principles. It is advantageous if theoretical knowledge can be accompanied by practical examples of its application. This was one of the reasons for developing prototypes, also called demonstrators, showcasing application of sustainability principles while developing eco-innovative services and products. Being a showcase of project network's capabilities, they have been used the enhance the project's appeal to the target group of stakeholders. The demonstrators that have been developed in the project to give evidence of practical application of the ECOLABNET's offer are an excellent example for European SMEs that it is possible to exploit successfully the potential of eco-innovations and commercialise them on the market. This in turn can lead to enriching the market offer of products manufactured by SMEs with new, environmentally-friendly products and services that will be broadly accepted by the society.

Future research on the role of demonstrators in projects aimed to support eco-innovativeness of SMEs may well focus on evaluating their impact by the target audience. This is the focus area of the author in the future research.

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Knowledge Management in the Context Of Remote Work in the Opinions of Employees: Challenges and Opportunities

Leszek Cichobłaziński
Czestochowa University of Technology, Poland

leszek.cichoblazinski@pcz.pl

Abstract: The article presented here focuses on the determinants of knowledge management in a remote work environment. Information and knowledge management is an essential part of organizational management, which has been undergoing major changes as electronic media, mainly internet-based platforms, have been replacing traditional interpersonal contacts completely. Knowledge production, distribution and clarification are all subject to significant transformations under conditions of limited face-to-face contact. Changes in this scope imply significant problems in knowledge management, both at the level of knowledge creation and knowledge distribution as well as information perception and exchange. As an important resource for modern organizations operating in today's economy, knowledge is particularly susceptible to all kinds of distortions in its transmission, interpretation and application. Due to the above, there is need for an in-depth analysis of the issue, both at the theoretical level and, above all, at the empirical level. The main goal of this research is to show how remote work affects knowledge management in an organization. The research was conducted on a sample of 387 respondents belonging to the Z generation. A questionnaire based on the Likert scale was used for this purpose. The general conclusion that can be drawn from the research highlights the fact that, in relation to knowledge management, remote work mode works to varying degrees depending on the industry in which the organisation operates as well as its size.

Keywords: Knowledge management, Human resources Management, Remote work

1. Introduction

Even though remote work has been known and used for a long time, the COVID-19 pandemic has forced its wider application. Taking into consideration the increasing importance of knowledge management in organisations, it is worth noting the impact that remote work shows in terms of this very sphere of functioning. Although the presented results constitute part of research focused on a much broader issue, knowledge management is still an important part of it. The main research question posed in this paper is: how does remote work affect knowledge management in an organisation?

The first part of this article constitutes of a review of the literature concerning both knowledge management and remote work. The following section includes a discussion concerning the results of the study, both in the form of descriptive statistics as well as an analysis of the Kruskal-Wallis significance test. The end of the discussion includes theoretical and practical conclusions arising from analysing the research results.

The issues addressed in this study are relevant from the point of view of both management practice and theory, and that is why the presented results may prove to be helpful for managers managing enterprises from various industries and of various sizes. These findings may also constitute a starting point for further research in this area. That is because remote work may find a permanent place in the life of an organisation, so it is important to take a closer look at the factors determining its effectiveness.

2. Literature Overview

When writing about knowledge management, it is important to present the meaning of the term "knowledge" and the broader conceptual context in which it is used in Organisational Studies. Davenport and Prusak propose the following meaning of the term: "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 minds of knowers. In organizations, it often becomes embedded not only in documents or repositories but also in organizational routines, processes, practices, and norms." (Davenport and Prusak 2000, p. 5). Norms, values, or artefacts as elements of organisational culture can include an organisation's knowledge, for example, in the field of how to achieve goals or respond to crisis situations. This also concerns the type of organizational culture, e.g. a culture based on individualism or collectivism, based on competition or cooperation that conveys knowledge about the manners of achieving goals in various ways. Changing this type of knowledge is often much more difficult than technology-type knowledge, as Information Technology concerns the realm of mechanisms regulating human behaviour in organisations, while remaining outside the realm of consciousness. There is one feature of knowledge that is worth emphasizing: people are

the ones who possess knowledge and develop it. Similarly, to information that comes from data, knowledge comes from information. Information can be transformed into knowledge through the following actions:

- Comparison: how does information concerning this situation relate to other previously known situations?
- Consequences: what is the meaning of information for decisions and actions?
- Connections: does this knowledge refer to the already possessed knowledge?
- Conversation: what do others think about this information? (Cichobłaziński 2022)

The data comes from relevant databases, records, archives, etc. Information comes from messages, but knowledge is born in the minds of people and among people who are professionals in certain areas. Knowledge can also originate from interpersonal contacts, conversations, and learning. Hence, the exchange of knowledge constitutes an important tool for creating and developing knowledge.

Exchanging and sharing knowledge are an inseparable part of organisation management. Some authors point to the role of imitation in developing knowledge (Butler and Grahovac 2012). This is why human contacts, and the favourable social, organisational, and spatial structures are so important in developing knowledge. Of course, there is a big difference between simple imitation and innovation. However, the latter is not possible without the former (Legare and Nielsen 2015). It can be stated that innovation is imitation and added value. In some situations, losing the ability to imitate, due to the lack of social contact, can lead to a loss of knowledge which, once forgotten, can no longer be retrieved[1] (Dimond 2003).

The role of knowledge sharing can be considered at many levels of the organisational structure. This is how Anna Albrychiewicz-Słocińska explains the determinants of knowledge sharing: "Sharing knowledge behaviour can be called an engine of exchange and creating knowledge processes. (…) Knowledge sharing behaviour is a first step to knowledge transfer, which is a one-way action, yet the final and most desirable phase is knowledge exchange as it reflects to knowledge seeking action." (Albrychiewicz-Slocińska 2015, p. 70)

The phenomenon of knowledge sharing has recently been strongly explored. It is significant due to the widely used digital technologies (Kukowska & Skolik 2021). However, this paper focuses on analysing the phenomenon at the micro level, i.e. at an enterprise level. It is precisely within an enterprise (or other institution) that knowledge sharing is most vulnerable to various disruptions caused by replacing "face to face" employee relationships by remote relationships (Nemțeanu, Dabija & Stanca 2021). Remote work also impacts the process of knowledge sharing in terms of organisational hierarchy and distributing power in organisations (Skolik & Karczewska 2021). In this context, it is important that knowledge sharing is not artificially restricted by dysfunctional organisational structures. Sometimes the source of these dysfunctions may consist in the managers themselves, who deliberately obstruct the flow of knowledge believing that knowledge is power (Cichobłaziński 2017).

3. Remote Work

A separate issue to focus on is remote work. The relationship between remote work and knowledge exchange is becoming an important issue. This concerns the issue of how much does remote work help or hinder knowledge sharing within an enterprise? The apogee of remote working came during the COVID-19 epidemic. It looks like its application will increase. "While some companies continue to thumb their noses at The Great Resignation and insist that employees come back into the office, data scientists at Ladders insist that the writing is on the wall. Remote work is here to stay. According to their projections, 25% of all professional jobs in North America will be remote by the end of 2022, and remote opportunities will continue to increase through 2023." (Robinson 2022). For this reason, the problem seems important, both from a scientific and practical point of view, because defining remote working is not easy. This is how Agnieszka Jeran comments on the issue: "Remote work can be treated as a special case of flexible work - out of the four dimensions of flexibility: time, relationship permanence, location, and the form of the contract between the employee and the employer, in this case it mainly concerns the aspect of location - because remote work constitutes primarily work carried out away from the employer's premises, depending on the form in the employee's place of residence or in a different location, sometimes on the move, i.e. during the employee's journey (literal, as it is not a case of delegation)." (Jeran 2016, p. 50). However, it is possible to come across definitions that shed a slightly different light on the issue of

[1] The best example is Tasmanian Aborigines who gradually began to forget well known inventions and Technologies, i.e. striking fire, swing clothes or fishery when their Island disconnected from Australian continent.

remote work. Remote work (also known as work from home [WFH] or telecommuting) is a type of flexible working arrangement that allows an employee to work from remote location outside of corporate offices. For employees who can perform work offsite, this arrangement can help ensure work-life balance, access to career opportunities or reduced commutation costs. Benefits for the company include increased employee satisfaction and retention, increased productivity and cost savings on physical resources. Remote work arrangements can be temporary or permanent, part-time or full-time, occasional or frequent. Remote work requires policies governing equipment use, network security and performance expectations (Gartner Glossary 2023). This definition emphasizes above all the practical aspects of remote work, such as reducing commuting costs or the possibility to better manage one's career.

4. Methodology

This empirical research was conducted among the employees of Polish companies which used this type of work in full or hybrid form during the COVID-19 pandemic and afterwards. The survey was conducted in autumn 2022 among people belonging to Generation Z. It was carried out among 387 people. The questionnaire was based on a Likert scale. Generation Z was chosen because it is currently the group with the greatest experience in remote work and having the greatest competence in this area. In addition, these people will be the main employee in the future on the labor market where the remote mode will dominate.

The results obtained for the dependent variables were correlated with the independent variables. In addition to traditional variables such as age and gender, there were variables related to strictly organisational aspects, such as the size of organisation, the industry in which it operates, or the length of service and position held.

The cognitive purpose of the research is to fill the knowledge gap on knowledge management processes in remote work settings. The results of the research are ultimately to be used to formulate generalisations that extend organisational theory in the field of knowledge management.

The research results presented in this paper are part of a quantitative survey entitled: "Managerial aspects of managing remote work", carried out among young people, working remotely and representing Generation Z. The survey was conducted in December 2022.

Commented [A1]: Należy chyba uzasadnić powiązanie pomiędzy terminem generacja Z a grupą badanych w wieku 15-34

The study presents an excerpt from the results of a survey concerning respondents' views on the impact of remote work on knowledge management. In terms of the conducted study, among other things, the following problem has been posed: how does remote work affect knowledge management in an organisation? The study was carried out with the use of quantitative research methods which take advantage of the survey technique. The study included young people, representatives of Generation Z, whose experience of working remotely extends to at least 2022. Due to the fact that there are no statistics concerning the number of people aged 15-34 performing remote work in Poland, the focus was on the group of young people representing the aforementioned category who are economically active. Based on the 2021 Statistical Yearbook, the size of the working population in Poland in the age range of interest to the researchers was determined at 4,802 thousand people. Table 1 presents the structure of the study population by gender and age. For the population estimated in such a manner, with the following statistical assumptions: fraction size: 0.5; confidence level: 95%; maximum error: 5% the study sample size was set at 384 persons. The study was carried out by a specialist market research agency - Fieldstat Ltd. The study was carried out using quantitative research methods, taking advantage of CATI (Computer Assisted Telephone Interview - 50% of respondents) and CAWI (Computer-Assisted Web Interview - 50% of respondents) telephone survey techniques. The mixed technique was chosen because of an increased direct contact with the respondent. Contact was made with 2,783 persons working remotely. Some people declined to participate, some were could not participate due to the survey criteria (e.g. no experience of remote working in 2022) or exhausting the sample in terms of age or gender. The assumption regarding the experience of remote working in 2022 was related to eliminating the group of workers whose work was organised remotely only due to the COVID-19 outbreak. This is because these workers most often performed their duties and tasks in an extraordinary mode, significantly deviating from the conditions for remote work defined in the literature, the primary and basic of which assumes the freedom to choose this particular form of work. The opinions of respondents forced to perform their work remotely due to external circumstances could therefore lead to falsified conclusions concerning attitudes and beliefs.

Commented [A2]: Główny Urząd Statystyczny / Obszary tematyczne / Roczniki statystyczne / Roczniki Statystyczne / Rocznik Demograficzny 2022

Table 1: Structure of Respondents by age and Gender

age categories	women population indicators	sample size women	men population indicators	sample size men	population in general (in thousands)	study sample size
15-24	357 38.93%	28	560 61.07	45	917 19.09%	73
25-29	760 43.16%	61	1000 56.84	80	1761 36.67%	141
30-34	928 43.69%	74	1196 56.30	96	2124 44.23%	170
Study sample size	2045	163	2756	221	4802	384

Source: Own study

In the end, 388 correctly completed survey questionnaires were obtained (redundant surveys do not disrupt the planned structure of the study group).

The used research tool consisted in a standardized questionnaire consisting of 57 closed statements and eight questions concerning the socio-demographic characteristics of the respondents. A Likert scale (the so-called Likert scaling technique) was used for the responses, which makes it possible to determine the relative intensity of the various responses (Babbie, 2004, p. 192). This form allows for a reliable and quick analysis of the collected material, as well as uniformity and ease of elaboration (Churchill, 2002, p. 309). The research tool (questionnaire) is proprietary and was prepared by members of the research team - employees of the Department of Applied Sociology and Human Resource Management, Faculty of Management, Częstochowa University of Technology.

The STATISTICA software was used in the process of compiling the research results. To assess the significance of differences in the analyzed variables, non-parametric tests were used: Mann-Whitney U test (UMW), Kruskal-Wallis ANOVA (AKW) test, Chi-square test. The obtained statistics were analysed using a publication by A. Stanisz (2006, pp. 369-391). Spearman's rank correlation coefficient was used to assess the strength of correlations occurring between variables. Four questionnaire validity procedures have been used: content (Rossiter 2008), face (Czakon 2014), construct (Cronbach and Meehl 1955) and nomological (Czakon 2014) ones. The scale reliability was validated using Cronbach's alpha that is a measure of internal consistency (α = ,970019).

Commented [A3]: Jak bardzo będzie potrzebne to przetłumaczę to na polski, na razie jakby ktoś był zainteresowany dołączam artykuł dotyczący walidacji narzędzia badawczego. To zdanie musiałam zamieścić ponieważ w zeszłym roku zapytał o to recenzent

For the purpose of analyzing the study results, a number of statistical hypotheses were adopted concerning the existence of significant differences in the statements of respondents in relation to their socio-demographic characteristics. It was assumed that H0 constitutes the hypothesis concerning no differences due to the grouping variable, while H1 is an alternative hypothesis about the occurrence of such differences. These hypotheses were verified using the aforementioned statistical tests allowing to reject the null hypothesis concerning the lack of significant differences and accepting the alternative hypothesis on the existence of differences in the answers provided by respondents with regard to the individual independent variables. The study presents the relationships verified with statistical tests, authorizing to draw conclusions on the regularities in the studied group.

The application-based purpose of this study is to develop methods to support effective knowledge management when working remotely. In the longer term, this research is intended to create a model for knowledge management in the large-scale use of remote work. The point is that the benefits of remote work (e.g. reduced labour costs) are not offset by counter-productive consequences in terms of knowledge management within the organisation.

5. Empirical Section Part 1 - Frequency Analysis

At this stage, the distributions of responses to questions relevant to the posed research problem, namely the question concerning a relationship between remote work and knowledge management, will be analysed.

The first question analysed in terms of analyzing the managerial aspects of remote working is whether remote working helps to better explain new knowledge to employees? In this question, the emphasis is on clarifying knowledge and removing ambiguities of various kinds. Across the entire sample, it is difficult to identify clear correlations, but when the responses to this question are analysed by the variable of gender, some differences can be identified. Men generally state that remote work allows them to better understand the communicated content. Rather agree and completely agree responses were provided by a total of just over 40% of men, while disagree and completely disagree responses were provided by only around 30%. Whereas, in terms of women, the answers to this question are distributed inversely. Circa 42% of female respondents disagree with this opinion, with around 28% of female respondents having an opposite opinion. These results indicate that women believe that face-to-face contact with a supervisor is more conducive to understanding the transferred knowledge than remote contact.

Another issue addressed in this research concerns the transfer of knowledge. It concerns the extent to which remote working is favourable for the transfer of knowledge itself within the organisation regardless of the issues of interpretation, understanding, and clarification. 40.8% of respondents agreed that remote work is conductive to the transfer of knowledge by a supervisor. Only 25% of respondents had a different opinion. It can be concluded that the remote mode works better during the transfer of knowledge itself. This probably concerns the speed and precision enabled by electronic means of communication. This form of communication is most likely to avoid problems with interpreting data, information, and knowledge. In this case, gender is not a differentiating variable: 44.3% of men and 40.% of women supported such a claim.

More information concerning transferring information under the conditions of remote work can be provided by an analysis of the responses in terms of industry. It should be emphasized that the study sample in this survey was not representative in terms of industry. The most important criterion concerning selecting people for the study was the participation of respondents in working remotely. This is why not all industries are represented to the same extent. Information and communication constitute the industries represented in large numbers. Interestingly, respondents in this sector were not evenly divided in terms of their opinions (around 38% each) of them were supporters and opponents of the thesis that remote working is conducive to knowledge transfer. Employees in this sector perform well in terms of the transfer of knowledge in both remote and stationary work. This may result from the extensive experience of respondents in this industry with work involving transferring and processing information and knowledge, and thus, the form of this work does not matter much to them.

The problem is different in the industrial processing sector. Employees in this sector have a strong preference: 50% of respondents indicated that they disagreed with the statement that remote working promotes transferring knowledge, while 14% agreed with this statement. Such opinions seem understandable, as the nature of the industry means that employees are more likely to use stationary forms of communication. It is likely that, in this industry, employees do not see an opportunity to efficiently transfer knowledge in a remote manner and find that most information and knowledge is most effectively transferred in a stationary mode.

The following analyzed problem is working in favour of collecting and documenting employee knowledge. In this case, the focus is on the sectoral breakdown, a variable that differentiates the answers of respondents in an interesting way. First of all, it is important to note the vital importance for managing knowledge in an organisation, as well as collecting and documenting it. Knowledge resources in the form of databases, but also various types of documentation in the broader sense relating to both information and knowledge in the most general sense, constitute the basis for its processing and handling. The first to be selected was the information and communications industry. The vast majority of respondents employed in the sector agreed with the statement that remote working was conducive to acquiring and documenting knowledge. There were 60% of such indications, while the opposite view was held by only around 20% of the surveyed employees. This implies that employees in this sector appreciate the role of remote working in storing data, information, and knowledge. In order to deepen the knowledge concerning opinions it would be necessary to deepen the conducted research using qualitative methods. However, even such relatively superficial quantitative data suggests that remote work allows using a wide variety of IT tools in order to facilitate the collection of data and information. Email alone and the ability to record meetings held on various platforms such as ZOOM make it possible to access their records at any time.

It is also worth noting those survey results that are not differentiated by industry. An example of this consists in the industrial processing sector. In this case, 36.3% of respondents agreed that remote working was conducive to acquiring knowledge and almost the same number of respondents (37.6%) provided a negative answer. Therefore, as it can be seen, remote work in the industrial sector is of little importance for acquiring and

processing knowledge. Traditional forms of work are definitely better suited for this, which is completely understandable in the case of industry. That is because not all work can be performed remotely and not all knowledge can be stored and processed using the IT tools that are most readily applicable for remote working.

The research results are quite different in terms of the financial and insurance industry. For this industry, positive answers for the statement "remote working is conducive to acquiring and documenting employee knowledge" were provided by 62.5% of respondents, while only 18.7% of respondents disagreed. As shown by the presented results, in finance and insurance the specific nature of this industry means that remote working is well assessed by employees in terms of knowledge accumulation. The significant digitalization of this industry allows using appropriate electronic tools to enable properly acquiring employee knowledge, which in turn helps it to be reused at another time, place, and by other employees.

A different light is shed on the issue of acquiring knowledge by analyzing it in terms of the respondents' preferred future working mode. (Which mode of working do you prefer in the future?) The study included three modes of working: stationary mode, remote mode, and a hybrid mode, combining elements of the previous two. Of the employees who prefer a hybrid mode in the future, 65.1% state that working remotely helps to keep knowledge in the organisation. Only 14.6% have a different opinion. Respondents who prefer to work remotely in the future are not very different in this respect. They also state that working remotely allows for a more efficient accumulation of knowledge at 64.6%. Only 13.2% of respondents in this group have a different opinion. However, the opinions of employees who choose the stationary working mode for the future are different. Of these respondents, just over 41% state that working remotely allows them to acquire knowledge better. A negative opinion concerning this issue was provided by 31.4% of respondents, which is significantly more than was the case among workers choosing the previous two modes. This shows that the experience gained from working remotely has an impact on employees' subsequent preferences concerning the working mode. At least, this is the case for the "knowledge accumulation" variable. However, it can be assumed that employers should take these preferences into account when selecting the mode of work depending on the specifics of the job. If it involves acquiring knowledge, the employee will prefer remote work. However, it should be borne in mind that the differences in indications, which vary at around 10%, are not so great that far-reaching conclusions can be drawn from them. Instead, they help to sensitize employers to the issue.

A following differentiating variable that influenced respondents' answers consists in the size of the organisation. The studied organisations were divided in terms of the number of employees into the following categories: micro-organisations (1-9 employees), small organisations (10-49 employees), medium organisations (50-249 employees), and large organisations (more than 250 employees). Respondents were asked to provide their opinions concerning the statement: Working remotely allows to better explain new knowledge to other employees. In this case, the larger the organisation, the fewer affirmative answers provided by respondents in terms of this statement. Employees working in micro-enterprises provided 53.3% positive responses. Among respondents employed in small businesses, 19.7% completely and partially agreed with this statement. Among workers employed in medium-sized enterprises, 20% provided such answers. When it comes to large companies, such responses were provided by 18.7% of respondents. On the basis of the above data, it can be concluded that remote working allows to better explain the knowledge in small companies than in large ones. This conclusion requires further thought, as it cannot be easily explained at first glance. It can be concluded that employees of smaller enterprises, although accustomed to frequent face-to-face contact on a daily basis, have a fairly positive view of remote work in terms of knowledge clarification possibilities. In this area, employees of larger organisations prefer direct human contact. It is likely that employees of smaller organisations know each other much better than employees of larger companies and therefore find it easier to understand the knowledge being transferred remotely. They simply know what the other person means. Employees of large organisations experience the lack of direct contact more acutely and remote forms of contact are not sufficient for them. Therefore, the following conclusion can be drawn: if work is largely remote in a large organisation, regular face-to-face meetings should be arranged to clarify any doubts concerning the transferred knowledge.

6. Empirical Section Part 2 - Findings

This part of analysis is based on the Kruskal Wallis rank statistical test, For further analysis, the independent variable of "industry" in which the remote workers were employed was selected. A statistically significant result of the Kruskal-Wallis test indicates whether a variable differentiates the responses provided by respondents.

Independent (grouping) variable: Industry in which remote work was/is performed.

The results of the Kruskal-Wallis test (p = 0), at the accepted level of significance (α = 0.05), indicate rejecting the verified null hypothesis.

This means that the industry in which the respondents worked had a significant impact on the dependent variable – provides for better explanation of new knowledge to other employees. It turns out that, according to the studied persons, remote working in this case does not help achieve satisfactory results in every industry.

Independent (grouping) variable: Industry in which remote work was/is performed.

The results of the Kruskal-Wallis test (p = 0.0014), with the assumed level of significance (α = 0.05), indicate rejecting the verified null hypothesis. It can be concluded that the industry in which the respondents worked differentiates the answers related to the dependent variable: remote working is conductive to acquiring and documenting employee knowledge. Similarly as in the case of the previous variable, also here the industry has a significant impact on the effectiveness of knowledge management in an organisation.

Independent (grouping) variable: Industry in which remote work was/is performed.

The results of the Kruskal-Wallis test (p = 0.0077), with the assumed level of significance (α = 0.05), indicate rejecting the verified null hypothesis.

Analyzing the above data allows to conclude that, also in this case, the industry significantly differentiates the responses relating to the dependent variable: remote working allows to locate people more easily with the needed knowledge.

Independent (grouping) variable: Industry in which remote work was/is performed. The results of the Kruskal-Wallis test (p = 0), at the accepted level of significance (α = 0.05), indicate rejecting the verified null hypothesis.

This variable differentiates the answers of respondents relating to the dependent variable - works in favour of transferring knowledge by a supervisor. Therefore, also in the case of the transfer of knowledge by managers of different levels to their subordinate employees, the industry in which the respondents work has a significant impact on the effectiveness of this managerial function.

Independent (grouping) variable: size of organisation.

The results of the Kruskal-Wallis test (p = 0), at the accepted level of significance (α = 0.05), indicate rejecting the verified null hypothesis.

It turns out that the size of the organisation/enterprise differentiates in a statistically significant way the answers related to such a dependent variable - the possibility to better explain new knowledge to other employees when performing remote work. Thus, the mode of work (remote, stationary, hybrid) should be adapted to the size of the organisation or enterprise.

Independent (grouping) variable: size of organisation.

The results of the Kruskal-Wallis test (p = 0.0429), at the assumed level of significance (α = 0.05), indicate rejecting the verified null hypothesis.

In this case, the size of the organisation differentiated the indications relating to the dependent variable: works in favour of acquiring and documenting employee knowledge. Also in the case of considering introducing the remote working mode, the size of the institution should be taken into account.

Independent (grouping) variable: experience of working remotely.

The results of the Kruskal-Wallis test (p = 0.0002), at the assumed level of significance (α = 0.05), indicate rejecting the verified null hypothesis.

Another independent variable differentiating respondents' indications is whether or not the studied employees have experience of remote working. The analyzed indications were related to the dependent variable: allows to easier locate people with the needed knowledge. It can be concluded that the experience of working remotely quite clearly influenced whether or not employees could more easily locate people possessing useful knowledge.

7. Conclusions

Basing on an analysis of research results - both the quantitative analysis and the Kruskal Wallis test - the following theoretical and practical conclusions can be drawn.

- Remote work has a significant impact on knowledge management in an organization, although this impact depends on several factors and is not the same in every type of organisation.
- One of the variables that differentiate the answers of respondents is the industry. In manufacturing-focused industries, remote work had relatively little significance in terms of knowledge management. This is understandable as in the production management process remote work plays a lesser role in the transfer, acquisition, and clarification of knowledge.
- Another variable to look at is the size of the organisation. The obtained research results do not allow for a clear indication of the direction of the relationship between the variables. However, the existence of such a relationship can be stated with certainty.
- An example of this is the number of indications provided for the statement: works in favour of acquiring and documenting employee knowledge. It turns out that the size of the organisation does make some difference in this case. Arguably, remote working has a greater impact on knowledge management in larger organisations.
- Similarly, in the case of explaining and transferring knowledge, remote working allows to better control the process in small enterprises than in large ones.
- Employers should consider the variables indicated above when deciding between remote, stationary, and hybrid working modes.

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Knowledge Transfer in Hybrid Organizations: A Case Study of Smart Energy Community (SEC)

Simone Cifolelli[1] Andrea Ziruolo[2] and Marco Berardi[2]
[1]Department of Management and Business Administration, "G. d'Annunzio" University, Pescara, Italy
[2]Department of Philosophical, Pedagogical and Economic-Quantitative Sciences, "G. d'Annunzio" University, Pescara, Italy

simone.cifolelli@unich.it
andrea.ziruolo@unich.it
marco.berardi@unich.it

Abstract: This paper presents a case study on knowledge transfer within hybrid organizations, specifically focusing on a Smart Energy Community (SEC) located in the Italian internal areas. Hybrid organizations, characterized by their blend of for-profit and non-profit motives, play a crucial role in addressing societal challenges while maintaining economic viability. Knowledge transfer, an essential aspect of knowledge management, becomes particularly significant within such organizations, as they navigate the complex terrain of innovation, collaboration, and sustainability. By examining the knowledge transfer practices within the SEC, this study aims to uncover valuable insights into the challenges, strategies, and outcomes of knowledge transfer in hybrid organizations. The findings contribute to the understanding of knowledge management in hybrid contexts and provide practical implications for organizations seeking to facilitate effective knowledge transfer. These insights result in the attempt to build up a replicable and transferable knowledge transfer model.

Keywords: Knowledge management, Knowledge transfer, Hybrid organizations, Smart Energy Community

1. Introduction

In recent years, the emergence of hybrid organizations has reshaped the business landscape. These entities, operating at the intersection of profit-driven goals and societal impact, face distinctive challenges related to Knowledge Management (KM hereafter). This contribution focuses on knowledge transfer in the context of an Italian Smart Energy Community, which represents a prime example of a hybrid organization and by adopting a qualitative research approach aims to shed light on the intricacies of knowledge transfer within this unique setting.

Hybrid organizations are increasingly recognized for their ability to leverage market mechanisms while addressing societal challenges. The Smart Energy Community (SEC hereafter) is an exemplary hybrid organization that aims to revolutionize the energy sector through sustainable practices and collaborative initiatives. Within such organizations, effective knowledge transfer plays a pivotal role in harnessing expertise, fostering innovation, and promoting long-term sustainability (Vakkuri et al., 2021; Grossi et al., 2022). This paper aims to explore the knowledge transfer dynamics within the SEC, identifying the challenges faced and strategies employed to facilitate knowledge sharing and collaboration.

Hybrid organizations, also known as hybrid ventures or social enterprises, have gained significant attention in recent years due to their unique organizational structure and dual objectives of generating social and economic value (Moore, 1995; Ziruolo, 2016). These organizations combine elements of both for-profit businesses and nonprofit organizations, aiming to address social or environmental challenges while remaining financially sustainable (Kondra & Hinings, 1998; Doherty et al., 2014; Mair et al., 2015). As hybrid organizations operate in complex and dynamic environments, the transfer of knowledge becomes a critical factor for their success (Jongbloed, 2015; Tangaraja et al., 2016). Simultaneously, KM plays a vital role in organizations by harnessing the power of knowledge to enhance innovation, improve decision-making, and foster continuous learning (Maurer et al., 2011; Bacon et al., 2019). By adopting appropriate theoretical perspectives, frameworks, and strategies, organizations can effectively leverage their knowledge assets and create a sustainable competitive advantage in today's dynamic and knowledge-intensive business landscape (Mazloomi Khamseh et al., 2008; Martins et al., 2019).

According to these premises, the present case study is based on the experience of the Smart Energy Community which arose in the first months of 2022 in the "Sub-Equana Valley", a highly depopulated Italian internal area which through the present project aims to increase the attractiveness and resilience of the entire territory. The SEC of the "Sub-Equana Valley" could be considered a hybrid organization because it involves members of the community in the generation, distribution, and consumption of clean energy (Barroco et al., 2021; Ceglia et al., 2022). In particular, hybridity is related to the continuous involvement of subjects and entities of third, public,

and private sectors which, starting from the embryonic stages, imagine and collectively build new models of consumption and active participation (Savelli & Morstyn, 2021). When all the solar panels are fully operational, the SEC will earn 10,000 euros per year, and for the next 20 years the members will be able to lower the bills of the participants or to invest in social projects and public interventions. The goal is to reach 300 kilowatts of photovoltaic panels by leveraging the funds of the "Piano Nazionale di Ripresa e Resilienza" (PNRR). Thus, when fully operational, with a 300 kilowatts yearly production, it will be possible to earn as much as 50,000 euros in incentives per year for the next twenty years.

As regards the methodology adopted in the present case study, it involves a qualitative approach. Data collection techniques include interviews with key stakeholders, document analysis, and observation of knowledge transfer practices within the SEC. The qualitative data is analyzed using thematic analysis to identify recurring patterns and themes related to knowledge transfer.

The novelty introduced by this contribution corresponds with the desire to fill the gap in the KM in hybrid organizations international literature, through the analysis of practical experiences capable of providing a clear representation of the knowledge transfer processes that influence the effectiveness of environmental initiatives.

Thus, the research questions underlying the present investigation are the following:

RQ1. How does knowledge transfer occur within hybrid organizations in the context of a Smart Energy Community?

RQ2. What factors influence the effectiveness of knowledge transfer in hybrid organizations operating in the Smart Energy community?

The relative answers, reported in Section 4 of the present work, could inform academics and practitioners about the state of the art of this KM case study, which is also discussed in Section 5 to trace the trajectories and establish a future agenda within this line of research. Sections 2 and Section 3 describe respectively the theoretical background and the methodologies used.

2. Theoretical Background

This section provides a theoretical foundation for understanding knowledge transfer in hybrid organizations (Billis, 2010; Doherty et al., 2014). It examines relevant concepts such as knowledge management, knowledge transfer processes, and the unique characteristics of hybrid organizations, by providing a comprehensive understanding of hybrid organizations, their definition, and the key characteristics that distinguish them from other organizational forms (Nonaka & Takeuchi, 1995; Nonaka et al., 1996; Mårtensson, 2010). Additionally, it highlights the role of knowledge transfer in fostering innovation and sustainability (Mazloomi Khamseh et al., 2008; Jongbloed, 2015; Tangaraja et al., 2016; Martins et al., 2019).

Hybrid organizations have emerged as a novel and intriguing form of organizational structure in recent years. They represent a departure from traditional organizational classifications, blending elements from both for-profit and nonprofit sectors to create a unique hybrid model (Vakkuri et al., 2021; Grossi et al., 2022). Hybrid organizations are characterized by their dual mission, which combines social or environmental objectives with the pursuit of economic sustainability. Unlike purely for-profit organizations that focus solely on generating profits for shareholders or nonprofit organizations that prioritize social or environmental impact, hybrid organizations aim to achieve a balance between the two. These organizations often strive to generate revenue through their activities, while also addressing social or environmental issues and making a positive impact on society (Vakkuri & Johanson, 2020).

In recent decades international literature promoted several theoretical perspectives, by providing insights into the emergence and functioning of hybrid organizations. One prominent perspective is Institutional Theory, which suggests that hybrid organizations arise as a response to external pressures and expectations (Doherty et al., 2014; Mair et al., 2015). They navigate the institutional environment by adopting elements from both sectors to gain legitimacy and access to resources (Moore, 1995; Ziruolo, 2016). Institutional theory also emphasizes the role of isomorphism, where organizations imitate established practices to conform to institutional norms (Kondra & Hinings; 1998).

Another theoretical lens is the Resource Dependence Theory, which emphasizes the importance of resource acquisition and dependence (Hillman et al., 2009). Hybrid organizations often face resource constraints due to their dual mission, requiring them to leverage resources from both sectors and this theory highlights the

strategic choices that hybrid organizations make to secure financial resources, partnerships, and support from diverse stakeholders (Emmert & Crow; 1998)

Thirdly, the Social Entrepreneurship Perspective emphasizes the role of hybrid organizations in addressing complex social problems through entrepreneurial activities (Ferreira et al., 2017). It highlights the innovative and entrepreneurial approaches adopted by these organizations to achieve their dual objectives, combining market-oriented strategies with social or environmental goals (Doherty et al., 2014). The following Table 1 encompasses these and other characteristics of hybrid organizations.

Table 1. Hybrid Organizations key Elements (adaptation by the authors)

Key elements	Features
Dual mission and values	Hybrid organizations have a distinctive feature of pursuing both social or environmental goals and financial sustainability. They articulate a clear mission and value proposition that encompasses the social or environmental impact they seek to create, along with their economic objectives.
Blended governance structures	Hybrid organizations often adopt governance structures that incorporate elements from both for-profit and nonprofit models. They may have a board of directors responsible for strategic decision-making, but also involve stakeholders representing the social or environmental causes they champion.
Revenue generation and resource diversification	Unlike traditional nonprofits relying heavily on donations and grants, hybrid organizations aim to generate revenue through various means. They may adopt a mix of market-oriented activities, such as product sales or fee-based services, alongside seeking philanthropic support or grants. This diversification of resources enables them to achieve financial sustainability while pursuing their social or environmental objectives.
Impact measurement and accountability	Hybrid organizations recognize the importance of measuring and demonstrating their impact on both social or environmental outcomes and financial performance. They often employ hybrid performance metrics that capture the dual bottom line, assessing their success in terms of social, environmental, and economic indicators.
Stakeholder engagement and collaboration	Hybrid organizations actively engage with a diverse range of stakeholders, including individuals, communities, businesses, government entities, and nonprofits. Collaboration and partnerships are crucial for hybrid organizations to leverage resources, expertise, and networks to address complex societal challenges effectively.

According to these hybridity premises, knowledge has become one of the most relevant intangible assets for economic and non-economic entities in order to achieve long-term advantage in the current high-turbulent competitive environment (Nevis et al, 1995; Hicks et al, 2007). Hence, point the following basis of KM have been considered as a starting point by part of international literature.

KM has emerged as a crucial field in modern organizations, recognizing the value of knowledge as a strategic asset for achieving competitive advantage and organizational success (Berardi et al., 2022). With the rapid pace of technological advancements, globalization, and increasing complexity of business environments, organizations are constantly faced with the challenge of effectively managing their knowledge resources to support decision-making, innovation, and overall performance. Knowledge can be broadly defined as a combination of information, experience, insights, and expertise that is valuable to an organization and its members (Chow et al, 2000; Zahra and George, 2002). It encompasses both explicit knowledge, which is codified and can be easily articulated and documented, and tacit knowledge, which resides in individuals' minds and is challenging to capture and share. In this light, KM aims to facilitate the creation, acquisition, organization, sharing, and utilization of knowledge to enhance organizational learning, problem-solving, and decision-making processes (Scarbrough et al., 1999)

Several theoretical perspectives and frameworks have been proposed to understand and guide KM initiatives within organizations. One prominent framework is the Nonaka and Takeuchi's SECI Model, which emphasizes the socialization, externalization, combination, and internalization processes involved in the creation and transfer of knowledge (Nonaka & Takeuchi, 1995; Nonaka et al., 1996). This model recognizes the dynamic nature of knowledge, highlighting the importance of interactions, dialogue, and collaboration among individuals and teams to facilitate knowledge creation and sharing.

Another influential perspective is the Knowledge-Based View (KBV) of the firm, which posits that knowledge assets and capabilities are critical determinants of a firm's competitive advantage and long-term success (Felin

& Hesterly, 2007). According to KBV, organizations need to actively manage their knowledge resources by investing in knowledge creation, acquisition, and retention, as well as establishing effective mechanisms for knowledge sharing and utilization. This perspective underscores the role of organizational culture, leadership, and infrastructure in fostering a knowledge-friendly environment that supports learning and innovation (Grant, 2013; Jongbloed, 2015).

Finally, we *land* to the *trait d'union* that merges the previous wide and complex research strands, Knowledge Transfer in Hybrid Organizations, looking for answers to RQ1. Knowledge Transfer refers to the process of sharing and disseminating knowledge from one individual or group to another (Mazloomi Khamseh et al., 2008; Martins et al., 2019). It involves the transmission, adoption, and application of knowledge within an organization, across organizational boundaries, or between organizations (Jongbloed, 2015; Tangaraja et al., 2016). Knowledge transfer is vital for hybrid organizations as it enables them to leverage internal and external knowledge resources, improve performance, enhance innovation, and fulfil their social mission effectively (Maurer et al., 2011; Bacon et al., 2019). Hybrid organizations face unique knowledge transfer challenges due to their dual nature. On one hand, they need to transfer knowledge related to traditional business practices, such as marketing, finance, and operations, to ensure their financial viability. On the other hand, they must also transfer knowledge related to their social or environmental mission, including best practices for addressing social issues, community engagement strategies, and impact measurement techniques. Balancing these two dimensions of knowledge transfer is crucial for hybrid organizations to achieve their hybrid goals (Jongbloed, 2015; Berardi et al., 2022).

3. Methods

The research methodology adopted for this case study involves a qualitative approach. The research employed a qualitative case study design to explore the phenomenon of knowledge transfer in hybrid organizations, focusing on the context of a Smart Energy Community. A case study approach was chosen to gain an in-depth understanding of the processes and dynamics involved in knowledge transfer within this specific organizational setting. After careful consideration, a specific SEC was identified as the primary case for this study. The community was chosen for its innovative and collaborative approach to sustainable energy practices, which provided a rich context for investigating knowledge transfer processes, especially due to its embryonic states. The reference literature included contributions published in the period 1997-2022, excluding duplicates and conference proceedings (Christofi et al., 2021).

Firstly, the data collection process involved the collection of primary and secondary data, in the period between January and May of this year. These methods were chosen to capture multiple perspectives and sources of information related to knowledge transfer within the SEC (Tellis, 1997; Merriam, 1998). Data collection techniques include interviews with key stakeholders, document analysis, and observation of knowledge transfer practices within the SEC. The interviews were carried out in 2 rounds in the period between January and May 2023, by interviewing twenty pivotal members of the SEC. Structured and Semi-structured interviews were conducted with key stakeholders involved in the smart energy community, including community leaders, employees, and external partners (Secinaro et al., 2021). The interviews focused on understanding their experiences, perceptions, and practices related to knowledge transfer within the organization. Afterwards, participant observation was employed to gain insights into the daily operations and interactions within the SEC. The researchers spent considerable time within the community, attending meetings, workshops, and other events, while taking field notes and recording observations. Then, several documents, such as reports, project plans, and internal communication materials, were analyzed to complement the interview and observation data (Seale et al., 2003). These documents provided additional context and background information related to knowledge transfer processes and strategies.

Secondly, the collected data underwent a rigorous process of analysis to identify key themes and patterns related to knowledge transfer in the SEC. The interview transcripts, field notes, and documents were systematically coded using qualitative data analysis software (NVivo) (Jackson & Bazeley, 2019). The codes were then organized into broader themes and sub-themes that captured the main ideas and patterns within the data (Gioia et al., 2013). The themes were constantly reviewed and refined to ensure their coherence and relevance to the research objectives. Finally, the themes were interpreted and synthesized to generate a comprehensive understanding of Knowledge Transfer processes in the Smart Energy Community. Connections and relationships between the themes were identified, and theoretical frameworks and models were used to support the analysis (Mazloomi Khamseh et al., 2008; Grossi et al., 2022). The deriving research design is reported in the following Figure 1.

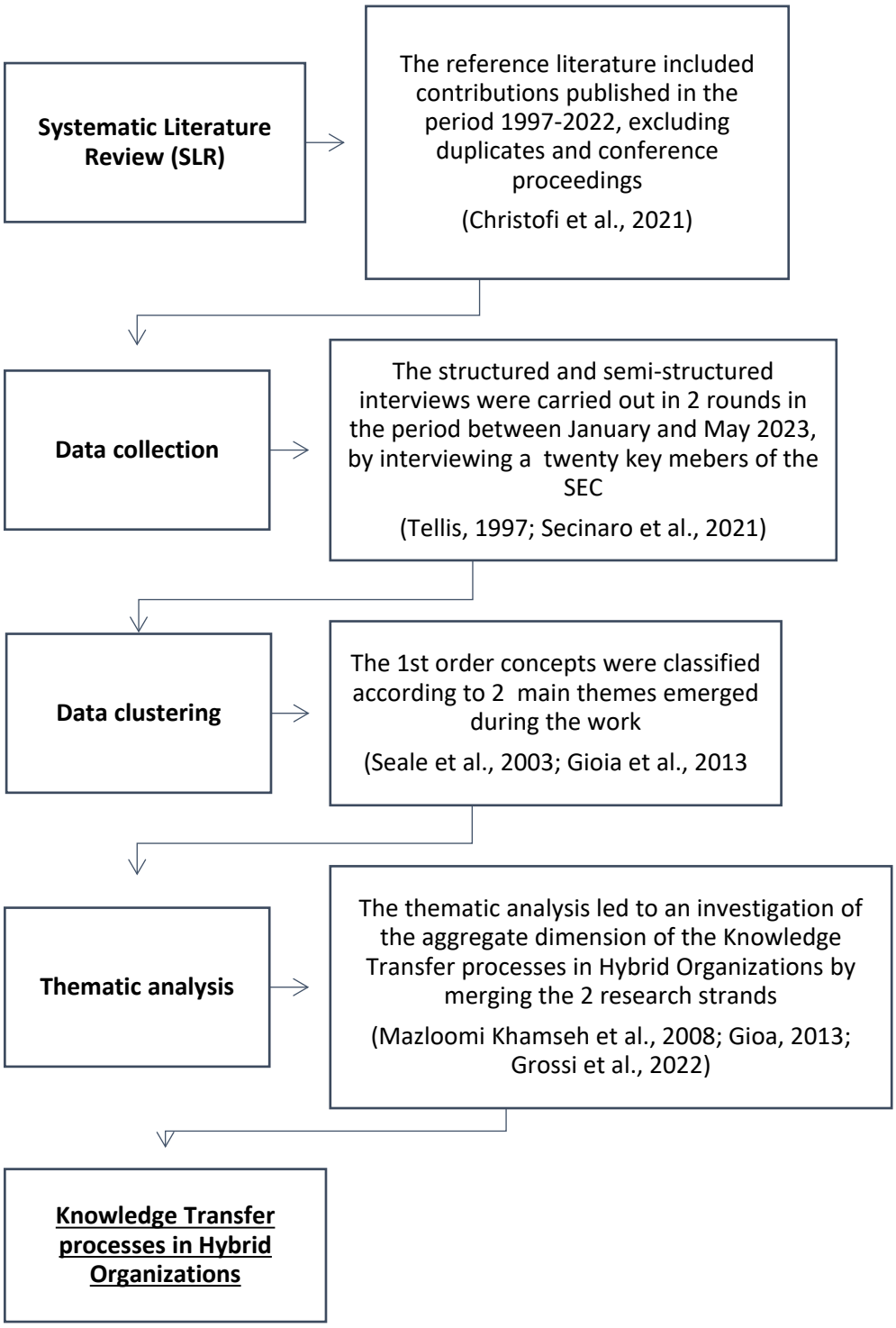


Figure 1: Research Design (adaptation by the authors)

The aforementioned research was carried out to address the RQ2. What factors influence the effectiveness of knowledge transfer in hybrid organizations operating in the Smart Energy Community?

First, the researchers considered first-order concepts starting from evidence of knowledge transfer mechanisms within the SEC. Appropriately, these are strictly connected with the Knowledge-Based View (KBV) perspective, which posits that knowledge assets and capabilities are critical determinants of a firm's competitive advantage and long-term success (Felin & Hesterly, 2007). Furthermore, this challenge must be met by municipalities using nonstandard governance models. As demonstrated in the literature sections, new challenges require public entities to adopt a new approach that allows the collaboration of several private, private, and third sector actors (Vakkuri et al., 2021; Grossi et al., 2022). Finally, as a first-order concept, we also denote the role of operational

initiatives in fostering effective knowledge sharing. For the second-order concepts, we need to refer to Hybrid Organizations models to explain if a complex network of actors could be able to easily transfer knowledge and best practices. Finally, aggregating the previous concepts and themes makes it possible to create a unique aggregate dimension that combines the previous approaches and relies on "Knowledge Transfer processes in Hybrid Organizations".

4. Results

This section examines the outcomes and impact of knowledge transfer within the SEC. It assesses the tangible and intangible benefits resulting from successful knowledge transfer, such as improved decision-making, enhanced innovation capabilities, increased stakeholder engagement, and positive environmental and social impacts. Based on the above, Table 2 summarizes the thematic analysis of this contribution.

Table 2: Summary of the Thematic Analysis (adapted from Gioia et al., 2013)

1st order concepts	2nd order themes	Aggregate Dimension elements
Factors Influencing Knowledge Transfer in the Smart Energy Community Organizational culture and climate Leadership and governance Social Networks and relationships Knowledge sharing mechanisms Learning and training Initiatives Knowledge sharing and collaboration Knowledge transfer strategies	Hybrid Organizations Knowledge Transfer	Findings and Analysis for the "Knowledge Transfer processes in Hybrid Organizations" aggregate dimension through Barriers and challenges to Knowledge Transfer Facilitators of Knowledge Transfer Practical implications and recommendations

Several key themes emerged from the data analysis. The first theme that emerged from the analysis is the importance of knowledge sharing and collaboration within the SEC. The interviews revealed that the community members (priorly major and researchers) actively engage in sharing expertise, experiences, and best practices. This knowledge sharing was facilitated through various mechanisms, such as regular meetings ("Communitas Gagliani"), workshops, and online or onsite information campaigns. The stakeholders emphasized the significance of collaboration in addressing complex energy challenges and leveraging the collective intelligence of the community (Newman et al., 2004; Jongbloed, 2015).

The second theme that emerged from the analysis is the influence of organizational culture and values on knowledge transfer within the Smart Energy Community. The interviews revealed a strong culture of learning and knowledge sharing, where community members were encouraged to exchange ideas and experiences openly. The community's values, such as sustainability, innovation, and inclusivity, played a crucial role in shaping knowledge transfer practices. The stakeholders highlighted that a supportive and inclusive organizational culture fostered effective knowledge transfer among members (Brandsen & Karré, 2011). Afterwards, from the analysis emerged the presence of barriers to knowledge transfer within the Smart Energy Community. The interviews and document analysis identified several challenges that hindered effective knowledge transfer (Doherty et al., 2014). These barriers included time constraints, lack of resources, and limited access to external expertise. The stakeholders expressed the need for dedicated resources, better communication channels, and efforts to overcome these barriers to enhance knowledge transfer within the community (Secinaro et al., 2019). Simultaneously, the interviews and observations identified several strategies employed by the community to facilitate knowledge transfer. These strategies included mentoring programs, knowledge exchange events, and the planning of using digital platforms for sharing information (Milton et al., 2007; Jongbloed, 2015). The stakeholders emphasized the importance of tailoring knowledge transfer strategies to the specific needs and characteristics of the community members.

The final theme that emerged from the analysis is the impact of knowledge transfer on the Smart Energy Community. The findings indicated that effective knowledge transfer had several positive outcomes for the community. These included increased innovation and creativity, improved decision-making processes, enhanced problem-solving capabilities, and the development of new energy solutions. The stakeholders highlighted that

knowledge transfer played a vital role in driving the community's overall growth, sustainability, ability to address complex energy challenges, a new community-based tourism thinking (Blackstock, 2005; Okazaki, 2008).

Overall, the thematic analysis revealed the significance of knowledge transfer in hybrid organizations such as the Smart Energy Community. The findings emphasized the importance of creating a collaborative and inclusive organizational culture, overcoming barriers to knowledge transfer, and implementing effective knowledge transfer strategies for creating public value (Ziruolo, 2016; Pereira et al., 2017; Burns & Andrucki, 2021).

5. Discussion

This contribution provides valuable insights into the dynamics of knowledge transfer in hybrid organizations, specifically focusing on the case of the "Sub-Equana Valley" Smart Energy Community. In the literature the debate about KM in hybrid organizations is ongoing, however, these findings contribute to the field of knowledge management by offering practical recommendations for practitioners and policymakers to enhance knowledge transfer in similar hybrid organizational settings.

In particular, this section focuses on the valuable insights gained through the thematic analysis, starting from the report on the challenges faced during knowledge transfer within the SEC. These challenges may arise due to the diverse nature of stakeholders, the integration of profit and non-profit motives, organizational culture, and resource constraints. By understanding these challenges, organizations can proactively address them and enhance knowledge transfer effectiveness (Jongbloed, 2015; Tangaraja et al., 2016). Despite the potential benefits, knowledge transfer in hybrid organizations is not without challenges. Common barriers include organizational culture clashes, resistance to change, lack of clear knowledge transfer strategies, limited resources, and the absence of well-defined performance metrics for hybrid goals (Maurer et al., 2011; Bacon et al., 2019). Overcoming these challenges requires a comprehensive understanding of the unique dynamics and context of hybrid organizations and the development of tailored strategies to promote effective knowledge transfer.

Concretely, the strategies employed by the SEC could facilitate knowledge transfer. The development of mechanisms such as communities of practice, mentoring, and technology-enabled platforms promotes collaboration, learning, and knowledge sharing among stakeholders, thereby fostering innovation and sustainability and reducing the reluctance and fatalism of the participants. And all this was possible through two fundamental levers: social capital and organizational learning.

Social capital plays a significant role in facilitating knowledge transfer within hybrid organizations. Social capital refers to the network of relationships, trust, and norms that exist among individuals and groups (Inkpen & Tsang, 2005; Walter et al., 2007). In this particular hybrid organization, social capital acts as a bridge between the profit-oriented and mission-oriented aspects, enabling the transfer of knowledge across these boundaries and enhancing communication, collaboration, and the willingness to share knowledge among individuals with different expertise and backgrounds. On the other hand, organizational learning is another relevant concept for understanding knowledge transfer in hybrid organizations. Organizational learning involves the acquisition, interpretation, and integration of knowledge to improve organizational performance (Bierly et al., 2000; Rhode et al., 2008). In hybrid organizations, learning processes are essential for reconciling the diverse goals and practices inherent in their hybrid model. Effective knowledge transfer mechanisms can facilitate organizational learning by capturing and disseminating valuable insights and experiences across the organization.

Finally, based on the findings, we could point out some practical implications and recommendations for hybrid organizations seeking to improve knowledge transfer. It highlights the importance of creating a supportive knowledge-sharing culture, implementing effective communication channels, investing in technology infrastructure, and fostering collaboration among diverse stakeholders. Moreover, various mechanisms can support knowledge transfer in hybrid organizations. These include formal processes such as training programs, mentoring, and communities of practice, as well as informal mechanisms like storytelling, peer-to-peer interactions, and social networks (Jongbloed, 2015; Tangaraja et al., 2016; Bacon et al., 2019). In this sense, the SEC adopted a combination of these mechanisms and strategies to address the diverse knowledge mechanisms considered the organization's unique context, culture, and resource constraints.

Lastly, hybrid organizations often collaborate with external stakeholders, such as government agencies, nonprofits, academic institutions, and private businesses, to achieve their social and economic objectives. In the present case study, external knowledge transfer and collaboration have brought in valuable expertise, resources, and networks that are essential for addressing complex social issues. The SEC should better and better leverage partnerships, joint projects, and knowledge-sharing platforms to facilitate the exchange of knowledge with

external stakeholders, fostering mutual learning and innovation. All and other of these concluding remarks are graphically reported in the following Figure 2, in the attempt to build up a replicable and transferable knowledge transfer model for hybrid organizations.

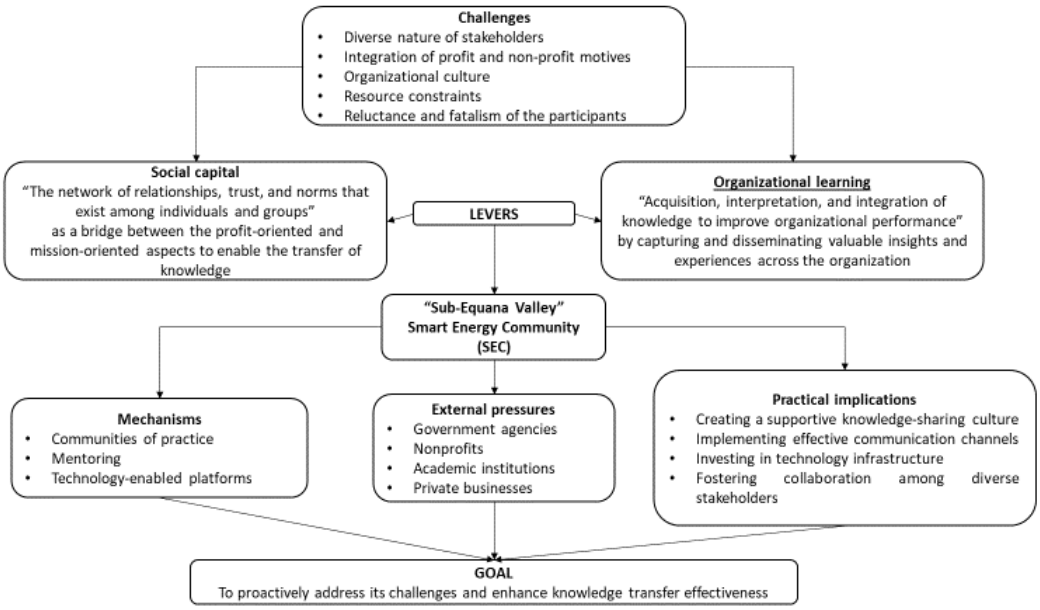


Figure 2: The SEC Knowledge Transfer Model for Hybrid Organizations (adaptation by the authors)

6. Conclusions

By studying the knowledge transfer practices of the SEC, this research provides valuable insights into the complexities of knowledge management in hybrid organizations. The findings contribute to the existing literature on knowledge transfer, expand the understanding of hybrid organizational dynamics, and offer practical guidance for organizations operating in similar contexts. Ultimately, effective knowledge transfer can drive innovation, collaboration. These insights can inform policymakers, managers, and practitioners in similar contexts, providing valuable guidance for fostering knowledge transfer in hybrid organizations and advancing sustainable energy initiatives.

It is important to acknowledge some limitations of the study. Firstly, the research focused on a single smart energy community, which may limit the generalizability of the findings. Secondly, the study relied on self-reported data from participants, which could be subject to biases or selective recall. Nevertheless, the findings contribute to the existing literature on knowledge transfer in hybrid organizations and offer valuable insights for practitioners and policymakers in the smart energy sector. By answering the RQs, this work aims to fill the gap of such a very specific research strand: it must be emphasized the significance of knowledge transfer in hybrid organizations and underscored the importance of effective knowledge management practices for achieving sustainable development goals. All and other of these concluding remarks are graphically reported in the previous Figure 2, in the attempt to build up a replicable and transferable knowledge transfer model.

In conclusion, knowledge transfer is a critical process for hybrid organizations aiming to achieve their dual objectives of social impact and financial sustainability. By understanding the concepts and theories related to knowledge transfer in hybrid organizations, researchers and practitioners can develop strategies and mechanisms that facilitate the exchange and utilization of knowledge within and beyond the organization, ultimately contributing to the success and long-term sustainability of hybrid organizations in addressing social and environmental challenges.

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Tacit Knowledge and Skills Transfer in Family Business During Generational Succession

Concetta Lucia Cristofaro[1], Sabrina Bonomi[1] and Rocco Reina[2]
[1]University Ecampus, Novedrate, Italy
[2]University Magna Graecia, Catanzaro, Italy

concettalucia.cristofaro@uniecampus.it
sabrina.bonomi@uniecampus.it
rreina@unicz.it

Abstract: The succession process remains a critical challenge in family businesses (Ramadani et al., 2015; Ramadani and Hoy, 2015), as this factor is connected to the low survival rate in the long term of the same. One of the reasons for this challenge may concern the successor's ability to adequately acquire the predecessor's silent and explicit knowledge and critical skills to maintain and improve the company's organizational performance. Much research focused on the successor profile (De Massis et al., 2008), highlighting the multiplicity of the skills requested. Recent studies show that the successor must have both hard and soft competence (Beeson, 2009). Hard skills refer to the technical skills related to work, cognitive skills, and traditional and learned skills (Bereiter and Scardamalia, 2006, Laker and Powell, 2011) or those objectively measurable and demonstrable skills, such as the ability to identify business opportunities, to develop a business vision, to create and manage business networks and their work (Bird and Jelinek, 1989; Chandler and Jensen, 1992; Charles-Pauvers et al., 2004, Laviolette, 2006). On the contrary, the transversal intangible and difficult-to-measure skills reflect "skills and traits that concern personality, attitude and behavior" (Moss & Tilly, 2001) as motivation, communication, team spirit, and trust in themselves. Therefore it is essential to find practical tools, given the poor literature on the topic, to transfer silent Knowledge, skill, legitimacy, and credibility, which are of fundamental importance for the members of the new generation family (Le Breton-Miller et al., 2004). On these premises, our work aims to answer the following questions 1. What are the tacit knowledge tools used in knowledge transfer? 2. Which of them are helpful to transfer skills? The methodology of this work involves the administration of a semi-structured interview with family companies who are experiencing the generational transition or have lived it.

Keywords: Tacit Knowledge, Family business, Generational succession, Skills

1. Introduction

Family businesses account for a huge percentage of employment in most capitalist countries (Morck et al., 2000; Shepherd and Zacharakis, 2000). In these types of organizations, the founders seek to ensure continuity of family control through intergenerational succession. Unfortunately, recent literature suggests that only 30% of family businesses survive beyond the first generation and that many intergenerational successions fail soon thereafter.

the second generation (Davis and Harveston, 1998, Handler 1992;). Research suggests that there are many reasons why such successions fail. They include unclear succession plans, incompetent successors, family rivalries and even an erroneous transfer of knowledge (Dyer, 1986; Hugron, 1993; Lansberg, 1999; Pitt 2000).

Within organizations, knowledge is a crucial competitive factor for their success. It is more than just information and data and can be described as a "fluid mix of experiences, values, contextual information and expert insights" (Davenport and Prusak, 1998).

Knowledge manifests itself in the form of intangible (tacit) and tangible (explicit) assets; the former is embodied in human beings while tangible goods are incorporated over time into organizational procedures, routines, processes and documents. Therefore, paying attention to the transfer of knowledge, especially in family businesses, is a critical issue for the survival and growth of the company over time. In fact, in these organizations' knowledge - often - is rooted in the figure of the entrepreneur and therefore during the succession process the very survival of the company could appear threatened. While in the family business system the value of knowledge is clear, it is often difficult to recognize all the different components involved (Takeuchi, 2001), therefore, it is essential that the entrepreneur focuses not only on developing and managing the different aspects of knowledge, but above all on its transfer (Spender, 1996).

The contribution therefore aims to identify and analyze - through an empirical approach - if tacit knowledge is considered a valid support in the transfer of knowledge from the entrepreneur to the successor; how this tacit transfer of knowledge takes place, in particular through what specific tools in the difficult passage of generational change.

In fact, it is a crucial moment in the life of the company because it involves the passage from one generation to the next to a real wealth of know-how and management skills, acquired over years of experience.

2. Theoretical Framework

2.1 The Role of Knowledge in the Process of Generational Succession

One of the great challenges that family business experience during the generational transition is the successor's ability to acquire the knowledge of the predecessor. This knowledge transfer, both tacit and explicit, is essential for maintaining and improving performance family business.

In the academic literature the management of knowledge in the succession family business emphasizes the transfer of knowledge between the founder and the next generation is problematic, but essential for a successful transition (Cabréra-Suárez et al., 2021; Handler, 1990). The Knowledge can be defined as the set of skills and competences that family members accumulate during their educational, work and life experiences and which they collectively possess (Martínez et al., 2013)

Knowledge management is used to safeguard the business over time, as it is essential importance during a succession process (Cabrera-Suárez et al., 2021). In particular, knowledge management can prove to be a key success factor in passing the business to the next generation.

Therefore, the issue of knowledge has long been addressed by scholars of organizational disciplines, developing and enriching itself in parallel with what happened in companies with reference to business studies, enriching the flow of implications from IT to Management (De Nito and Reina, 2003). A key aspect to address when talking about knowledge is related to the nature of knowledge and its dimension. As for the dimension, knowledge must be analyzed under two aspects, both ontological and epistemological. The first refers to those who create knowledge by passing from the individual to the organization, it can be said that knowledge is a product of the individuals in an organization because without them it could not create knowledge (Monzani, 2005). From an epistemological point of view, however, the concept of knowledge has always been a place for comparison and interpretation within the scientific community: from the classic distinction between tacit and explicit knowledge (Polanyi, 1966; Nonaka, 1994; Brown and Duguid, 2001).

It is widely accepted that the figure of the founder represents the holder of specific knowledge of the company who needs to pass on the knowledge to another generations (De Massis, Sieger, et al., 2016;).

A highly motivated predecessor is able to facilitate the process of knowledge transfer (Bracci and Vagnoni, 2011; Cabrera-Suárez et al., 2021). However, many predecessors may be influenced by the thought of losing their leadership position and becoming superfluous over time (Lansberg, 1988). This is often referred to as a barrier to the knowledge transfer process and succession process. Knowledge transfer is greatly enhanced when the owner is willing to disclose rather than retain knowledge (Bracci and Vagnoni, 2011).

On the other hand, the characteristics of a successor also significantly influence the process of knowledge transfer in family businesses (Bracci and Vagnoni, 2011; Szulanski, 2004). Successors need to be strongly motivated to gain experience and knowledge from their predecessors (Cabrera-Suárez et al., 2001; Chirico and Saves, 2008). Lack of motivation can lead to an overestimation of the knowledge transfer process (Cabrera-Suárez et al., 2001).

The successors' ability to acquire the knowledge of their predecessors is influenced by their education (Chirico, 2007; Csizmadia et al., 2016). Business knowledge continues to develop through formal education (Barbera et al., 2015;), in fact the successor's performance after joining a family business may be related to the successor's formal education (Pérez-González, 2006).

2.2 Tacit Knowledge in the Generational Succession

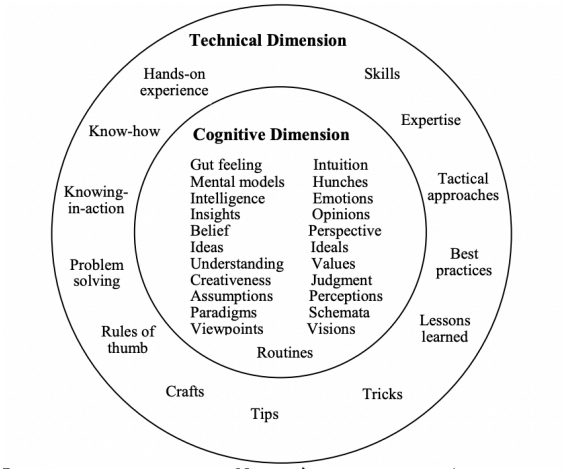
The distinction between tacit and explicit knowledge is the key to understanding organizational knowledge (Nonaka and Takeuchi, 1995; Inkpen and Dinur, 1998). Polanyi (1962) defined tacit knowledge as non-verbalizable, intuitive and non-articulated knowledge. Tacit knowledge is learned through collaborative experience and is difficult to articulate, formalize and communicate (Nonaka and Takeuchi, 1995; Polani, 1966). Tacit knowledge could be held by individuals or held collectively, in shared collaborative experiences and interpretations of events. Individual tacit knowledge can be found in an employee's patterns, skills, habits and abstract knowledge (Lyles and Schwenk, 1992; Starbuck, 1992). Tacit collective knowledge typically resides in top management schemes, organizational consensus on past collaborative experiences, business routines, corporate culture and professional culture (Nelson and the Winter, 1982; Nonaka and Takeuchi, 1995).

Spender (1996) suggested that tacit knowledge might best be understood as knowledge that has not yet been turned into practice. It is knowledge that has been made into habit, and it is highly context specific and has a personal quality (Nonaka, 1994).

On the contrary, explicit knowledge is encoded and transferable in formal and systematic methods, such as in rules and procedures (Nonaka and Takeuchi, 1995). Individual explicit knowledge consists of knowledge and skills that can be easily taught or transcribed, while collective explicit knowledge resides in standard operating procedures, documentation, information systems and rules (Brown and Duguid, 1991; Starbuck, 1992).

As Inkpen and Dinur (1998) have pointed out, the distinction between explicit and tacit knowledge must not be seen as a dichotomy but as a spectrum with the two types of knowledge as the poles at either end.

Nonaka and Takeuchi (1995) identified two elements of tacit knowledge: cognitive and technical. Figure 1 shows the potential distribution of examples of tacit knowledge within the two dimensions of Nonaka and Takeuchi.



Source: Nonaka and Takeuchi 1995

Figure 1: Potential Distribution of Tacit Knowledge

The cognitive impression includes beliefs, ideas, paradigms, values, intuition and mental models. The technical dimension is more related to "know-how", trades and "informal skills" which are commonly accepted definitions of tacit knowledge (Nonaka, 1994).

3. Case Study

3.1 Methodology

To deepen investigate our topics, we used here a qualitative method for the analysis. In particular, we thought that the case study (Yin and Pinnelli, 2005) was the most appropriate methodology to answer our research questions. This method, in fact, seemed us suitable to correctly answer an “if” and "how" question in a specific context (Edmondson and McManus, 2007) (in particular: if tacit knowledge is considered a valid support in knowledge transfer from entrepreneur to the successor/s; how this tacit knowledge transfer is made, more specifically through which specific tools). Therefore, we could understand peculiarity of each organizational setting (Stake, 2005).

The scientific research on support of tacit knowledge transfer during a generational succession in Italian family business is still in a pioneering phase (Bryman and Bell, 2011).

We chose a multiple case study, because it seems offer more advantages than the case study: the single data collected seem more reliable and greater rigor in the study of the observed phenomenon.

The cases analyzed were three: one small manufacturing enterprise in the northwest Italy and two commercial enterprises in the northeast Italy, one very small and one medium size. These cases were considered particularly significant because they were representative of different generational succession situations in family business, both for the different types of businesses (manufactural and commercial; tiny, small, and medium enterprises), and the variety of geographic collocation (in Italy it is particularly significative). The three cases were also chosen because, despite the small size, shows also several combinations of generational successions: one from father

to three sons, one from father to daughter, one from mother to son. Moreover, one hadn't any plan for the generational handover, and two had; one of this was helped by an external support and the other wasn't.

The data were collected through eight semi-structured interviews, recorded and transcribed, conducted with three older entrepreneurs (two fathers and one mother) and five younger (four male and one female). The interviews on average lasted about 40 minutes and the dataset retained a certain degree of flexibility, along with our research questions, which were often updated according to ongoing feedback and unexpected events (Leonad-Barton, 1998). The survey is made up of 9 questions, of which six are open, and three are multiple choices.

The researchers then processed the results. Through a group of work and discussion, we selected the most interesting and relevant contents from the incoming materials and, when necessary, transcribed these contents with a word processor to build a homogeneous archive for the analysis.

3.2 Cases Description

CL is a small mechanical enterprise situated in northwest Italy. It was founded in the seventies and divided into two different businesses in the eighties. Considering the first foundation, this is the second generational transition; if we contemplate the current activity, it is the first. This delicate phase was planned two years ago, with the help of an external consultant, and it is still ongoing.

A.A. is a. tiny commercial enterprise, in the furniture field, situated in northeast Italy; it was founded in 1966; at the beginning, it was carpentry that was enlarged in the seventies and transformed into a commercial company. Today it is a shop of about 5000 square meters, with only six employees, and it is experiencing the third generational transition. The change process has been planned about ten years ago and the mentoring is still in progress.

AB is a medium enterprise for the luxury furniture and design sector, founded in the eighties in northeast Italy. In ten years, it became a group of six shops and one tailor-made production, with fifty employees, and experienced the first generational step, without planning, concluded few years ago.

4. Analysis and Results

As regards the first question of our research, we asked all the interviewees if, in their opinion, the knowledge transfer in the generational transition was important. In particular, according to Davenport e Prusak (1998) and Nonaka and Takeuchi (1995) we asked them to specify which component of knowledge (tacit or explicit) they considered a primary support for the generational change.

All the interviewees, both senior and junior, answered affirmatively and indicated tacit knowledge as the main support. The generational change was considered by all, albeit with slightly different words, a delicate moment for the life of the company, which, for this reason, requires a lot of attention and care. They added that a good protection is precisely the transfer of experiences, intuitions, relationships, and so on, that cannot be explicitly learned neither passed on.

To investigate the second proposal, five tools of tacit knowledge were suggested, and more precisely: intuition (Nonaka & Takeuchi 1995; Virtainlahti 2006), personal business sense, observation (Senker, 1995; Mohajan, 2016)), mentoring, and participation (Mohajan, 2016). We asked each respondent if they were considered important and why. In the end, a free field called "other" was also left to allow everyone freely insert further tools of tacit knowledge deemed necessary.

- Intuition: four people answered "no" (all sons, one of whom, however, said that "if present, it helps speed up the transfer of knowledge") and four "yes" (all the three senior entrepreneurs and the daughter; this latter considered appropriate to specify that "it is very useful because it speeds up the knowledge transfer")
- Personal business sense: six interviewed people answered "yes", and two said "no". A senior entrepreneur and one junior, both explained that "you can learn and develop it through technique and method even in a second time".
- Observation: seven people answered "yes"; only one said "no" (a son, who specified "it is not necessary but, when it is present, can be helpful"). A curious detail is that the two females, senior and junior, both thought it proper to specify, respectively, that "with the term "observation", I don't just mean "gaze", but I think to the use of all senses" and "I consider it a necessary tool, but I mean an empathic observation, not only with the eyes but with all senses, and with the hearth".

- Mentoring: four people answered that it is really supportive, but one of them specified “I mean external mentor, because my father is not able to do it well”; the two women and one entrepreneur specified that “it is an important tool, that helps and simplifies the tacit knowledge transfer and it must be a reciprocal mentoring; we must support each other by teaching and learning in a mutual educational process”. Four people, three junior and one senior, answered that mentoring is not a necessary tool.
- Participation: almost all interviewed people replied that it is a fundamental tool ("without participation, it is useless to think of a knowledge transfer or even a generational change”). The only one who answered "it is not important", was one of the senior entrepreneurs. However, the other, even if he answered "yes", pointed out that "mine answer is " yes "only if the successors are ready; otherwise, they should not participate because they only do damage".

Only five people have inserted other tools in the free space, namely “trust, we-thinking, humility, empathy, listening, cooperation, competencies". Two juniors underlined the importance of regular meetings and feedback.

TOOL FOR TACIT KNOWLEDGE TRANSFER	Senior entrepreneur (M)	Senior entrepreneur (F)	Senior entrepreneur (M)	Junior entrepreneur (M)	Junior entrepreneur (M)	Junior entrepreneur (M)	Junior entrepreneur (F)	Junior entrepreneur (M)
Intuition	YES	YES	YES	NO	NO	NO	YES	NO*
Personal sense of business	YES	YES	NO	YES	YES	YES	NO	YES
Observation	YES	YES	NO	YES	YES	YES	YES	YES
Mentoring	NO	YES	YES	YES	NO	NO	YES	NO
Participation	YES*	YES	YES	YES	YES	YES	YES	NO
Other	Competencies	Trust, Hunility, we-thinking	empathy	I don't know	I don't know	I don't know	Trust, cooperation, regular feedback and meetings	Listening, regular feedback and meeting

Source: Our elaboration from the interviews

Figure 2: Tol for Tacit Knowledge Transfer

5. Limits

The present on field analysis contributes to verify how tacit knowledge is considered a valid support in knowledge transfer process during generational succession. The interviews done show that differently are valued the tools able to transfer tacit knowledge among generations. The contribution represents a first step regarding the aim to deep how knowledge and what kind of is relevant in Family business in the generational transition. So the small number of firms involved represent a first limit to overcome; perhaps the different typologies of firms contacted have permitted to underline the importance of topic analyzed, but on the other hands can have created distortion in real comprehension of tacit knowledge transfer tools.

Next step will regard to rise the number of firms involved in the study, maybe through a selection of a specific industrial sector in order to reduce the interpretative ambiguity and then to select the Family business in different Italian regions.

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East *vs* West: Satisfaction With Knowledge Sharing Among Millennials

Carla Curado[1], Mírian Oliveira[1,2], Paulo Lopes Henriques[1], and Anna Dolot[3]
[1]Department of Management, Advance/CSG, ISEG – Lisbon School of Economics and Management, Universidade de Lisboa, Portugal
[2]Business School, Pontifical Catholic of Rio Grande do Sul, Porto Alegre, Brazil
[3]Labour Resources Management Department, Cracow University of Economics, Poland

ccurado@iseg.ulisboa.pt
miriano@pucrs.br
lopeshen@iseg.ulisboa,pt
anna.dolot@gmail.com

Abstract: Knowledge sharing (KS) among individuals working together is complex and has an effect on their satisfaction. We adopt the self-determination theory and the theory of reasoned action to examine the relationship between millennials' characteristics, KS and the resulting satisfaction. Using a mixed-method approach we address the antecedents of satisfaction in KS for 213 millennials attending Master programs in management at Polish and Portuguese business schools. The quantitative results show that knowledge characteristics influence KS as well as the fear of losing power due to KS. Knowledge complementarity and knowledge complexity positively contribute to KS. Knowledge complexity increases the fear of losing power due to KS, while knowledge complementarity decreases it, probably because individuals recognize complex knowledge as a more valuable one. The qualitative findings corroborate the quantitative results. Knowledge complementarity's presence alone leads to KS, while its absence and knowledge complexity's existence generate the fear of losing power. KS behavior and not being afraid of losing power due to KS lead to satisfaction from KS. The integration of both outputs is robust since quantitative results and qualitative findings converge: a) KS results from knowledge complementarity: knowledge complementarity relates positively to KS, which is consistent with a high level of knowledge complementarity providing a sufficient condition for a high level of KS; b) The fear of losing power results from the absence of knowledge complementarity and the existence of knowledge complexity, which is consistent with knowledge complementarity relating negatively to the fear of losing power and knowledge complexity relating positively to the fear of losing power; c) Satisfaction occurs when KS exists and the fear of losing power is absent, which is in line with KS relating positively to satisfaction and the fear of losing power due to KS relating negatively to satisfaction. Furthermore, the results show that millennial students' satisfaction from KS is really a behavioral question and not a cultural one since there is no evidence of significant differences between the two subsamples. Millennials behave uniformly on Europe's western and eastern ends.

Keywords: Knowledge, Knowledge sharing, Fear of losing power, Satisfaction, Millennials

1. Introduction

Knowledge sharing is a significant asset and a powerful tool to acess to a competitive advantage (e.g., Argote and Ingram, 2000; Foss *et al.*, 2010). Its importance both to academicians and practitioners is widely reflected in the large number of published works that address the determinants of knowledge sharing in various contexts with various supporting theories (e.g., Curado *et al.*, 2021; Oliveira *et al.*, 2019; Wu, 2013). However, these studies have neglected the importance of the millennial generation in conjunction with the satisfaction from the type of knowledge shared. Analyzing the behavior of the millennial generation regarding knowledge sharing is especially relevant since the distinct characteristics of this generation when compared to others (Adriani *et al*, 2022).

However, the literature has neglected the influence of the type of knowledge on its sharing and the fear of losing power. Additionally, the effect of this influence on the satisfaction from sharing knowledge remains unaddressed. Analyzing the knowledge sharing of millennials is especially relevant because of the distinct characteristics of this generation (Andriani *et al*., 2022; Galdames and Guihen, 2022). Millennials were born from 1980 to 2000 and have particular characteristics that are different from preceding generations, so there is a larger scope for research on generational social change (Kavanagh *et al*., 2021). Millennials are collaborative, impatient, and search for recognition; they prefer a good work-family balance and tend to seek self-fulfillment and to be less committed to the workplace, as a result, sometimes they are considered "job-hoppers" (Galdames and Guihen, 2022). These characteristics when combined with a work environment with high turnover and entrepreneurial opportunities create a huge challenge to knowledge management and in particular to knowledge sharing.

1.1 Knowledge sharing

While organizations can promote a culture of sharing knowledge, a university can also develop knowledge sharing as a skill (Gamlath and Wilson, 2020). Knowledge sharing (KS) is "the process where individuals mutually exchange their knowledge and jointly create new knowledge" (Hooff and Ridder, 2004, p. 118). Among the knowledge management (KM) processes, KS is the most significant (Lo and Tian, 2020). KS in a competitive environment (an organization or a classroom) can be an asset (Foss *et al.*, 2010) or a significant basis for competitive advantage (e.g., Argote and Ingram, 2000). At the individual level, knowledge can be considered a strategic asset and a source of power. Therefore, the type of knowledge is important in encouraging individuals to share it (Wu, 2013). Employees face a potential loss of importance when they share what they know with other organizational members (Kankanhalli *et al.*, 2005).

Knowledge sharing involves gathering and then donating knowledge: the first consists of seeking knowledge, that is, asking or looking for someone else's knowledge (Hooff and Ridder, 2004), and the second consists of giving knowledge to another. Knowledge sharing is one of the most important processes in knowledge management (Kuo and Young, 2008), as KS has effects at the individual and organizational levels (Ahmad and Karim, 2019). At the individual level, KS increases the efficiency in carrying out actions, solving problems, and making decisions (Ahmad and Karim, 2019). Knowledge sharing encourages innovation and the creation of new knowledge (Iqbal *et al*., 2015). At the individual level, KS also leads to increased autonomy, skills, and self-realization; at the organizational level, KS is a significant basis for competitive advantage (Argote and Ingram, 2000; Wang and Noe, 2010). However, promoting and encouraging KS within organizations remains a challenge (Davidavičienė *et al*., 2020).

1.2 Complex and Complementary Knowledge

In order for KS to be effective, the type of knowledge should be conducive to sharing. In this study, we classify knowledge as either complex or complementary. Knowledge complementarity is "the degree to which knowledge is not redundant and is interesting enough to join with other knowledge" (Subramaniam and Venkatraman, 2001). Knowledge complementarity has the ability to generate added value from the interaction between the complementary parts (Kim *et al.*, 2010). Given the synergy, individuals will share it as a way to increase their stock of knowledge and to simultaneously avoid appearing opportunistic by maximizing their own stock of knowledge at the expense of others. (Kim *et al.*, 2012). In this study, we follow Henriques *et al*.'s (2019) study and we assume characteristics of complementary knowledge. Complementary knowledge and skills contribute to knowledge creation (Yao *et al*., 2013); thus, it is relevant for achieving a competitive advantage that is similar to KS (Argote and Ingram, 2000; Wang and Noe, 2010). Complementary knowledge increases the advantage in the competitive race against others, therefore it relates oppositely to the fear of losing power. Thus, we hypothesize that:

H1. Knowledge complementarity relates positively to knowledge sharing.

H2. Knowledge complementarity relates negatively to the fear of losing power.

However, complex knowledge reflects the degree to which sharing knowledge is not simple and is intricate (Subramaniam and Venkatraman, 2001). Therefore, the people with this type of knowledge are likely to do a cost-benefit analysis before sharing it (Cabrera and Cabrera, 2002). If the cost-benefit analyses indicates a cost from sharing, the individual will not share the knowledge because it contributes to the progress of other individuals that leads to losing the competitive advantage over others in the organization (Andolšek and Andolšek, 2015). Sharing the individual knowledge in the group is limited by the fear of losing value in the group, in the same way employees lose value in the organizations (Lam and Lambermont-Ford, 2010). Therefore, one of the strongest factors that reduces KS within the group is the fear of losing their value (Clark *et al.*, 2007; Evans *et al.*, 2015; Iheukwumere-Esotu and Kaltungo, 2020; Kankanhalli *et al.*, 2005; Silva de Garcia *et al.*, 2020). Following Henriques *et al*.'s (2019) study rationale, we assume characteristics of complex knowledge. It is highly valuable, since it can be assisted and enhanced, but not replaced, by technological devices such as computers (Autor *et al*., 2003). Thus, it requires a human contribution and cannot be substituted with software programs (e.g., using artificial intelligence) (Petterson, 2019). Therefore, we propose the following hypotheses:

Therefore, we propose the following hypotheses:

H3. Knowledge complexity relates negatively to knowledge sharing.

H4. Knowledge complexity relates positively to the fear of losing power.

Guaranteeing satisfaction is a way to encourage KS (Wu, 2013). This satisfaction means the individual's positive evaluation and affective response to the overall experience of sharing knowledge with others (Chiu *et al.*, 2011). Thus, we may consider that satisfaction with KS results from a comparison between expectations and perceived performance, and it could be a feeling of pleasure or disappointment (Chiu *et al.*, 2011). Knowledge-intensive environments (organizations or classrooms) are learning environments. Learning occurs through KS and could be one of the explanations for satisfaction with it (Yuen and Majid, 2007). Additionally, its effect on satisfaction is associated with helping others which is a motivation for KS (Lo and Tian, 2020). Following previous studies on the KS dependence on satisfaction with KS (Chen *et al.*, 2012; Wu, 2013), we hypothesize:

H5. Sharing knowledge relates positively to satisfaction with knowledge sharing.

Knowledge is often seen as a basis to ensure power in organizations. Fear emerges from thinking that sharing will diminish an individual's value when the individual is no longer the exclusive owner of that knowledge. This psychological phenomenon restrains individuals from sharing what they know (Evans *et al.*, 2015; Silva de Garcia *et al.*, 2020). Consequently, there is a fear of losing one's own value due to KS (Smaliukienė, *et al.*, 2017), that is why knowledge workers fear sharing their expertise (Iheukwumere-Esotu and Kaltungo, 2020). Individuals contribute with their knowledge to the progress of other individuals, thus, sharing one's knowledge leads to losing the advantage in the competitive race with other employees and lose value in the organizations (Lam and Lambermont-Ford, 2010). So, they might be reluctance to share knowledge because the fear of feeling disadvantaged (; Smaliukienė, *et al.*, 2017). When employees do not share what they know, they will not feel the satisfaction of doing so. Following Oliveira *et al*. (2019) and Arain *et al*. (2020) studies, we assume individuals often do not engage in KS because they fear losing power, therefore, we propose that:

H6. The fear of losing power relates negatively to satisfaction with knowledge sharing.

2. Method

2.1 Mixed Methods

There is a growing methodological trend in literature that integrates qualitative and quantitative methods in the same study. The resulting mixed methods approach provides the necessary empirical sophistication and rigor to match the complexities of organizational phenomena (Molina-Azorin, et *al.,* 2017). By integrating of quantitative and qualitative approaches we want to offer a better understanding of the research problem and the related complex phenomenon than either approach alone could give (Creswell and Plano Clark 2011).

2.2 Data Collection and Measures

Data for the study were collected through a cross-sectional survey. The sample was the students' databases of master programs at two business schools (one in Poland - far east European mainland - and one in Portugal - far west European mainland). This type of data diversity is important when addressing satisfaction with KS from a behavioral point of view (Lauring, 2009). The questionnaires were distributed among the 215 students who agreed to participate in the study and were collected at the end of a class, which resulted in 213 complete questionnaires. Two questionnaires were removed after applying cleaning procedures (Hair *et al.*, 2009). Respondents' demographics are presented in Table I.

Table 1: Demographic Statistics of Students

Millennials		Portugal (n=129)	Poland (n=84)	Total Total n=213
Gender	Male	38,8%	16,7%	30%
	Female	61,2%	83,3%	70%
Average age (years)		24,88	23,62	24,7
Average % of respondents that have a job		53%	63%	57%
Having a job on average for (years)		2,68	2,14	2,7

Survey questions for measuring the variables in the study were adopted from pre-existing instruments in the literature. Their measurements were based on Likert scales with options ranging from 1 (complete disagreement) to 5 (complete agreement):

Knowledge complementarity (KCM) measures the level of knowledge shared that occurs within the class that is not redundant (Subramaniam and Venkatraman, 2001).

Knowledge complexity (KCX) measures the level of complex knowledge shared that occurs within the class (Subramaniam and Venkatraman, 2001).

Knowledge sharing (KS) is the process of sharing one's own knowledge within the class (Xue *et al*., 2011).

Fear of losing power (FLP) is the perception of power and unique value lost due to the knowledge shared within the class (Kankanhalli *et al*., 2005).

Satisfaction with knowledge sharing (SATS) measures the individual's assessment and emotional response to the global experience of KS with other students in the class (Chiu *et al*., 2011).

2.3 Data Analysis

The exploratory factor analysis using the principal component analysis (PCA) with the varimax rotation method was used with the support of SPSS 21®. The factor loading of each item was greater than the recommended 0.70, except KCM3, KCM5, KCM6, STATS3 and KS4. These five items were removed. Structural Equation Modeling (SEM) was used to test hypotheses and validate the model, considering the measurement model and the structural model. The data were analyzed with the support of SPSS 21® and PLS 3.0®. Qualitative Comparative Analysis was developed using fsQCA 3.0.

2.4 Measurement Model

The reliability of the constructs was verified using Cronbach's alpha, rho_A, and composite reliability (CR). The values obtained were within the range recommended by Hair *et al.* (2020). The convergent validity was checked using the analysis of the average variation extracted (AVE) and CR. The AVE should be higher than 0.5 (Bagozzi and Yi, 1988), and the CR should be higher than 0.8 (Koufteros, 1999) (Table II). The discriminant validity was assessed using the heterotrait-monotrait (HTMT) ratio of correlations, as recommended by Hair *et al.* (2020). The HTMT ratio of correlation is presented in Table III. The maximum value was below 0.85 (for conceptually different constructs) and 0.90 (for conceptually similar constructs) according to Hair *et al.* (2019). Considering the HTMT, discriminant validity was established for this model. The model had no collinearity problem because the variance inflation factor (VIF) was below 5, as recommended by Hair *et al.* (2019). According to Kock (2015), VIF test values under 3.3 indicate there is no common method bias. In this model, all the values for VIF were under 1.001.

Table 2: Reliability and Convergent Validity

Constructs	Cronbach's Alpha	rho_A	CR	AVE
KCM	0.673	0.698	0.821	0.608
KCX	0.848	0.882	0.890	0.622
KS	0.691	0.726	0.826	0.616
FLP	0.897	0.918	0.928	0.763
SATS	0.668	0.675	0.819	0.601

Table 3: The Heterotrait-Monotrait Ratio of Correlations (HTMT)

Constructs	KCM	KCX	KS	FLP	SATS
KCM					
KCX	0.162				
KS	0.556	0.194			
FLP	0.162	0.432	0.107		
SATS	0.391	0.071	0.724	0.270	

2.5 Structural Equation Modelling

The significance of the relationships was assessed using a bootstrapping algorithm. The hypotheses are valid when the *t* values are above 1.96 (Hair *et al.*, 2019). Table IV has the results of the hypothesis test. The model explains 16.3% of the variance in KS, 17.6% of the variance in FLP and 30.3% of the variance in SATS. No significant differences were identified between Polish and Portuguese students' responses. This result means that students in both countries have similar behavior regarding the research model estimation.

Table 4: Results of the Hypothesis Test

Paths	Coefficient	t value	P	Hypothesis testing result
H1 KCM→KS	0.367	5.212	0.000	Supported
H2 KCM→FLP	-0.141	2.133	0.033	Supported
H3 KCX→KS	0.159	2.366	0.018	Not Supported
H4 KCX→FLP	0.399	5.549	0.000	Supported
H5 KS→SATS	0.509	10.355	0.000	Supported
H6 FLP→SATS	-0.190	2.938	0.003	Supported

2.6 Fuzzy-set Qualitative Comparative Analysis

In this study, fsQCA complements the SEM results to discover the configurations of conditions for the outcome variables, apart from the SEM's single estimated solution to the dependent variable: satisfaction (Rihoux and Ragin, 2009). Our qualitative research questions are interrelated as follows: what are the configurations of causal conditions that generate KS, FLP, and satisfaction with KS? Thus, the application of fsQCA to the data enables us to answer these questions by developing a configurational model.

Table 5: Descriptive Statistics and Calibration of the Conditions and the Outcomes

Conditions (C) and Outcomes (O)	Descriptive statistics (n= 213)	Calibration
KCM (C)	μ = 3.34; σ = 0.51; min= 2.00; max = 5.00	(4.2; 3.2; 2.6)*
KCX (C)	μ = 2.82; σ = 0.74; min= 1.00; max = 5.00	(3.9; 2.8; 1.6)*
KS (C/O)	μ = 3.62; σ = 0.76; min= 1.75; max = 5.00	(4.6; 3.6; 2.4)*
FLP (C/O)	μ = 2.08; σ = 0.98; min= 1.00; max = 5.00	(3.1; 2.0; 1.0)*
SATS (O)	μ = 4.02; σ = 0.59; min= 2.00; max = 5.00	(4.8; 4.1; 3.1)*

μ = Mean; σ = Standard Deviation; min = Minimum; max = Maximum; *Cut-off values: 0.95; 0.50; 0.05

3. Results

3.1 Results From SEM

KCM is related positively with KS (H1). Knowledge complementarity could give a sense of belonging to group. Knowledge complementarity is related negatively with the FLP (H2). KCM aggregates value for the donor and collector which reduces the FLP. Knowledge complexity is related positively to the FLP (H4). However, it was not enough to support H4. KS is positively related to SATS (H5). The results of this research could be aligned with Lo and Tian (2020) who find that enjoyment in helping others motivates KS that leads to satisfaction with it. The FLP is related to SATS (H6). If the individuals consider knowledge as power, they will not find satisfaction in KS.

3.2 Findings From fsQCA

There are no necessary conditions for either of the three outcomes. Both solutions and configurations for each model were analyzed using consistency and coverage levels. In this investigation, the solutions and configurations obtained fulfill the imperatives of consistency and coverage emphasized by the literature, as well as the best practices for presenting the results (Ragin, 2008). Thus, we included in the study the intermediate solutions for the three results (Tables VI, VII and VIII). There is no solution for the configurational modelling on the absence of FLP, thus, millennials seem to be afraid of losing it. All conditions in the tables are core conditions.

Table 6: Configurational Modeling for (and Absence of) KS

KS=f(KCM, KCX) **Attributes (causal configuration) → KS (outcome)**				
Causal configuration	Raw coverage	Unique coverage	Consistency	Interpretation of configuration

KCM	0.785353	0.785353	0.765050	A high level of knowledge complementarity provides a sufficient condition to high levels of knowledge sharing
Solution coverage:0.785353				
Solution consistency:0.765050				
Absence of KS=f(KCM, KCX) **Attributes (causal configuration) → ~KS (outcome)**				
Causal configuration	Raw coverage	Unique coverage	Consistency	Interpretation of configuration
~KCM	0.730612	0.730612	0.752930	A low level of knowledge complementarity provides a sufficient condition to low levels of knowledge sharing
Solution coverage:0.730612				
Solution consistency:0.752930				

Table 8: Configurational Modeling for FLP

FLP=f(KCM, KCX) **Attributes (causal configuration) → FLP (outcome)**				
Causal configuration	Raw coverage	Unique coverage	Consistency	Interpretation of configuration
~KCM *KCX	0.476031	0.476031	0.802796	A combination of low levels of knowledge complementarity and high levels of knowledge complexity provides a high level of fear of losing power due to knowledge sharing
Solution coverage:0.476031				
Solution consistency:0.802796				

Table 7: Configurational Modeling for (and Absence of) SATS

SATS=f(KS, FLP) **Attributes (causal configuration) → SATS (outcome)**				
Causal configuration	Raw coverage	Unique coverage	Consistency	Interpretation of configuration
KS*~FLP	0.581020	0.581020	0.831610	A combination of high levels of KS behavior and low levels of fear of losing power provides a high level of satisfaction with knowledge sharing
Solution coverage:0.581020				
Solution consistency:0.831610				
~STAS=f(KS, FLP) **Attributes (causal configuration) → ~SATS (outcome)**				
Causal configuration	Raw coverage	Unique coverage	Consistency	Interpretation of configuration
FLP*~KS	0.550092	0.550092	0.838988	A combination of high levels of fear of losing power and low levels of KS behavior provides low levels of satisfaction with knowledge sharing
Solution coverage:0.550092				
Solution consistency:0.838988				

4. Discussion and Conclusions

The SEM results show that knowledge characteristics influence KS as well as the FLP. KCM and KCX positively contribute to KS, the more complementary and complex the knowledge; the more it stimulates KS. KCX increases the FLP, while KCM decreases it, probably because individuals recognize complex knowledge as a more valuable one.

The fsQCA findings corroborate the SEM results. KCM's presence alone leads to KS, while its absence and KCX's existence generate the FLP. KS behavior and not being afraid of losing power due to KS lead SATS. The fsQCA results reveal a much more complex causation of the sequential models used to address the phenomena at hand, which is particularly suitable for analyzing high levels of complexity (Fiss, 2011), involved in behavioral issues. The combination of the results from the mixed methods approach enable us to confirm the relevant roles that the antecedents considered in this study play in generating millennials' satisfaction in sharing knowledge. The integration of both outputs is robust since quantitative results and qualitative findings converge:

a) KS results from KCM: The SEM supports H1 in which KCM relates positively to KS. The fsQCA configuration in Table VI shows that a high level of KCM provides a sufficient condition for a high level of KS. Such results are in line with the effect produced by knowledge complementarities (Hamel *et al*., 1989; Milgrom *et al*., 1991; Kim *et al*., 2010), confirming individuals tend to share complementary knowledge (Kim *et al*., 2012).

b) The FLP results from the absence of KCMand the existence of KCX. The SEM supports H2 that KCM relates negatively to the FLP and supports H4 in which KCX relates positively to the FLP. The fsQCA configuration in Table VII shows that a combination of low levels of KCM and high levels of KCX provide a high level of the FLP. Our findings are consistent with sharing complementary knowledge being accepted as a practice that will benefit all collectively and thus generates no fear for it is not seen as a threaten (Kim *et al*., 2012). Regarding KCX, the lack of support for H3 might underline the "characteristics" of the respondents – millennials and the conditions of competing in a both competitive and cooperative setting. Millennials present a different cost-benefit analysis (Cabrera and Cabrera, 2002). They do not feel frightened by sharing complex knowledge that contributes to the progress of others. Thus, they do not perceive the loss of their competitive advantage in the organization, which is in contrast to Andolšek and Andolšek (2015).

c) SATS occurs when KS exists and the FLP is absent. The SEM supports H5 in which KS relates positively to SATS and H6 in which the FLP relates negatively to SATS. The fsQCA configuration in Table VIII shows that a combination of high levels of KS and low levels of the FLP provides a high level of SATS. This evidence shows that satisfaction with sharing knowledge results from a positive individual's evaluation and affective response to KS and a feeling of pleasure based on personal expectations (Chiu et al., 2011). It is also associated with altruism in helping others, which is a motivation for KS (Lo and Tian, 2020). Additionally, and since knowledge is a way to ensure power in organizations, there is a FLP (Iheukwumere-Esotu and Kaltungo, 2020; Smaliukienė *et al*., 2017) that is not associated with satisfaction or joy. So, individuals restrain themselves form sharing what they know (Evans et al., 2015; Silva de Garcia *et al*., 2020), and they share less and consequently feel less satisfied about sharing.

The introduction of diversity by using two different samples from Portugal and Poland brings to the discussion the importance of the cultural background and the generation traits related to KS. The results indicate that millennials behave in a similar way when the issue is KS despite the two different cultural backgrounds. Such results clarify the concerns of Lauring (2009) on the real effect of national culture dimensions on the discussion of KS in a context of international diversity. Millennials behave uniformly on Europe's western and eastern ends.

The theoretical implications of our quantitative study emerge from the specificity of the results on a particular generation: the millennials. Their behaviors show a generational social change as they have different behavioral options. Complex knowledge positively and significantly relates to both KS and the fear of losing power. While the impact of complex knowledge is stronger than the fear of losing power, the millennials keep sharing it. Millennials dare to do what they want (KS), despite the fear that comes with it. Therefore, the results of our research model show that the theory of reasoned action needs to be revised regarding millennials.

Practical implications regard the consequences of engaging in KS related routines and paying attention to the type of knowledge used in organizations. Managers should create knowledge repositories that individuals feel comfortable using and adding to. Reducing the fear of losing power and increasing the KS of millennials is a way managers can provide satisfaction to these workers in knowledge intensive organizations. Our results suggest that it is possible to adopt universal KS related practices in organizations with multicultural millennial employees. Such managerial uniformity supports the perceptions of internal equity in the treatment of employees and eases

the implementation of generalized practices that may generate positive consequences for performance. Social implications regard the effect managers can generate on organizational climate by increasing their millennials' satisfaction through KS. Managers may use knowledge management tools to facilitate KS.

We acknowledge the limitations due to the use of a small sample and the cross-sectional data that prevent us from suggesting causality, despite the cross-country database used and a double approach to the data. Future research should develop longitudinal studies to address the dynamics of building SATS over time. Additionally, we invite colleagues to check if employees in other age segments also react to the same antecedents that influence the satisfaction with KS for millennials.

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Stakeholder's Perception of Subsequent Goodwill Measurement: An Analysis of IASB Comment Letters

Mónica D'Orey[1] and Carla Carvalho[2]
[1]Instituto Superior de Contabilidade e Administração do Porto, Instituto Politécnico do Porto, Porto, GOVCOPP, Universidade de Aveiro, Aveiro, Portugal
[2]Instituto Superior de Contabilidade e Administração, GOVCOPP, Universidade de Aveiro, Aveiro, Portugal

orey@iscap.ipp.pt
carla.carvalho@ua.pt

Abstract: Goodwill is the most intangible of intangibles and continues to generate great debate in academic, business, and regulatory circles, with no consensus on its subsequent measurement. In early 2020, the International Accounting Standards Board (IASB) published a discussion paper entitled *DP/2020/1 Business Combinations – Disclosures, Goodwill and Impairment*, to gather input on more useful disclosures on business combinations, bringing back to the discussion the subject of the subsequent measurement of goodwill. The IASB received comments on its proposed disclosures, as well as new evidence and arguments on how to account for goodwill, having received 193 comment letters from a wide range of stakeholders. This study aims to analyse the perception of those interested parties about the subsequent measurement of goodwill proposed by the IASB, as well as the arguments used for its reasoning. For this purpose, the content of stakeholder's comment letters was analysed and classified as academics, auditors, investors, standard setters, preparers, regulators/securities, and others, and by region. In addition, the preparers' comment letters were subclassified by sectors of activity to identify differences in the perception of preparers by industry. These differences point to the need to reflect on the existence of more than one goodwill measurement model, which best fits the sector of activity, a pioneering aspect in research on goodwill. The results reveal a preference trend for the systematic amortisation of goodwill. In all categories of stakeholders, apart from the "Others", the preference is for the reintroduction of goodwill amortisation. Similarly, most stakeholders in the Americas, Asia, Europe, and Oceania are in favour of reintroducing the systematic amortisation of goodwill. In some industries (Automotive, Banking, Luxury Goods, Electrical Appliances, Energy and Technology) no preparer prefers the impairment-only model, which suggests that perhaps in those sectors of activity, this model is not suitable. This study contributes to the literature on the subsequent measurement of goodwill, as well as to the different stakeholders, by presenting, under different perspectives of analysis, the respondents' preferences on the subsequent measurement of goodwill, as well as the arguments in favour of each model.

Keywords: Goodwill, Intangibles, Impairment, Amortisation, IASB, Subsequent measurement

1. Introduction

In March 2020, the International Accounting Standards Board (IASB) published the Discussion Paper (DP) *Business combination: disclosures, goodwill and impairment* (IASB, 2020a), to receive input on the most useful disclosures on business combinations, bringing the subsequent measurement of goodwill back into public discussion. The IASB (2020a) highlights the relevance of goodwill in corporate accounts, with the value of that asset reaching around $8 trillion in 2019 in listed companies worldwide, representing approximately 18% of their equity and 3% of their assets.

In that DP, the IASB (2020a) preliminary view is to keep the impairment-only model and not to reintroduce goodwill amortisation. However, this position was not consensual among IASB members (8 of 14 Board members voted in favour). Therefore, the IASB solicited input from various stakeholders on this topic. The IASB received new evidence and arguments on how to account for goodwill, having received 193 comment letters from a wide range of stakeholders.

This study aims to analyse the perception of those interested parties about the subsequent measurement of goodwill proposed by the IASB, as well as the arguments used for its reasoning. In this context, this study aims to answer the following three research questions:

- What is the preference in the subsequent measurement of goodwill by stakeholder category?
- What is the preference in the subsequent measurement of goodwill by region?
- What is the preference in the subsequent measurement of goodwill by sector of activity of the preparers?

After the global financial crisis of 2008 and the subsequent sovereign debt crisis of the EURO, the current moment could not be of greater importance for the debate on the subsequent measurement of goodwill. Not only due to the economic crisis created by the pandemic by COVID-19 but also the war in Ukraine, with economic consequences on a global scale, phenomena that potentiate the recognition of goodwill impairment losses.

This study provides important contributions to the literature by presenting the respondents' preferences on the subsequent measurement of goodwill, as well as the arguments in favour of each model. The results of this study also contribute for future research, namely, to confront the preference trend of the respondents for the reintroduction of systematic amortisation, with the IASB's final position on the discussion on the subsequent measurement of goodwill. On the other hand, the differences in perception identified in this study point to the need to reflect on the existence of more than one goodwill measurement model, which best fits each activity sector, a pioneering aspect in research on goodwill.

The study is organised as follows: after this first section of the Introduction, section 2 presents the theoretical background of the research. Section 3 explains the methodology of content analysis of the comment letters received by the IASB to the DP. Section 4 presents the results of that analysis and, in section five, the main conclusions of the study.

2. Background

2.1 Accounting for Goodwill

IFRS 3 defines goodwill as an asset representing the future economic benefits arising from other assets acquired in a business combination that are not individually identified and separately recognised (IASB, 2020b). This is why goodwill is commonly dubbed the most intangible of intangibles, given its complex nature.

In 2004 was issued the IFRS 3 – *Business Combinations* that introduced the impairment-only approach and replaced International Accounting Standards 22 - *Business Combinations*, that was issued in November 1983, which required goodwill amortisation. The IASB began the IFRS 3 Post-implementation Review (PIR) in 2013 and published the *Report and feedback statement: post-implementation review of IFRS 3 Business Combinations* in June 2015. In March 2020, DP 2020/1 was published by the Board for comment only.

The first major joint accounting harmonisation project between the IASB and the FASB focused on business combinations (Hughes et al, 2017). As a result of this process, the majority of the accounting standard boards currently prescribe the initial recognition of goodwill acquired as an asset, subjecting it only to annual impairment tests in its subsequent measurement (Carvalho, 2015). The IFRS 3 was issued to improve the accounting treatment for goodwill and provide users with more useful and value-relevant information. However, it has been criticized on the grounds of the managerial discretion inherent in impairment testing (Abughazaleh, Al-Hares and Roberts, 2011; Carvalho, 2015; Hayn and Hughes, 2006; Li and Sloan, 2017).

The Board's preliminary view is that there is no compelling evidence to justify once again changing the accounting for goodwill and the costs that such a change would entail (IASB, 2020a). In other words, the IASB considers that goodwill amortisation should not be reintroduced but requests the indication of any new arguments or evidences that stakeholders have on this topic.

2.2 Literature Review

The adoption of the fair-value-based goodwill impairment approach in 2005 has been motivated by the assumption that the impairment approach will enable managers to provide information regarding goodwill that is value-relevant to the market (Colquitt and Wilson, 2002). However, several authors state that the goodwill impairment is not timely (Bepari and Mollik, 2017; Li and Sloan, 2017; Pechlivanidis, Ginoglou and Barmpoutis, 2022; Ramanna and Watts, 2012). Thus, the empirical evidence suggests that the impairment approach has resulted in inflated goodwill balances and untimely goodwill impairments, because the estimates of the current fair value of goodwill rely on unverifiable assumptions such as expectations of value to be generated by managers' future actions. Ramanna and Watts (2012) state that the unverifiability in goodwill accounting rules is used to manage financial reports opportunistically. They found some evidence of an association between goodwill non-impairment and CEO compensation, CEO reputation, and debt-covenant violation concerns.

Bepari and Mollik (2017) studied a sample of Australian companies for the period 2006-2009, and found a significant increase in the number of impairments recorded by companies. However, a large number of firms

did not impair goodwill even during the 2008-2009 global financial crisis, although their firms' market-to-book ratios were less than one. These results are consistent with those of Carvalho (2015) and Li and Sloan (2017), concluding that the model of impairment-only is subject to opportunistic managerial behaviour.

Some empirical findings suggest that only current-year acquired goodwill is value relevant compared to older goodwill, and therefore goodwill's impact on stock prices is decreasing as it ages (Pechlivanidis, Ginoglou and Barmpoutis, 2022). However, there is also evidence that under the impairment approach the value relevance of goodwill does not decline with the ages of goodwill (Bepari and Mollik, 2017). These results contrast with those of Bugeja and Gallery (2006) under the amortisation regime, by concluding that the market assumed that the remaining goodwill balance has lost its value relevance. The study of Bagna, Ramusino and Ogliari (2023) shows that the information provided by listed companies to market investors, under the current accounting regime (impairment-only), is value relevant and contributes to explain the level of the market to tangible book value multiple.

The findings above, lead us to the question of comparability. In this regard, Durocher and Georgiou (2021) state that the concept of comparability is different for standard setters and analysts/investors. The authors refer that for the standard setters: information about a reporting entity is more useful if it can be compared with similar information about other entities and with similar information about the same entity for another period or another date; and for the users: comparability is about being able to cross compare companies that adopt different growth strategies. Users strive to compare acquisitive firms to organically-grown firms. So, users hence tend to ignore goodwill and goodwill impairment losses. For its part Ma and Zhang (2023), refer in their study on intangible assets, that to enhance comparability, standard-setters, regulators and practitioners should work together to establish more industry-specific guidance on the timing of research and development (R&D) capitalization.

The subjective nature of goodwill impairments also makes it difficult for auditors and regulators to enforce impairments (Li and Sloan, 2017), with goodwill impairment tests being commonly cited as an audit deficiency (Ayres, et al, 2019). Estimates to measure goodwill are based on unverifiable characteristics, assumptions and cash flow projections, requiring the audit of this asset to be subject to extensive professional scepticism (Chambers and Finger, 2011).

Ferramosca and Allegrini (2021) found evidence that accounting culture affects chief financial officers' preferences for the impairment-only model or the amortisation model, which is consistent with the study of André, Filip and Paugam (2016), that find differences in the frequency and magnitude of goodwill impairment losses reported by European-listed firms compared with what is reported by US-listed firms. During the financial crisis, European-listed firms reported a significantly smaller proportion of goodwill impairment losses concerning goodwill balances than US-listed firms. In this respect, Martínez, Rubio and Morales (2023) warn of the lack of studies covering samples of several countries and a deeper analysis of the factors that may justify those differences between companies and countries. In the studies on the contrast of the application of different goodwill accounting practices, those authors concluded that sample sizes and composition are varied and there is generally no distinction between different sectors of activity. On the other hand, Linsmeier, Wangerin and Wheeler (2020) conclude that a one-size-fits-all subsequent accounting alternative for goodwill may be difficult to apply, due to heterogeneity in the economic components of goodwill.

The various stakeholders try to influence the standards-setting process in order to maximise utility for themselves (Hartvvig, 2012; Sutton, 1984; Watts and Zimmerman, 1978), whereby the lobbying is most productive when the rule-makers' preferences are still undecided (Sutton, 1984). Because changes in IFRS may pressure national standard-setters to change country-specific standards, the IASB has been subjected to lobbying efforts from not only preparers, users, accounting professionals and academics but also from regulators and national standard-setters (Hughes et al., 2017).

3. Methodology

This study aims to analyse the perception of those interested parties about the subsequent measurement of goodwill proposed by the IASB, as well as the arguments used for its reasoning. The rational-choice model of lobbying serves as the main theoretical lens that guides the examination of these matters (Sutton, 1984). By recognising that the accounting standard-setting process is political, it is accepted that there are different conflicting interests among the parties involved, which will have some impact on the standard to be set (Fogarty, Hussein and Ketz, 1994).

The methodology used for data collection was content analysis (Bardin, 1977) of the 193 comment letters received by the IASB to DP/2020/1, transcribing into an analysis grid the content of the comment letters that allowed answering the three research questions defined in the Introduction. Thus, we proceeded to collect the respondents' answers about their preference on the subsequent measurement of goodwill (in favour of the amortisation model; in favour of the impairment-only model; in favour of another approach; or no preference/response). The content of the 193 comment letters was subsequently classified by type of stakeholder (academics, auditors, investors, standard-setters, preparers, regulator/securities, and others), following the methodology of other studies (*e.g.* Anantharaman, 2015; Bautista-Mesa, Muñoz-Tomás and Horno-Bueno, 2019; Giner and Arce, 2012) and the classification of the IFAC (2008). In the particular case of preparers, they were then classified by activity sector in order to identify differences in perceptions by sector.

The IASB establishes accounting standards now used in some form in over 160 countries. Diverse geographical participation in IFRS standard-setting is seen as desirable as it may improve the consistency of IFRS applications, reduce criticism of regional over-influence, and promote the legitimacy of the IASB (Larson and Herz, 2013). The comment letters were also classified by geographical region.

It should be noted that, of the 193 comment letters analysed, 22 are from a group of Malaysian students, the vast majority advocating the impairment-only model. In order not to bias our analysis, those 22 comment letters were considered as only one response, in the category of academics. Thus, our final sample consists of 172 comment letters. It should also be noted that, although most respondents followed the structure of the questions posed in DP/2020/1, some did not, indicating only their general position on the subsequent measurement of goodwill. On the other hand, some respondents gave brief and direct answers, but others gave exhaustive answers, which required complex, time-consuming and very careful work to interpret the answers, for subsequent classification of their position.

4. Results

4.1 Preference in the Subsequent Measurement of Goodwill by Stakeholder Category

To answer the first research question, we classified the respondents by their role in the financial reporting chain: academics; auditors; investors; standard-setters; preparers; regulators/securities; and others (Table 1).

Table 1: Responses from Comment Letters by Stakeholder Category

Category	In favour of the amortisation		In favour of the model impairment-only		Another approach		No preference/ response		Total	
Academics	11	6.4%	9	5.2%	2	1.2%	1	0.6%	23	13.4%
Auditors	10	5.8%	6	3.5%	-	0.0%	-	0.0%	16	9.3%
Investors	6	3.5%	5	2.9%	1	0.6%	-	0.0%	12	7.0%
Standard-setters	26	15.1%	16	9.3%	2	1.2%	7	4.1%	51	29.7%
Preparers	33	19.2%	11	6.4%	6	3.5%	6	3.5%	56	32.6%
Regulator/securities	4	2.3%	2	1.2%	-	0.0%	2	1.2%	8	4.7%
Others	-	0.0%	2	1.2%	1	0.6%	3	1.7%	6	3.5%
Total	**90**	52.3%	**51**	29.7%	**12**	7.0%	**19**	11.0%	**172**	100.0%

The responses in favour of the amortisation model, preparers and standard-setters stand out, accounting for 62% of the responses received by the IASB. These two categories are mainly in favour of reintroducing goodwill amortisation (34.3%). Regarding those in favour of the impairment-only model, preparers and standard-setters are also those who most support this model but are less representative (15.7%) than those in favour of the amortisation model. The likelihood of lobbying is greater among preparers than among investors (Georgiou, 2010; Hewa, Mala and Chen, 2020; Rey, Maglio and Rapone, 2020), so greater participation from that category of respondents was already expected. The same applies to the participation of standard-setters, given the influence of IASB standards on accounting standards in each country (Hughes et al., 2017).

Although in all the categories presented most respondents are in favour of reintroducing the amortisation of goodwill, academics and investors stand out as they are the ones where the difference between the number of

responses in favour of reintroducing amortisation (17) and the number of responses in favour of the impairment-only model (14) is smaller. The auditor's category also stands out, more specifically concerning the Big4, their positions being divided (2 prefer the reintroduction of amortisation, and 2 are in favour of maintaining the impairment-only model).

Among the comment letters in favour of the reintroduction of the amortisation, we highlight the one from *La Société Française des Analystes Financiers*, classified in the investors' category, defending that the current impairment-only model has to underlie that the economic benefits associated with the goodwill are difficult to capture, both in terms of timing and amount of realization. As such, goodwill is an asset that is consumed over time and therefore should be depreciated systematically.

As for the advocates of maintaining the impairment-only model, EFRAG's response (in the category of standard-setters) stands out. Considering that an accounting policy should only be changed if it would provide reliable and more relevant information, EFRAG suggests the IASB further explore improvements to existing impairment tests and any cost and consequences of reintroducing amortisation.

In the categories in favour of another approach, 7 respondents consider that the treatment of goodwill should be a matter of accounting policy choice and that the standard should prescribe different subsequent measurement models. In this group is also a preparer who supports a global review of goodwill accounting, from its initial recognition (reopening the discussion on whether goodwill is or is not an asset), to its subsequent measurement.

In the group "No preference/response" is the response of the European Securities and Markets Authority (ESMA) as it does not clearly express its preference on the subsequent measurement of goodwill. If, upon further assessment, the IASB confirms its preliminary conclusion that the current impairment test cannot be significantly improved at a reasonable cost for issuers, ESMA considers that the Board should explore the possible re-introduction of goodwill amortisation. ESMA highlights that the existing impairment-only model is not sufficiently enforceable and auditable. This group also includes the response of the International Organization of Securities Commissions (IOSCO): some members argue that the IASB should improve the impairment test before considering re-introducing amortisation; others argue for the urgent re-introduction of goodwill amortisation to improve the reliability and usefulness of financial statements.

4.2 Preference in the Subsequent Measurement of Goodwill by Region

To answer the second research question, the content of the stakeholders' comment letters was classified by region (Table 2). The United Kingdom is the only European country in which most respondents support the impairment-only model, which is why it was separated from the other European countries in Table 2.
In the Europe region (ex. UK), respondents from France are the most divided, although they are more in favour of the amortisation than the impairment-only model. On the contrary, from Germany, Sweden, and Switzerland there is no comment letter in favour of the impairment-only model. We also highlight 6 comment letters from European bodies that we do not allocate to any country, but to the European continent as a whole (3 in favour of amortisation, 1 in favour of the impairment-only model, and 2 with no preference).
The respondents from Latin America are largely in favour of reintroducing goodwill amortisation, while in North America the respondents are divided: Canada favours the impairment-only model, while in the United States there is a slight preference for the amortisation regime. As regards the Asian continent, the answers come from 11 countries, with respondents from India, Korea, Malaysia and Thailand favouring the impairment-only model. We consider in the international group the respondents representing countries from different continents (*e.g.* Auditors/Big4).

The analysis of the results suggests that the legal system of the respondents' countries influences the preference for the subsequent goodwill measurement model. Overall, the 11 countries that contributed the most comment letters represent 55% of the responses obtained, which can be divided into two subgroups according to their legal system (La Porta et al, 1998): civil law (Germany, Brazil, China, France, Japan, the Netherlands and Switzerland), with 38 responses in favour of reintroducing amortisation, and 8 for the impairment-only model); and common law (Australia, Canada, US and UK) with 16 responses in favour of amortisation; and 15 in favour of the impairment-only model). Most respondents from civil law countries are in favour of reintroducing goodwill amortisation, while those from the common law regime are divided (with a slight preference for amortisation). In terms of representativeness of participation, our results are similar to those of Larson and Herz (2013).

Table 2: Responses from Comment Letters by Region

Region	In favour of the amortisation		In favour of the model impairment-only		Another approach		No preference/ response		Total	
Europa (ex. UK)	**36**	**66.7%**	**5**	**9.3%**	**5**	**9.3%**	**8**	**14.8%**	**54**	**100.0%**
Germany	11	84.6%	-	0.0%	1	7.7%	1	7.7%	13	100.0%
France	4	50.0%	3	37.5%	1	12.5%	-	0.0%	8	100.0%
Netherlands	4	57.1%	1	14.3%		0.0%	2	28.6%	7	100.0%
Switzerland	3	60.0%	-	0.0%	1	20.0%	1	20.0%	5	100.0%
Sweden	3	100.0%	-	0.0%	-	0.0%	-	0.0%	3	100.0%
Others	11	61.1%	1	5.6%	2	11.1%	4	22.2%	18	100.0%
United Kingdom	**6**	**35.3%**	**8**	**47.1%**	**2**	**11.8%**	**1**	**5.9%**	**17**	**100.0%**
America	**16**	**55.2%**	**9**	**31.0%**	**2**	**6.9%**	**2**	**6.9%**	**29**	**100.0%**
Latin America	11	78.6%	3	21.4%	-	0.0%	-	0.0%	14	100.0%
United States	4	44.4%	3	33.3%	1	11.1%	1	11.1%	9	100.0%
Canada	1	16.7%	3	50.0%	1	16.7%	1	16.7%	6	100.0%
Asia	**15**	**50.0%**	**10**	**33.3%**	**2**	**6.7%**	**3**	**10.0%**	**30**	**100.0%**
China	4	44.4%	3	33.3%	1	11.1%	1	11.1%	9	100.0%
Japan	5	83.3%	-	0.0%	-	0.0%	1	16.7%	6	100.0%
Singapore	2	50.0%	1	25.0%	1	25.0%	-	0.0%	4	100.0%
Others	4	36.4%	6	54.5%	-	0.0%	1	9.1%	11	100.0%
Oceania	**6**	**50.0%**	**4**	**33.3%**	**1**	**8.3%**	**1**	**8.3%**	**12**	**100.0%**
Australia	6	66.7%	2	22.2%	-	0.0%	1	11.1%	9	100.0%
New Zealand	-	0.0%	2	66.7%	1	33.3%	-	0.0%	3	100.0%
Africa	**3**	**37.5%**	**5**	**62.5%**	-	**0.0%**	-	**0.0%**	**8**	**100.0%**
International	**7**	**38.9%**	**8**	**44.4%**	-	**0.0%**	**3**	**16.7%**	**18**	**100.0%**
Others (Unidentified)	**1**	**25.0%**	**2**	**50.0%**	-	**0.0%**	**1**	**25.0%**	**4**	**100.0%**
Total	**90**	**52.3%**	**51**	**29.7%**	**12**	**7.0%**	**19**	**11.0%**	**172**	**100.0%**

The preference for impairment-only model is higher in countries with a less conservative accounting culture. More optimistic accounting cultures exist mostly in Anglo-Saxon countries (André et al., 2016; Ferramosca and Allegrini, 2021). It is curious to note that US and Australia respondents prefer the amortisation model. This preference is noticeable in the preparers category, which suggests that the sector of activity of these respondents may be influencing their response.

4.3 Preference in the Subsequent Measurement of Goodwill by Sector of Activity of the Preparers

To answer the third research question, we classified the content of the 56 comment letters from preparers by activity sector, as shown in Table 3. In the "Others" sector are included the responses received from business associations or preparers not fitting into a specific sector.

From the automotive sector, both Ford Motor Company (USA) and Volkswagen Group (Germany) are in favour of the reintroduction of depreciation. Along the same lines, the Banks sent 6 comment letters, 4 of which were in favour of the reintroduction of depreciation (Germany, UK, France, and Netherlands). For example, Barclays believes that it would be beneficial to re-introduce amortisation of goodwill. Also, the European Association of Co-operative Banks (EACB) believe that amortisation is the only way to show the consumption of goodwill over its useful life and prevent the entities from recognizing "internal goodwill".

In the luxury goods sector, Swiss company Richemont is firmly against the Board's proposal to not reintroduce the amortisation of goodwill. They consider that acquired goodwill is not an indefinite life asset. This is particularly true in the current environment, with the impact of technology leading to rapid changes in business models across many industries. In the communications sector, meanwhile, there is only one comment letter from the French group Vivendi, which is in favour of the impairment-only model.

Of the 3 comment letters framed within the consultant sector, there are two that are in favour of the impairment-only model, although one of them agrees that, in some circumstances, such as limited life mining operations, it might be better that goodwill be amortised rather subject to the impairment test. In turn, the respondent from the electrical appliances sector (Siemens) does not express a preference as to the subsequent treatment of goodwill, acknowledging that there are benefits and challenges to both models for subsequent goodwill accounting.

Table 3: Responses of Comment Letters from Preparers by Activity Sector

Sector of activity	In favour of the amortisation		In favour of the model impairment-only		Another approach		No preference/ response		Total	
Automotive sector	2	100.0%	-	0.0%	-	0.0%	-	0.0%	2	100.0%
Bank	4	66.7%	-	0.0%	1	16.7%	1	16.7%	6	100.0%
Luxury Goods	1	100.0%	-	0.0%	-	0.0%	-	0.0%	1	100.0%
Communication	-	0.0%	1	100.0%	-	0.0%	-	0.0%	1	100.0%
Consultant	1	33.3%	2	66.7%	-	0.0%	-	0.0%	3	100.0%
electrical appliances	-	0.0%	-	0.0%	-	0.0%	1	100.0%	1	100.0%
Energy	8	88.9%	-	0.0%	1	11.1%	-	0.0%	9	100.0%
Insurance	3	37.5%	3	37.5%	-	0.0%	2	25.0%	8	100.0%
Technological	2	100.0%	-	0.0%	-	0.0%	-	0.0%	2	100.0%
Others	12	52.2%	5	21.7%	4	17.4%	2	8.7%	23	100.0%
Total	**33**	**58.9%**	**11**	**19.6%**	**6**	**10.7%**	**6**	**10.7%**	**56**	**100.0%**

In the energy sector, the 9 preparers are from the American, European and Oceania continents. Of these, 8 preparers are in favour of the reintroduction of amortisation, with only 1 considering that amortisation should be reintroduced as an accounting policy option. In other words, there is great unanimity in this sector for the reintroduction of the systematic amortisation of goodwill. These preparers argue that the current impairment test is very onerous and not provides useful information about the performance of an acquisition. They believe that goodwill has a finite life and should be amortised over time.

Of the 11 preparers who are in favour of the impairment-only model, 3 are from the insurance sector, which is the one with the highest number of companies (37.5%) advocating this model. As for the technology sector, 2 respondents support the reintroduction of goodwill amortisation. They argue that the current requirement for an annual impairment test is onerous, requiring significant resources to develop internal forecasts and document related assumptions despite the absence of any indication of impairment. Goodwill has a finite life and is consistently being consumed and replaced by internally generated goodwill.

Of the 23 comment letters grouped under "other", about half (12) favour systematic amortisation of goodwill, 5 favour the impairment-only model, 4 advocate another approach, and 2 have no preference. For example, Business Europe and the 100 Group argue to give companies an accounting policy choice to amortise, or not, based on their assessment of whether the goodwill has, or not, a limited life. The Brazilian Association of Publicly-Held Corporations (ABRASCA) strongly supports a hybrid approach that combines goodwill's amortisation with impairment. The Confederation of Swedish Enterprise, for its part, highlights the improvement of comparability between entities with different growth strategies (organic *versus* through acquisitions) as the main argument for reintroducing the systematic amortisation of goodwill. This argument is consistent with the analysts/investors' perspective of the concept of comparability, once the users strive to compare acquisitive firms to organically-grown firms (Durocher and Georgiou, 2021).

5. Conclusions

From the results presented in this study, which focused on the analysis of the content of 172 comment letters to DP/2020/1 of the IASB, in all categories of stakeholders, apart from the "Others", the preference is for the reintroduction of goodwill amortisation. Similarly, an analysis by region also shows that most stakeholders in the Americas, Asia, Europe, and Oceania are in favour of reintroducing the systematic amortisation of goodwill. Only respondents from the African continent are mostly in favour of the impairment-only model, as well as a group of respondents who operate at an international level.

When analysing the 56 comment letters of the preparers by sector of activity, in some sectors (Automotive, Banking, Luxury Goods, Electrical Appliances, Energy and Technology) no preparer prefers the impairment-only model, which suggests that perhaps in those sectors of activity, this model is not suitable. Some of those respondents mention that the pace of change at the technological level, in customer preference, market

competition and substitute products, among others, contribute to the goodwill acquired losing value over time and having to be systematically replaced by internally generated goodwill.

In fact, in the past the pace of change in the economic environment was slower, contributing to a view that goodwill could remain indefinitely in the balance sheet of companies. However, nowadays, in a world of constant change, where companies need to constantly reinvent themselves, otherwise they may be excluded from the market, the concept that acquired goodwill does not lose value may be outdated. These companies are daily replacing acquired goodwill with internally generated goodwill, reinvesting in the renewal of their goodwill, just as they do with their tangible fixed assets. In this way, the acquired goodwill is being consumed in a going concern.

Indeed, the IASB itself has expressed concern that IAS 38 might be outdated in various ways in the new economy. As of IASB's April 2022 meeting, revisiting financial reporting standards on intangible assets is finally

considered to be a research pipeline project for the coming five years. To enhance comparability, standard-setters, regulators, and practitioners should work together to establish more industry-specific guidance (Ma and Zhang (2023).

This study provides important contributions to the literature on the subsequent measurement of goodwill, as well as to the different stakeholders of financial information, by presenting, under different perspectives of analysis, the respondents' preferences on the subsequent measurement of goodwill, as well as the arguments in favour of each model. The results of this study may be the basis for future research, namely, to confront the preference trend of the respondents for the reintroduction of systematic amortisation, with the IASB's final position on the discussion on the subsequent measurement of goodwill. On the other hand, the differences in perception identified in this study point to the need to reflect on the existence of more than one goodwill measurement model, which best fits each activity sector, a pioneering aspect in research on goodwill.

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Identifying Knowledge Management Processes in Futures Research

Jonathan Augusto da Silva[1], Matheus Argôlo[1], Carlos Eduardo Barbosa[1,2], Yuri Oliveira de Lima[1], Herbert dos Santos[1], Alan Lyra[1] and Jano de Souza[1]

[1]Programa de Engenharia de Sistemas e Computação do Instituto Alberto Luiz Coimbra de Pós-Graduação e Pesquisa em Engenharia, Universidade Federal do Rio de Janeiro, Brazil

[2]Centro de Análises de Sistemas Navais, Marinha do Brasil, Rio de Janeiro,Brazil

jonathan@cos.ufrj.br
matheusargolo@cos.ufrj.br
eduardo@cos.ufrj.br
yuriodelima@cos.ufrj.br
herbertsds@cos.ufrj.br
alanlyra@cos.ufrj.br
jano@cos.ufrj.br

Abstract: Governments and organizations utilize Knowledge Management to create, share, use, and manage their knowledge to gain competitive and strategic advantages. They also use Futures Research techniques, such as Foresight, technology assessment, and technological forecasting, to comprehend the forces that shape the future and consequently affect them. Despite Knowledge Management and Futures Research being two distinct subjects, they support decision-making processes and help people make the right decisions, sharing unexplored similarities. However, there is a lack of understanding regarding the relationship between Knowledge Management and Futures Research, the integration of Futures Research techniques to support Knowledge Management processes within organizations, and how specific Futures Research techniques align with different knowledge dimensions. A brief search showed us that academic literature that combines knowledge from both areas is quite scarce. By identifying the similarities between Knowledge Management and Futures Research, this work aims to demonstrate how to apply Futures Research techniques to Knowledge Management processes, particularly in the SECI (Socialization, Externalization, Combination, and Internalization) knowledge creation and conversion model. Therefore, this study analyzes 53 Futures Research techniques, such as Scenarios, Brainstorming, Expert Panels, Delphi, and Bibliometrics, among others, to establish a relationship between Knowledge Management and Futures Research. The proposal also includes exploring the relationship between different Futures Research techniques and the four knowledge conversion dimensions according to the SECI model, providing justification for how Futures Research techniques can be helpful for knowledge conversion activities. With the relationships between Futures Research techniques and Knowledge Management processes established, a framework is provided for further development of practical guidance on how organizations and governments can integrate the implementation of Knowledge Management and Futures Research techniques, particularly with methods that are useful for decisions regarding technological investments. Understanding the relationship between Knowledge Management and Futures Research is expected to provide valuable insights for governments and organizations seeking to improve their decision-making processes through Knowledge Management.

Keywords: Knowledge management, Futures research, SECI model, Decision-Making processes

1. Introduction

The VUCA (Volatile, Uncertain, Complex, and Ambiguous) acronym often describes our contemporary world, characterized by constant change, encompassing potentially harmful disruptions and beneficial advancements. However, uncertainty yields understanding, as it constitutes an opportunity for leaders to listen and understand, thus discovering new ways of thinking and acting (Johansen, 2007).

Knowledge Management (KM) is one of many tools organizations can use to deal with the so-called VUCA world. The primary purpose of KM is to share perspectives, ideas, experiences, and information (Colburn, 2012). Making sure that the correct information is available to the right people at the right time enables informed decisions, thus helping these people gain the necessary understanding to mitigate uncertainties. Another way to deal with uncertainty is by utilizing Futures Research. By applying a series of methodologies related to this area of Futures Research, one can forecast change and anticipate future threats or opportunities. Scenarios, Cross-impact Analysis, and SWOT are among other techniques in the Futures Researcher toolbox, which will help him tackle the lack of predictability in general. Despite KM and Futures Research's goal of assisting people in making the right decisions, literature combining both areas is limited.

This work explores how Knowledge Managers can use Futures Research methods in their processes, specifically in the SECI (Socialization, Externalization, Combination, and Internalization) model. We analyze 53 Futures Research techniques and establish parallels between them and the four modes of knowledge conversion in the SECI model and KM processes in a generic KM model.

Through this analysis, we aim to create an interface between KM and Futures Research, demonstrating how the latter can enhance KM processes and also how Futures Research can benefit from KM. This interface is expected to benefit both areas, particularly in decision-making processes related to forecasts and technological investments.

2. Literature

In this article, we will explore two different topics: KM and Futures Research. This section aims to provide the necessary theoretical foundation for the subsequent discussion in Section 3, in which we will establish a relationship between KM and Futures Research. Sub-section 2.1 will present some definitions of KM and explain the SECI model of knowledge dimensions. Sub-section 2.2 will focus on Futures Research, a transdisciplinary field that explores possible, plausible, and preferable futures using different methodologies and techniques. We will discuss the classifications of Futures Research methods based on their nature, approach, family, and capability.

2.1 The SECI Model and Generic Knowledge Management Models

The role of knowledge as a critical source of potential advantage for organizations and hence whole economies has been a hotly debated topic over the last decades. It has become one of the essential factors in business strategies associated with technological innovation capacity, producing competitive advantages. It follows that for organizations, individuals, and society, the processes of knowledge creation or acquisition, communication, application, and usage, must be effectively managed (Quintas, Lefrere and Jones, 1997). In this way, KM has become necessary in this scenario.

There is a variety of definitions of KM in the literature. According to Davenport and Prusak (1998), KM is related to capturing, distributing, and effectively using knowledge. Later, Duhon (1998) considered KM a discipline that promotes an integrated approach to identifying, capturing, evaluating, retrieving, and sharing an enterprise's information assets, including databases, documents, policies, procedures, and expertise previously captured from workers' knowledge. This variety of studies of KM over the last years has resulted in the development of different techniques and methods.

In their different definitions and classifications, models and processes of KM have been the object of extensive analysis in the literature of the last years. Nonaka and Takeuchi (1995) developed the most widely known contribution, which expresses a shared knowledge creation process model. Figure 1 shows a straightforward representation of the SECI model. This model considers knowledge either tacit (unarticulated, non-verbalized, and intuitive) or explicit (articulated, specified by writing, drawing, among others) and evidences the ways of knowledge transformation: Socialization (tacit to tacit knowledge, e.g., a chat between colleagues), Externalization (tacit to explicit knowledge, e.g., formalizing a body of knowledge in the form of a document or audiovisual media), Internalization (explicit to tacit knowledge, e.g., translating theory into practical activity), and Combination (explicit to explicit knowledge, e.g., combining, merging existing ideas).

		TO	
		Tacit	**Explicit**
FROM	**Tacit**	**Socialization**	**Externalization**
	Explicit	**Internalization**	**Combination**

Figure 1: The SECI Model for Knowledge Creation and Conversion. Adapted From Nonaka and Takeuchi (1995)

Stollenwerk (1999) presents a survey that groups existing KM models in the literature based on similar concepts, as shown in Figure 2. This grouping evidenced equivalences between the processes present in the different works, bringing nine sets of KM processes, namely: (i) *Identification*, (ii) *Capture*, (iii) *Selection and Validation*, (iv) *Organization and Storage*, (v) *Sharing*, (vi) *Application*, and (vii) *Creation*. This broad study led to the development of a generic KM model that unifies and synthesizes the different aspects addressed by the literature, circumscribed by KM facilitating factors, which are: (a) *Leadership*, (b) *(Organizational) Culture*, (c) *(Information and Communication) Technology*, and (d) *Measurement and Reward*.

The *Identification* process involves identifying the knowledge that is needed and available, as well as mapping the sources of necessary knowledge. The *Capture* process is associated with acquiring the required knowledge

and can be done using internal or external sources. The *Selection and Validation* process filters the captured knowledge, assesses its relevancy and reliability, and consolidates valuable knowledge while discarding redundant, uncertain, and unhelpful knowledge. The *Organization and Storage* process ensures that knowledge can be retrieved quickly. This knowledge retrieval is usually done through software-based storage systems. The *Sharing* process is about facilitating access to the stored knowledge and disseminating it to others. It also relies on software to enable easy sharing. The *Application* process involves applying the knowledge to specific situations and sharing experiences and lessons learned. Finally, the *Creation* process involves knowledge externalization, creative thinking, research, experimentation, discovery, and innovation. These activities promote learning, help to generate new knowledge, and support the development of new ideas and solutions (Stollenwerk, 1999).

Leadership has a primary role as KM is a facilitating factor since corporate leadership is essential to sponsor Knowledge Management. The Organizational Culture is a facilitating factor focusing on excellence, flexibility, self-management, proactivity, and future vision. *Information and Communication Technology* provides KM systems for storing, sharing, and organizing knowledge. *Measurement and Reward* is the facilitating factor that improves the focus on the actions that achieve mensurable goals and performance indicators (Stollenwerk, 1999).

Section 3 will establish a relationship between some Futures Research methods, the SECI model dimensions, and the generic KM model processes in Figure 2. The SECI and generic KM models proposed by Stollenwerk (1999) will serve as interfaces between KM and Futures Research.

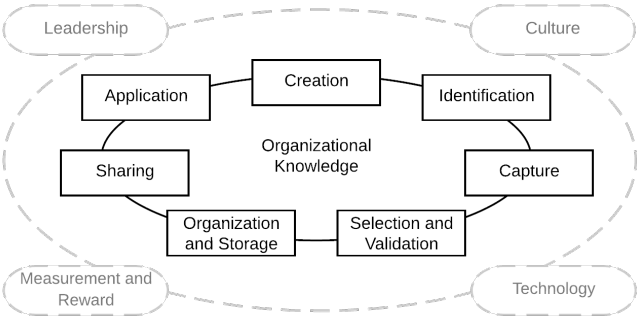


Figure 2: KM Processes And their facilitating factors. Adapted From Stollenwerk (1999).

2.2 Futures Research

Futures Research is a transdisciplinary field that uses various methods to explore possible, plausible, and preferable futures (Bengston, 2019). Its activities involve the analysis of technology futures and impacts (Johnston, 2008). These activities aim to formulate and test possible and desirable futures to assist decision-making, including analyzing how these conditions can change from implementing policies and actions (Reis, Vincenzi and Pupo, 2016).

Because of its broad definition, involving a variety of methodologies and techniques for the analysis of technology future, different classifications for Futures Research methods are present in the literature. Futures Research methods may be classified in different ways according to:

- *Nature*: Popper (2008) classifies methods as qualitative (soft), quantitative (hard), or semi-quantitative. Qualitative methods deal with the subjective and creative perception of events and their meanings. Quantitative methods comprise statistical analyses of datasets, such as historical series or economic indicators. Semi-quantitative methods rely on mathematical models to reduce the subjectivity of opinions from non-professionals or experts.
- *Approach*: Porter et al. (2004) divide Futures Research methods into normative or exploratory. Normative Futures Research methods start from perceiving future needs and aim to delimit the decisions and actions leading to the desired scenario. Explorative methods produce possible future scenarios from the extrapolation of the present situation.
- *Family*: Porter et al. (2004) offer a classification of the individual methods into nine families as follows: (i) *Creativity*, (ii) *Descriptive and Matrices*, (iii) *Statistical*, (iv) *Expert Opinion*, (v) *Monitoring and Intelligence*, (vi) *Modeling and Simulation*, (vii) *Scenarios*, (viii) *Trend Analyses*, (ix) *Valuing/Decision/Economic*.

- *Capability*: Another kind of classification, developed by Popper (2008), is related to its ability to gather or process information based on evidence, expertise, interaction, or creativity – attributes not exclusive or restrictive but quantified together in a polar multidimensional way. Evidence-based methods are based on knowledge usually already public, such as statistics or documentation, that is, explicit knowledge. Methods based on creativity are strongly influenced by imaginative thinking, such as science fiction and simulation games; therefore, they are based on tacit knowledge. Expertise-based methods rely on expert opinions and the data underlying those opinions; interaction-based methods involve knowledge exchange and discussion. Thus, both methods can depend on both tacit and explicit knowledge. This classification is the basis of the widely known Foresight Diamond, represented in Figure 3.

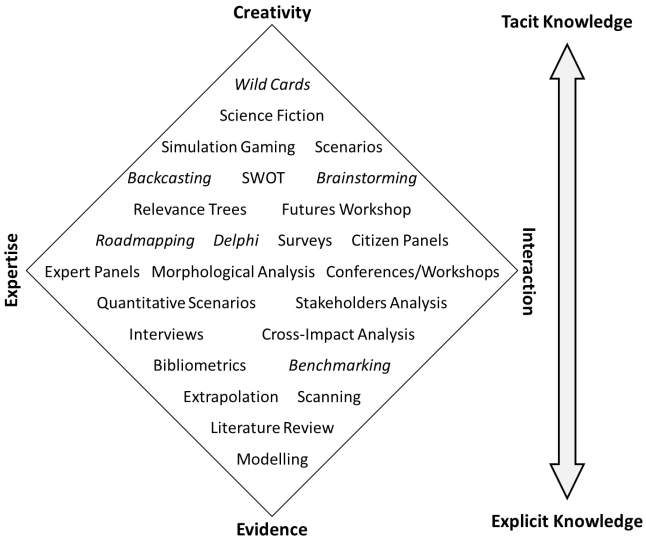


Figure 3: Adaptation of the Foresight Diamond (Popper, 2008) to Highlight the Knowledge Types Involved

3. Identifying Knowledge Management Processes in Futures Research

The relationship between Knowledge Management and Futures Research is pertinent because Knowledge Management focuses on managing knowledge within a company, while Futures Research aims to predict future events. By incorporating upcoming trends into Knowledge Management, a company can gain a competitive advantage by identifying early market risks and opportunities. Ultimately, the goal is to effectively comprehend, store, and utilize information about the future (Castro *et al.*, 2019). According to Junior *et al.* (2019), using both Knowledge Management and Futures Research can provide three significant benefits to organizations. First, organizations that manage their knowledge tend to perform better in Futures Research activities than those that don't because much of the necessary knowledge is already identified and explicit. Second, Futures Research can help identify, create, acquire, store, transfer, and use organizational knowledge, generating feedback to improve Knowledge Management processes. Finally, organizations with structured knowledge tend to be more resilient, enabling them to deal better with uncertainty, develop innovation, and explore new business fields.

The methodology we used to establish the relationships between Knowledge Management and Futures Research was based on the works of Nonaka and Takeuchi (1995), Stollenwerk (1999), Eerola and Miles (2011), and Barbosa (2018). By thoroughly reading the 53 descriptions of Futures Research methods provided by Barbosa (2018), we were able to determine the type of knowledge conversion each method employed (according to the SECI model) and its corresponding Knowledge Management process (according to Stollenwerk's generic KM model). Furthermore, by analyzing the knowledge-based perspective proposed by Eerola and Miles (2011) for Futures Research methods, we connected it with the same 53 methods and their categories. Thus, the bridge between Knowledge Management and Futures Research was constructed through an in-depth analysis of each method based on the abovementioned authors.

Section 3 establishes our view of the relationship between Futures Research and Knowledge Management, based on the Futures Research and Knowledge Management processes and SECI Dimension. First, in Sub-section 3.1, we show how to apply Futures Research methods to KM processes. Then, in Sub-section 3.2, we show how

organizations can incorporate KM into Futures Research. We aim to provide practical guidance on integrating Knowledge Management and Futures Research techniques in organizations.

3.1 From Futures Research to Knowledge Management

A reflection on Futures Research's objectives, methods, and practices can point out that Futures Research is nothing more than a process that involves finding, developing, merging, using, and creating knowledge about the future (Eerola and Miles, 2011). Its primary purpose is to assist in decision-making about the future scenario, which involves both historical and contemporary knowledge and its implications for the future.

Table 1 presents a set of 53 Futures Research methods and their classification according to approach and family. While some methods, such as Brainstorming, are well-known and widely used by KM practitioners, others – like *TRIZ* and *FAR* – may be less familiar to those outside the Futures Research field. As Barbosa (2018) provides a detailed description of each of the 53 methods, this work will focus on establishing the relationship between these methods and the corresponding SECI model dimensions associated with a KM process. We can identify the relationship by analyzing these descriptions and comparing them with the works in Sub-section 2.1. This association is justified because all the listed methods involve some form of knowledge conversion and are thus relevant to the KM process. More specifically, as Futures Research often involves generating knowledge for strategic planning, the processes of *Identification*, *Capture,* and *Creation* of knowledge are the ones that can most benefit from applying a specific method.

In our efforts to draw parallels between the methods chosen and knowledge conversion activities, we concluded that methods from the *Expert Opinion* and *Creativity* families, as well as methods that involve the elaboration of alternative futures – *Brainstorming*, *Delphi*, *Focus Groups*, *Interviews*, *Options Analysis*, *SWOT*, *Science Fiction Analysis*, *TRIZ*, and *Vision Generation* – are related to the *Externalization* mode of knowledge conversion because their main goal is to convert the tacit knowledge to be expressed by the participants into explicit knowledge. On the other hand, methods that deal with structured data, whether numerical or not, established by databases, documents, and other subsidies, are associated with the *Combination* mode. Examples include *Bibliometrics*, *Cross-Impact Analysis*, *Demographic Analysis*, *Trend Extrapolation*, and *Trend Impact Analysis*. The *Socialization* mode and *Externalization* mode are often used together in workshops or group-related methods to convert tacit knowledge into both tacit and explicit knowledge. Since none of the methods listed in the table convert explicit knowledge into tacit knowledge, *Internalization* is omitted. However, it is important to note that the classification of methods according to their relationship with knowledge conversion activities may vary depending on the theoretical framework or perspective adopted.

The last column of Table 1 suggests the KM processes where the methods can be best applied. We used the generic KM model proposed by Stollenwerk (1999), which includes the *Identification* process for identifying critical knowledge, the *Capture* process for acquiring essential abilities, experiences, and knowledge, and the *Creation* process for generating new knowledge through learning, research, experimentation, and innovation. *Scenarios* can be used across all three processes. Other methods such as *Action Analysis*, *AHP*, *Decision Analysis*, *and Relevance Trees* do not focus on generating new knowledge but instead, identify necessary knowledge to prepare for more complex knowledge generation processes. We could not relate the other processes in Sub-section 2.1 to any of the listed methods.

Table 1: Futures Research Methods, Classifications, Corresponding SECI Model Dimension, and KM Process. Methods and Categories Adapted From Porter et al. (2004) and Barbosa (2018)

Method	Approach [1]	Family [2]	SECI Model Dimension [3]	KM Process
Action Analysis	N/Ex	V	C	Identification
Agent Modeling	Ex	Mod	C	Creation
Analogies	Ex	Desc	C	Creation
Analytical Hierarchy Process (AHP)	N	V	C	Identification
Backcasting	N	Desc	C	Identification Capture
Bibliometrics	Ex	Mon/Stat	C	Creation Identification
Brainstorming	N/Ex	Cr	E	Creation Capture
Brainwriting	N/Ex	Cr	E	Creation Capture
Causal Models	Ex	Mod	C	Creation

Method	Approach [1]	Family [2]	SECI Model Dimension [3]	KM Process
Checklists for Impact Identification	Ex	Desc	C	Creation
Complex Adaptive System Modeling (CAS)	Ex	Mod	C	Creation
Correlation Analysis	Ex	Stat	C	Identification
Cost-Benefit Analysis	Ex	V	C	Identification
Creativity Workshops	Ex/N	Cr	S/E	Creation Capture
Cross-Impact Analysis	Ex	Mod/Stat	C	Creation
Decision Analysis	N/Ex	V	C	Identification
Delphi	N/Ex	ExOp	E	Capture
Demographics	Ex	Stat	C	Creation
Diffusion Modeling	Ex	Mod	C	Creation
Economic Base Modeling	Ex	Mod/V	C	Creation
Field Anomaly Relaxation Method (FAR)	Ex/N	Sc	C	Creation Identification
Focus Groups	N/Ex	ExOp	E	Capture
Future Workshops	N/Ex	Cr	S/E	Creation Capture
Futures Wheel	N/Ex	Desc/V	C	Creation
Interviews	N/Ex	ExOp	S/E	Capture
Life Cycle Assessment	Ex	Desc/Mod	C	Identification
Long Wave Analysis	Ex	Tr	C	Identification
Mitigation Analysis	N	Desc	C	Identification
Monitoring (Environmental Scanning)	Ex	Mon	C	Identification
Multicriteria Decision Analysis	N	V	C	Identification
Morphological Analysis	N/Ex	Desc	C	Identification
Multiple Perspectives Assessment	N/Ex	Desc	S/E	Capture
Nominal Group Technique	N/Ex	Cr	S/E	Creation Capture
Options Analysis	N/Ex	ExOp/V	C	Identification
Organizational Analysis	Ex	Desc	C	Creation
Participatory Techniques	N	ExOp	S/E	Capture
Precursor Analysis	Ex	Tr	C	Identification
Relevance Trees	N/Ex	Desc/V	C	Identification
Requirements Analysis (PATTERN)	N	Desc/V	C	Identification
Risk Analysis	N/Ex	Desc/Stat	C	Identification
Roadmapping	N/Ex	Desc	C	Identification
Scenarios	N/Ex	Sc	C	Creation Identification Capture
Science Fiction Analysis	N	Cr	C	Creation Identification
Social Impact Assessment	N/Ex	Desc	C	Identification
Stakeholder Analysis	N	Desc/V	C	Capture
State of the Future Index (SOFI)	N/Ex	Desc	C	Identification
SWOT	Ex	ExOp	E	Identification
Technological Substitution	Ex	Mod	C	Identification
Technology Assessment	Ex	Desc, Mod	C	Identification
Trend Extrapolation	Ex	Tr	C	Identification
Trend Impact Analysis	N/Ex	Tr/Stat	C	Creation Identification
TRIZ	N/Ex	Cr	C	Creation Identification
Vision Generation (Aspirational Futures)	N/Ex	Cr	E	Creation Capture

[1] N – *Normative*, Ex – *Exploratory*
[2] Cr – *Creativity*, Desc – *Descriptive and Matrices*, Stat – *Statistical*, ExOp – *Expert Opinion*, Mon – *Monitoring and Intelligence,* Mod – *Modeling and Simulation*, Sc – *Scenarios*, Tr – *Trend Analyses*, V – *Valuing/Decision/Economic*
[3] S – *Socialization*, E – *Externalization*, C – *Combination*, I – *Internalization*

Futures Research has many diverse methods, drawing on various research traditions and areas. Practically any source of insight about science and technology – their production, communication, and application – can be utilized as knowledge inputs into Futures Research (Eerola and Miles, 2011). Futures Research is an iterative, multi-step work that uses multiple quantitative and qualitative methods to complement each other (Porter *et al.*, 2004). For example, the TIAMAT framework (Barbosa *et al.*, 2022) consists of generalizing Futures Research activities in workflows of Futures Research methods. The organization can use the best method or set of methods.

3.2 From Knowledge Management to Futures Research

If an organization plans to walk the other way and incorporate KM into Futures Research, Figure 4 summarizes how to conduct Futures Research exercises using a knowledge-based approach. The work adapted from Nonaka and Takeuchi (1995) and Eerola and Miles (2011) enables the Futures Researcher to be a Knowledge Manager, helping to incorporate KM into Futures Research.

The first step of a knowledge-based Futures Research exercise, design, and planning, in which the work's subject, scope, methods, workflow, and responsibilities are defined, corresponds to the *Socialization* and *Externalization* modes of the SECI model. This step involves dynamic interaction and sharing information about the views, opinions, expected results, responsibilities matrix, and definitions of the work itself. The workflow process, composed of multiple and diverse Futures Research methods, covers mainly the *Externalization* and *Combination*, consisting of eliciting and sharing information, expertise, and opinions from experts, stakeholders, or general participants. Such Future Research methods capture information to formulate posits, combined or not with structured information like statistical data, economic indicators, or trend extrapolations. We should highlight that, in Figure 4, the families of methods listed in the *Externalization* and *Combination* modes may differ from our previous classification shown in Table 1 because we're dealing with the methods belonging to a specific family more generically. As Table 1 deals with each method individually, the relationship between a family and a SECI model dimension may differ.

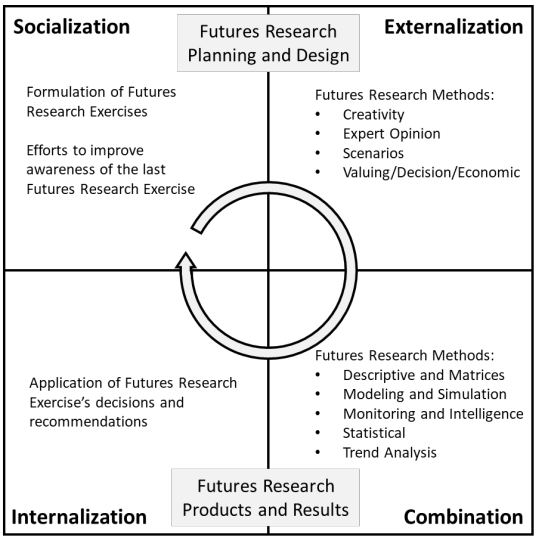


Figure 4: KM Processes in a Cycle of Futures Research Exercises. Adapted From Nonaka and Takeuchi (1995) and Eerola and Miles (2011)

As each method produces its results, new posits are put into context, providing feedback to the workflow. Future Research methods can be used for formulating clear priorities, recommendations, and decisions, covering the phases of *Combination*, *Internalization,* and *Socialization* again, indicating a cyclical process of knowledge exchange.

4. Discussion

One of our primary objectives was to facilitate mutual contributions between the areas of KM and Futures Research. By establishing an interface between the SECI model and the generic KM model proposed by Stollenwerk (1999), organizations can adapt their own KM models to deal with future knowledge and manage all the knowledge generated during Future Research exercises more effectively. We consider this objective to have been accomplished in Section 3.

Regarding using a knowledge-based approach, Eerola and Miles (2011) point out a "microcosm" of a Futures Research exercise. Scenario workshops typically consist of a sequence of activities, with periods of extensive exchange and debate of ideas, annotation, listing, combining different lists, and narrative construction. Thus, several rounds of the SECI processes are needed to accomplish this step of the Futures Research activity. This cyclical movement, therefore, consists of many sub-cycles within the grand cycle that covers the SECI model, as described by Eerola and Jorgensen (2002).

Integrating Knowledge Management and Futures Research requires organizational commitment, support, and readiness for change. As in any organizational cultural change, it often involves overcoming resistance to new ways of thinking and working and establishing collaborative structures and processes that foster knowledge-sharing and future-oriented thinking. Nevertheless, this combination's potential to offer complementary perspectives, enhance strategic planning, facilitate anticipatory knowledge creation, and improve decision-making.

Although we have achieved the objectives outlined in the introduction of this work, some limitations need to be addressed. Firstly, the methods presented in Table 1 do not fully apply to the remaining processes in our generic KM model. Processes such as *Selection and Validation*, *Organization and Storage*, *Sharing*, and *Application* of knowledge do not appear to align with or benefit from any of the Futures Research techniques listed. Another limitation is that we could not establish a clear relationship between the ways of classification – *Nature*, *Approach*, *Family*, and *Capability* – of Futures Research methods and the SECI model or the processes in the generic KM model. For instance, we suggested that methods from the *Creative* family were linked to the *Externalization* mode, but exceptions such as *Science Fiction Analysis* and *TRIZ* exist. Finally, there are inherent limitations in combining two distinct areas of knowledge. Futures Research deals with the uncertainty and complexity of anticipating future developments, while Knowledge Management focuses on managing existing knowledge within a known context. Integrating these fields has challenges of uncertainty and complexity in future-oriented knowledge management.

5. Conclusion

Our contemporary world is fraught with uncertainty, which governments and organizations can alleviate through the efficient use of knowledge and forecasting techniques. In this work, our main objective was to establish a two-way interface between Knowledge Management and Futures Research. To achieve this, we established a relationship between the SECI model of knowledge conversion, a generic KM model, and 53 Futures Research methods. This interaction enables Knowledge Management to benefit from Futures Research methods in activities related to future knowledge generation. Conversely, to enable Futures Research to benefit from Knowledge Management, we presented a knowledge-based approach framework based on the work of Eerola and Miles (2011).

As we discovered that literature covering both Knowledge Management and Futures Research areas is hard to find, this work is our contribution to expanding the literature about future knowledge management. Futures Research can help identify, create, acquire, store, transfer, and use organizational knowledge. Futures Research generates feedback to improve Knowledge Management processes, making organizations more resilient, enabling them to deal better with uncertainty, develop innovation, and explore new business fields. Understanding the relationship between Knowledge Management and Futures Research is expected to provide valuable insights for governments and organizations seeking to improve their decision-making processes through Knowledge Management.

To further advance this research, we recommend that researchers consider expanding the classification of Futures Research methods and explore ways to integrate methodologies with high applicability, such as Scenarios, into their KM models and processes for forecasting.

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Current State and Future Direction of Digital Knowledge Management in Small and Medium Enterprises

Yannick Dassen[1], Luca Liehner[2], Philipp Brauner[2], Simon Storms[1], Werner Herfs[1] and Martina Ziefle[2]

[1]Laboratory for Machine Tools and Production Engineering (WZL), Aachen, Germany
[2]Human-Computer Interaction Center (HCIC), Aachen, Germany

y.dassen@wzl.rwth-aachen.de
liehner@comm.rwth-aachen.de
brauner@comm.rwth-aachen.de
s.storms@wzl.rwth-aachen.de
w.herfs@wzl.rwth-aachen.de
ziefle@comm.rwth-aachen.de

Abstract: Systematic knowledge management is a decisive competitive advantage. While large companies can successfully implement knowledge management through dedicated people, tools, and processes, this topic poses major challenges for small and medium-sized enterprises. In this paper, we present the results of a qualitative study of knowledge management practices in different small and medium-sized enterprises. The results show that while on the one hand employees are aware of the importance of strategic knowledge management, on the other hand knowledge management is insufficiently implemented in the companies. Further, we also found that the potential of digital knowledge management is currently untapped. Consequently, there is a threat of knowledge loss due to staff turnover against the backdrop of demographic change and changing employment patterns. This likely loss of knowledge threatens the competitiveness and viability of the small and medium sized companies. Based on our findings, the article concludes with actionable recommendations for companies and future research tasks.

Keywords: Knowledge management, SME, Shopfloor, Production engineering

1. Introduction

Against the background of further increasing market dynamics, the rise of global competition and the high demands on product complexity, knowledge as a resource increasingly gains in importance compared to the classic production factors (Fakhar Manesh et al, 2021; Vanini, Hauschildt, 2012). At the same time, the risk of knowledge loss increases for companies. On the one hand, knowledge becomes outdated ever faster (VDI, 2009; Arbesman, 2012). On the other hand and due to changing employment patterns of younger generations and the emerging demographic change, many employees are leaving the company, which means that there is a risk that their knowledge and expertise will be lost for the companies (Hertling, 2013; Eropean Commission, 2020). Small and medium-sized enterprises (SMEs) are just as affected by the relevance of knowledge as large corporations (Pawlowsky et al, 2006). A study from 2010 also shows that the degree of knowledge management maturity in German companies is determined less by the size of the company and the industry than by business strategies and core competencies (Pawlowsky, Gözlan, Schmid, 2010). Thereby knowledge management is particularly pronounced in companies that pursue an innovation strategy. While companies are establishing knowledge management in many areas and departments, its implementation on the shop floor is rare (Zapp, Hoffmeister, Verl, 2013). Yet, especially on the shop floor, key knowledge about processes and machines is bound in the heads of experienced employees (Eckardt, Skaggs, Youndt, 2014).

One possible reason for this problem could be found in the gap between theory and practice in the field of knowledge management: While a variety of theories and concepts exist around the topic, very few approaches offer concrete guidance on its implementation (Ragab, Arisha, 2013). Practical guides for the introduction of knowledge management, such as the "ProWis" developed by the Fraunhofer Institutes IPK and IFF, at least offer methodological support (Orth, Voigt, Kohl, 2011). During the development of the guide, the following problems in knowledge management were identified, among others: Inconsistent data storage, lack of systematic recording and documentation of project experience, insufficient central storage of knowledge and inadequate process descriptions (Kohl, Orth, Steinhöfel, 2015).

The use of information technology (IT) plays a central role in an effective and efficient knowledge management process, as it accelerates the rapid collection, storage and exchange of knowledge to an extent that was not possible in the past (Abubakar et al, 2019).

However, the interpretation of the available information remains the task of humans, so that IT systems only implicitly support the creation of knowledge and thus knowledge management by providing suitable information (Kautz, Thaysen, 2001). Companies in the entertainment industry, e.g. Facebook (Meta) and TikTok, already use machine learning approaches to control the user experience and to selectively highlight individually suitable information from the abundance of information (Goncalve, 2021). This puts them ahead of many companies in the manufacturing industry. The result is a technical revolution that, unlike in the past, is going the wrong way round: Digitization is penetrating the manufacturing industry from the private sector and with it come young people who are fully accustomed to it and want to reap the benefits at work as well (Daheim, Korn, Wintermann, 2018).

According to Zimmermann (2018) many SMEs are not aware of the benefits of extensive digitization and invest less than larger companies. Reasons cited for this include a lack of IT expertise, problems adapting corporate structures and processes, and poor internet quality (Zimmermann, 2017). Nevertheless, in a 2016 study, about half of the companies surveyed assessed their level of digitization as moderately or normally developed compared to its competitors in its own industry (Bley, Leyh, 2016).

1.1 Research Questions

At the Laboratory for Machine Tools and Production Engineering (WZL), we are committed to designing production technology for the future. To automate processes, we require a comprehensive understanding of interdependencies. Currently, much of this knowledge resides in the minds of the employees, which is why we need to develop suitable methods to capture and utilize this knowledge effectively. To achieve this, it is crucial to gain an understanding of the requirements of the companies that will use these knowledge management systems. While previous studies often have a broader scope related to the region under consideration and often look at the company as a whole, we focus on the Aachen region and knowledge management on the shop floor. Therefore, the goal of this study is to document the functions of existing knowledge management systems used on the shop floor of SMEs in the Aachen region and identify desired functions and features that are not yet available. To categorize these requirements and wishes, we will also assess the status of the surveyed companies regarding the digital transformation of production, Industry 4.0, and knowledge management. As a result, we aim to answer the following four research questions:

RQ1: What is the status of SMEs regarding digitization/Industry 4.0?

RQ2: What is the status of SMEs regarding knowledge management?

RQ3: What are the strengths and weaknesses of the systems and methods currently used for knowledge management?

RQ4: What requirements and wishes do the companies have regarding potential knowledge management systems?

2. Methodology

2.1 Approach: In-Depth Interviews With Relevant Stakeholders

To assess the current state of knowledge management and identify the requirements for knowledge management systems, we conducted semi-structured interviews with shop floor workers and controlling staff from multiple SMEs operating in the Aachen region of North Rhine-Westphalia, Germany. While semi-structured interviews can be time-consuming, they provide a valuable starting point for exploring the status quo of knowledge management in SMEs. Given the limited information available about knowledge management in SMEs, these interviews allow us to gain an overview of common practices and explore specific topics in more depth with follow-up questions. Additionally, semi-structured interviews enable us to extract key concepts and factors that can be used in larger quantitative surveys (Adams, 2015).

Our interviews focused on assessing the status of knowledge management in SMEs and identifying the requirements, opportunities, and strengths of future knowledge management systems. To achieve this, we asked respondents to perform a SWOT analysis (Strengths, Weaknesses, Opportunities, and Threats) and then followed up with questions about their wishes and demands for future knowledge management systems, with a particular focus on shop floor workers.

2.2 Interview Guidelines

The interview was divided into five main sections: *introduction, person-related information, enterprise-related information, knowledge management, and requirements.* The *introduction* consisted of informing participants about the procedure and topic of the interview. In addition, they signed a consent form allowing us to record the interview for evaluation purposes. We further informed them that their participation was voluntary and that they could withdraw from the interview at any given time (informed consent).

The second section (*person-related information*) first queried respondents' age and gender. Respondents were then asked to describe their career path including high school degrees, apprenticeships, university education as well as experience in their previous professions.

To retrieve *enterprise-related* information, respondents were asked to briefly describe the company they were currently working in. This included the size of the company (number of employees and business locations), the core competence of the company, and the technical equipment (machinery, digital infrastructure, etc.). This section also included respondents' perceptions of the utilization and acceptance of new technologies in the company. Lastly, respondents were asked to describe the onboarding process.

To start the section about *knowledge management*, respondents were requested to find an example of either distinctly good or bad knowledge management in their company. This example was used as a reference point for the remaining questions of this section. After the description of their example, respondents were asked to describe their company's process of storing and transferring knowledge by explaining the utilized methods and practices. Lastly, respondents had to perform a SWOT analysis to identify potential strengths, weaknesses, opportunities, and threads regarding their current knowledge management system.

In the last section (*requirements*), respondents had to determine the requirements and specifications they had for an optimal knowledge management system. To specify the question, respondents were asked what kind of support they would need to implement such a system, how much time employees would need to spend (in hours per week) on the system, and which steps would be needed to come to an optimal system.

At the end of the interview, respondents were thanked for their participation and given the opportunity to ask questions. We pre-tested and adjusted the interview guideline before we started with the interviews.

2.3 Procedures, Sample and Data Analysis

Respondents were recruited through email invitations sent by university partners who were either current or former research or industry project partners of the research institutes. If they agreed to participate, we sent an email with a consent form, schedule, and online session link. Interviews were conducted online via Zoom or Microsoft Teams due to the pandemic. Respondents were greeted by the interviewer and participated in a short introduction round. Interviews were conducted with one interviewee or in groups of 2-3 (See Table 1), lasted an average of 46 minutes, and were conducted in German. The transcripts were used for qualitative content analysis, with primary categories derived from the interview guideline and additional subcategories developed inductively. Once analyzed, the entire category system and relevant quotes were translated into English.

Table 1: Overview of Interview Participants

Code	Gender	Age	Domain	Interview number
IoP_LX_1_C_m_30	Male	30	Controlling	1
IoP_LX_2_C_m_57	Male	57	Controlling	2
IoP_LX_3_S_m_44	Male	44	Shopfloor	3
IoP_LX_4_C_m_30	Male	30	Controlling	4
IoP_LX_5_C_m_59	Male	59	Controlling	5
IoP_LX_6_C_w_27	Female	27	Controlling	6
IoP_LX_6_S_m_57	Male	57	Shopfloor	6
IoP_LX_7_C_m_53	Male	53	Controlling	7
IoP_LX_7_S_m_56	Male	56	Shopfloor	7
IoP_LX_7_s_m_	Male	Age was not recorded	Shopfloor	7

3. Results

In addition to requesting personal information and a brief company description, we inquired whether the use of knowledge management tools is part of the company philosophy or strategy. From our analysis of the interviews, we observed that knowledge management is becoming increasingly important for SMEs. In the age of digitalization and Industry 4.0, it is crucial for SMEs to effectively manage the large amount of data produced by personnel and machines.

When we asked about the types of knowledge that are produced, respondents mentioned a variety of content types, including standardized documents, documentation of mistakes, construction and 3D models, customer requirements, instructions, warnings, and more. Most of the respondents acknowledged that knowledge management is an important part of their company's development. However, they also mentioned several challenges that need to be addressed to integrate efficient knowledge management systems into day-to-day operations. Although a large amount of knowledge is accumulated, respondents mentioned that the data is not always automatically collected and machines are not always interconnected and communicating with knowledge management systems. This lack of interconnection is not always due to technological limitations but is also deliberately suppressed for security reasons. For instance, one respondent said: "No, they're completely disconnected so that access or manipulation from the outside cannot take place." (IoP_KX_1_C_m_30, L. 69-69).

Another challenge to the adoption of knowledge management is workers' acceptance of new methods. The willingness to use knowledge management systems can be influenced by factors such as technical knowledge, age, or general interest in the system. These factors can have a bidirectional influence on the use of the system, as one respondent explained: "There are a couple of employees who are particularly interested in that. Others have already given up on it because they realize that nothing is happening. You have a broad field of different characters […]." (IoP_KX_6_C_w_27, L. 589-593).

In the final part of the enterprise-related information section, we inquired about the onboarding process and the transfer of existing knowledge within the company. Respondents mentioned various methods, including general training (such as face-to-face), learning by doing, knowledge databases, and mentoring programs where new employees are assigned a mentor to help them get acquainted with their new tasks. With a comprehensive understanding of the current state of knowledge management, the subsequent sections will concentrate on the current state of knowledge management in SMEs and the employees' requirements for future systems.

3.1 Current State of Knowledge Management

In the third section of the interview, respondents were asked to provide more details about the current state of knowledge management in their company. The primary focus was on the methods used for transferring knowledge. The most commonly mentioned method was face-to-face knowledge transfer, as reported by four interviewees. However, one respondent (IoP_KX_6_S_m_57) noted that this method often results in lost knowledge when an employee leaves the company. To address this issue, respondents suggested using protocols, digital training, training computers, history data of existing software solutions, or even pen and paper to retain knowledge within the company. Additionally, trial and error and status indication from software or machines were mentioned as methods of acquiring knowledge about processes and operating principles.

Regarding the capturing of transferred knowledge, three respondents reported not having a standardized knowledge management system in place. One interviewee (IoP_KX_3_S_m_44) explained that knowledge is passed on verbally and not documented. We observed that smaller-sized companies often rely on passing on knowledge from person to person, without deeming it necessary to save it permanently. However, when knowledge is saved, it is done either digitally on servers and hard drives (N=5) or in an analog manner through notes and physical folders (N=3).

To gain further insights into SMEs' knowledge management approach, we asked interviewees to perform a SWOT analysis, in which they identified the strengths, weaknesses, opportunities, and threats regarding how they transfer and store knowledge within their company.

3.1.1 Strengths

In general, respondents report, that through a central point of knowledge, unrestricted information transfer, data visualization, standardized processes, and regulated communication channels knowledge management can lead to higher efficiency, productivity, and flexibility. For instance, one respondent states that orders can be processed faster as knowledge is immediately and directly accessible by employees without relying on face-to-

face communication. A well-established knowledge management system can hence lead to a better *reproducibility*, which gives the company a competitive advantage in terms of speed and adaptability (*"You don't have to do it again and again. Thus, one is naturally faster and has a certain competitive advantage over others who have to do it for the first time."* (IoP_KX_1_C_m_30).

A further advantage of knowledge management systems is the ability to react to problems in a more structured and targeted manner allowing controlling personnel to identify the origin of the problem (*"The collection of numbers, data, and facts also gives us the opportunity to approach possible solutions to problems in a more structured way.",* IoP_KX_7_S_m_). Lastly, the respondents mention that knowledge management systems can allow for feedback in learning processes. By documenting their learning activities, employees can track their progress and adjust it accordingly allowing for a more individualized learning experience.

3.1.2 Weaknesses

As a major weakness, respondents report that knowledge management is too time-consuming in relation to its benefits (N=6). This is best illustrated by one respondent who states: *"The point is, that writing down all that knowledge is just exhausting. I once had an experienced colleague who spent his day writing down all he knew. It was a full-time job for several years. And then start to wonder if it's really worth it."* (IoP_KX_1_C_m_30).

This can on the one hand be due to a lack of structure or an inconsistent implementation of the knowledge management system. This inconsistency is for instance reflected in the different types of knowledge management systems put in place for the various tasks, machines, or departments, thus making it impossible to find a common communication ground between systems. The same is true for older pieces of equipment which are unable to communicate with the newer system. Finally, respondents state that knowledge is still very much linked to employees instead of machines: "To this day still the knowledge is linked to the people and as soon as they leave the company, of course, the knowledge also leaves the company as well." (IoP_KX_4_C_m_30).

3.1.3 Opportunities

From the identified strengths, a series of opportunities for SME's can be extracted. First, through the implementation of a knowledge management system, SME's can gain a competitive advantage by recording more detailed information and documenting experiences. To illustrate one of the respondents notes: "In reality, it's like a treasure chest full of experiences." (IoP_KX_5_C_m_59).

Furthermore, knowledge management gives SME's the opportunity to further develop their technical infrastructure as it provides employees with feedback systems and error tracking and notification. This can further be enhanced by error prevention using artificial intelligence methods. Respondents furthermore mention that knowledge management can greatly enhance transparency within the company. One respondent, for example, mentions that employees could be motivated by gaining insight into the data generated by knowledge management systems (*"I mean people should be motivated by seeing the numbers and tell themselves: 'We have to do something'"*, IoP_KX_7_C_m_53). Lastly, respondents see an opportunity for better training methods and onboarding processes, as they can rely on a larger pool of knowledge and experience.

3.1.4 Threats

While a great number of opportunities arise from the implementation of knowledge management systems, a series of threats and risks could also be identified. The most commonly threat mentioned by respondents proved to be the fear of being too digital. First of all, respondents were mindful of the technological dependence such a system can create. The possibility of their system being a target of cybercrime or being erroneous, thus halting production could influence the acceptance of these systems. They also fear that teamwork will be hampered by misunderstandings if much of the knowledge is stored and transmitted via digital devices instead of face-to-face communication. Along with this comes the threat of losing the ability to critically think about a given task or process. This is best illustrated by one respondent who states: *"The risk is, of course, that one relies too much on what is written. That is, if there is a specific program that you trust, but maybe someone made a mistake or somehow an error got in, uhm…that you rely on it and don't question yourself anymore, right? That one no longer uses their brain anymore."* (IoP_KX_1_C_m_30). Besides that, respondents state that they might be overwhelmed by the extra amount of work that is required to keep the knowledge management system up to date. They also mention the large amount of data that is generated and needs to be maintained on a day-to-day basis. This in turn can lead to a loss of efficiency, as more time is dedicated to the management of knowledge than to the actual creation of knowledge and the manufacturing of products.

3.2 Target state and requirements

In the last section of the interview, we asked respondents to state their requirements and wishes for future knowledge management systems for SMEs. First, we asked them for the support they would need to put these systems into place. Second, we queried requirements and wished they had for those systems.

3.2.1 Support needed

Respondents identified three main points when asked about the support needed. Firstly, they emphasized the need for sufficient time and manpower to establish, maintain and provide data for the knowledge management systems. Secondly, respondents noted that the necessary hardware and software are often lacking in SMEs, and professional technicians (such as electricians or programmers) are required to set up the technical infrastructure. One respondent, for instance, states: *"I would take care of the design. I just need a programmer at my disposal who could change something in the system when I need to."* (IoP_KX_3_S_m_44). Lastly, employees need to be trained by experts to be able to use newly implemented systems. One participant (IoP_KX_4_C_m_30) notes that it would be crucial to have an expert on-site who is specialized in knowledge management.

3.2.2 Requirements

For the analysis of the requirements, we focused on broad themes that are applicable to a series of different application domains. We identified the following five general requirements for knowledge management systems:

1. Build on transparency
2. Usability for all
3. Support instead of replace
4. Collaborative through communication
5. Multi-context adaptability

In a first step, respondents stated that the novel knowledge management systems should be built in a way that could be understood by controlling and shopfloor. Therefore, these systems must be transparent to be accepted by employees, extend their functionality and adapt them to a particular use case (*"My wish would be to have a system, which is transparent, which is accepted, and you can build on that."*, IoP_KX_7_S_m_56).

Second, the systems ought to be usable by all. In other words, the interface should be built in such a way that employees can easily understand it in an intuitive manner, without the need for additional support. This applies to both the transfer and storage of knowledge. Third, the systems should ensure the support of the employees without crossing the limits of their responsibilities. One respondent states that the system should support the employee's experiences to enable a learning process (*"The […] system must support experience. So again, human beings are so good at troubleshooting, when they have all the information […]"*, IoP_KX_7_C_m_53).

Further, the system needs to be able to support collaborative work by not only communicating information and knowledge between workers but also between machines and across different departments and domains.

To that end, knowledge management needs to adapt to varying contexts (e.g., controlling, shopfloor, finance, human resources, etc.) as well as be extensible to include new functionality for different application areas (*"But what I also think is crucial that the system must be adaptable at any time. Because if we now buy something "that can do this and that" and then we say, "there is still something missing", but we don't get it […]"*, IoP_KX_7_C_m_53).

4. Discussion

In the following, we discuss the results of this study regarding the research questions RQ1-4 posed at the beginning.

4.1 Status of Small and Medium Enterprises Regarding Digitalization and Industry 4.0

The results of the interviews show that the state of digitalization in companies varies greatly.

In principle, all participants show interest in switching from manual and analog to digital processes for knowledge management. The creation and management of digital documents in a wide variety of forms is part of the everyday life of many companies. However, there is usually no automatic exchange between these documents. Employees must access many different documents, directories, and tools to acquire knowledge and

there is no uniform database. In principle, these documents and tools can also be created or used on a normal desktop PC. The use of innovative technologies such as augmented reality, virtual reality, or smart assistants was not mentioned by any of the participants. All technologies used on the shop floor are basically the same as in the office. Digitalization therefore seems to essentially mean the elimination of paper for participants. The advantages that can be gained from the sensible use of information technology like rapid collection, storage and exchange of knowledge (Abubakar et al., 2019) are currently not being used. It is evident that the companies of the participants are falling behind the IT and entertainment industry as they are not utilizing machine learning or other AI algorithms to analyze and condense information, as suggested by Goncalve (2021).

The networking aimed at in the sense of Industry 4.0 is also handled differently. While some companies already use the data from their machines to solve already known problems faster, or to reuse programs, there are concerns about security when it comes to networking. Some companies do not connect their machines to any network at all, and thus prevent the data from being used for smarter production control. Consequently, these concerns must be addressed, as the close interlinking of machines and people is essential for realizing the vision of Industry 4.0 and the digital transformation of production (Brauner, Dalibor, Jarke, 2022; Kagermann, 2015).

4.2 Status of Small and Medium Enterprises Regarding Knowledge Management

When presenting the second research question, the thesis posited that companies recognize the importance of knowledge management, which has been validated by the findings. The participants are conscious of the swift loss of knowledge and the complications that arise. However, the results indicate that current methods employed are still deeply traditional: direct exchanges between employees, learning by doing, mentoring, and face-to-face discussions are widespread. Whether knowledge is digitized hinges mainly on the availability of appropriate software and hardware. Companies lack expertise in IT and a comprehensive understanding of potential technologies and their effective use. Poor internet connectivity, which Zimmermann (2017) cites as another factor for low digitalization levels, was not corroborated in our study. Thus, successful digitalization implementation is pivotal for innovative knowledge management. Not one of the participants mentioned having dedicated knowledge management systems.

4.3 Strengths and Weaknesses of Current Knowledge Management Systems

The SWOT analysis conducted in the interview regarding the knowledge management systems used made the participants reflect on the status. In doing so, they could formulate the strengths of knowledge management, even though the systems they are currently using only really cover these advantages to a certain extent. They cite higher efficiency, flexibility and adaptability as well as better training and learning processes.

The weaknesses found relate more specifically to the systems used. Lack of time or too time-consuming processes, unstructured and inconsistent implementation of knowledge management systems and methods are the biggest weaknesses mentioned. In particular, the inconsistency in interfaces and file formats prevents a uniform basis for communication. These statements of the participants coincide with the problems Kohl et al. identified for the implementation of knowledge management in their research (Kohl, Orth, Steinhöfel, 2015).

Based on the determined strengths the participants see the possibilities for feedback systems and error tracking, that can be even extended by artificial intelligence. The possible transparency and time-independent availability of knowledge is also seen as an opportunity to uncover previously unknown problems and to motivate employees to participate more actively in the problem-solving process. The companies can describe their needs quite succinctly but have no idea whether suitable technological solutions exist. For us as research institutes, this is also an indication of the large gap between research and practice that needs to be narrowed.

Two topics are mentioned as hazards: Fear of cybercrime and the danger of employees blindly relying on technical systems. People should always think along and question plausibility. Furthermore, the use of knowledge management systems must not lead to too much additional work, as this not only reduces efficiency, but also acceptance. These points show that psychology also plays a role in knowledge management. Trust in technology is essential and must be considered in the development of management systems just as much as productivity.

4.4 Requirements for Novel Knowledge Management System

From the need for time and manpower mentioned by the participants, it can be seen that the expertise to implement structural knowledge management is not currently available in most SMEs. Furthermore, it is difficult for them to determine the costs for the necessary hardware and software and the return on investment which confirms Zimmermann's (2018) findings.

The success of knowledge management is not trivially measurable. In addition to training their employees, companies therefore need a better overview of methods and systems and their impact.

The participants' wishes for future knowledge management systems can be derived not only from the queried requirements, but also from points mentioned in the context of the SWOT analysis. In addition to the five general requirements collected (Build on transparency, usability for all, support instead of replacing, collaborative through communication and multi-context adaptability), conclusions for the development of new systems can be drawn in particular from the weaknesses found in the current systems. Time consumption, lack of structure and the absence of a unified solution are indications that should be considered.

4.5 Limitations

Although our study has yielded valuable insights on the status of knowledge management systems and their requirements, it is not without its limitations. To overcome these limitations, future qualitative studies should broaden their scope to include a more diverse sample beyond university boundaries. This could provide a better understanding of cultural differences and introduce diversity in terms of SMEs' structures and cultures. Additionally, targeting a sample disconnected from university projects could minimize bias towards the usefulness and acceptance of knowledge management systems.

Apart from expanding the sample size, the results of our study should also be validated quantitatively, both within and outside of Germany, to identify and analyze current and future trends and perceptions of knowledge management systems on a wider scale.

5. Conclusion and Outlook

This study offers valuable insights into the demand, current utilization, and challenges of knowledge management in small and mid-sized companies, with a focus on shop floor operations. Specifically, the interviewees' requirements for knowledge management systems serve as a foundation for future research on the development of methods and systems for shop floor knowledge management.

Our findings reveal that the current proliferation of various approaches and tools makes it challenging to establish a transparent and uniform knowledge base. Thus, companies require a centralized, user-friendly system with intuitive interfaces that seamlessly integrate systematic knowledge management into standard work processes. Furthermore, such a system should provide understandable suggestions to users, empowering them to make informed decisions. The results also show that there is a significant knowledge gap on the part of companies regarding technical possibilities and their meaningful use, especially for knowledge management. As the present study was conducted qualitatively with a rather small group of companies, it provides only an impression and is not representative.

Building on these results, we aim to concentrate on the technical realization of a novel knowledge management system, including usage guidelines that will facilitate the systematic implementation of knowledge management on the shop floor. The integration of knowledge management into daily work processes is a priority. In the future, we will investigate how knowledge and experience of employees can be captured by tracking their activities, so that they may not have to actively perform additional tasks. This will be done in close cooperation with companies to ensure a continuous match between the possible solution and the requirements.

Furthermore, the use of AI for capturing, sorting, and analyzing knowledge will be particularly interesting in the future. The lack of digitalization in companies, as identified in this study, makes it difficult to collect the data necessary for training AI. Although the creation of training data for simple tasks is trivial to realize via MTurk and other services, capturing complex, heterogeneous, and often unstructured expert knowledge digitally is difficult (Hoffmann, 1987). Hence, there is often too little suitable data for training ML models (data scarcity) (Mansfield, Tamma, Goddard, 2021).

Improving systematic digital knowledge management in companies can make a significant contribution here and thus boost the digital transformation of production (Brauner, Dalibor, Jarke, 2022).

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Knowledge Absorptive Capacity in Fintechs: Evidence From Latin America

Guillermo Dávila[1], Marcelo Pimentel[1], Maria Teresa Cuenca[2] and Susanne Durst[3]
[1]Universidad de Lima, Perú
[2]Universidad Técnica Particular de Loja, Ecuador
[3]Reykjavik University, Iceland

gdavila@ulima.edu.pe
ppimente@ulima.edu.pe
mtcuenca@utpl.edu.ec
susanned@ru.is

Abstract: Fintechs use technologies to offer financial services in a different way than traditional ones. The Fintech sector has seen rapid growth in the global economy and has expanded access to financial services to a wide variety of users; consequently, it has drawn the attention of academics around the world. Being knowledge-intensive organisations, Fintechs can absorb knowledge as a key competence. Absorptive capacity – which includes practices to acquire, assimilate, transform, and apply knowledge - has been analysed in previous studies as a factor that can influence organisational performance. However, most studies have used data from developed countries. The objective of this ongoing study is to analyse the knowledge management (KM) practices used by a Latin American Fintech to absorb knowledge. For this, a case study with a qualitative approach will be presented, using data from an international company of Peruvian origin, specializing in leasing. Data was collected through interviews. The information collected was transcribed and categorized for analysis. The analysis will include content analysis and narrative analysis techniques, supported by Atlas.ti software. The results contribute to the KM literature in two ways: First, by describing how knowledge absorption occurs in Fintechs. Second, by systematizing evidence on how KM practices act in organisations in emerging contexts, to support absorption capacity, and consequently, contribute to organisational results. On the empirical side, this study provides specific insights to managers of companies in the financial and technological sectors in emerging contexts, on how and which practices implementing to improve KM in their organisations.

Keywords: Knowledge absorptive capacity, KM practices, Fintech, Peru

1. Introduction

In the last decade, the world has witnessed strong growth in digital innovation, especially in activities that focus on the design and delivery of FinTech financial services. According to Gomber, Koch, and Siering (2017), the term Fintech is a neologism that comes from the words “finance” and “technology” and is defined as financial companies that use technology to offer innovative financial services. Arner et al. (2015) in their article on the evolution of FinTech, described the historical development of FinTech as a continuous process of financial service and technology evolving together. As a result, investments in technology are doubling. In 2022, global Fintech investments are on par with the same period last year, at over USD 22 billion (Venture Scanner, 2023). By 2025, the size of the global Fintech market is estimated to be approximately US$305 billion, at a compound annual growth rate of around 20% over the coming years (Ng and Pan, 2022). The literature shows the entrepreneurial and adaptive capacity of FinTechs and implies that these companies continuously detect industry, market, and technological opportunities to renew their products and business models (Kazan et al. 2018). Therefore, Fintech is considered a key driver of knowledge and experts predict a very promising future (Gimpel, Rau, and Röglinger, 2018).

Most innovations result from acquiring, transforming and applying knowledge and not only from invention (Zahra and George, 2002; Leal-Rodriguez et al., 2014). In this context, it has been shown that the creation of heterogeneous firms is not only due to the diversity of inputs but also to the heterogeneous knowledge of entrepreneurs and their ability to coordinate disparate knowledge about technology, people, and processes (Alvarez and Busenitz, 2001). Furthermore, it has been shown that fintech growth is explained by founders' knowledge, founders' social ties with other founders whose knowledge domains are different from their own, and employees with different knowledge (Sako, Qian, and Verhagen, 2022). Elidjen et al. (2022) make a similar point in their study, mentioning that the use of external sources of knowledge is fundamental to the innovation process in organisations. In addition, bank—Fintech cooperation has been studied which allows for identifying cooperation patterns (Drasch, Schweizer, and Urbach, 2018). However, there is a lack of studies that shows how knowledge is managed in firms from emerging countries (Dávila, Dos Anjos, 2021). Most studies have used data from developed countries, and it is still unclear what KM practices are used by Fintechs.

In this context, the purpose of this research is to analyse the KM practices used by a Latin American Fintech to absorb knowledge and to present evidence of its contribution to organisational performance. To do so, we analyse a case of an international company specialising in leasing. It is considered one of the first Fintech companies registered in the new registry of leasing companies in Peru. The results are expected to contribute to the literature on KM in two ways: first, by describing how knowledge absorption occurs in Fintechs. Second, by systematizing the evidence on how KM practices work in organisations in emerging contexts to support ACAP and, consequently, contribute to organisational outcomes. On the empirical side, it aims to provide specific and novel insights to managers of companies in the financial and technology sectors from an emerging country context, on how and what practices to implement to improve KM in their organisations. Elidjen et al. (2022) note that startups suffer from the ability to innovate, which increases their propensity to fail and overcome this failure by increasing the absorptive capacity of the founding team to improve their ability to innovate.

2. KM Practices for ACAP in FinTech

The term “Fintech'' is a contraction of “financial technology” and was first mentioned in the early 1990s by Citicorp CEO John Reed (Puschmann, 2017). The term is used to denote those companies that provide innovative financial products and services, through the use of technology (Dorfleitner et al., 2017). These companies use cutting-edge technologies to increase efficiency and quality of work (Sharbek, 2022). In addition, they are associated with innovation where companies develop new products, business models and processes (Puschmann, 2017).

Fintech success requires financial industry insight to identify and evaluate potential opportunities and technological know-how to develop new products and services that deliver value (Harris, 2021). Moreover, it has been identified that Fintech entrepreneurs observe opportunities and then incorporate individuals with technology and finance expertise into their senior management team, which helps address gaps in founder expertise (Spigel, 2022). In addition, the creation of new knowledge affects both new entrants and the financing of new Fintechs (Cojoianu et al., 2021). Therefore, research pays special attention to investigating the importance of studying knowledge domains in founding teams, their social networks and early employees in Fintechs (Sako, Qian and Verhagen, 2022).

Knowledge identification is a valuable resource in an organisation. The literature shows that Fintech ecosystems are not just specialized technology or finance clusters, but remain the most generic forms of managerial knowledge for Fintech innovation and growth (Spigel, 2022). Fintech growth is explained by founding teams with similar expertise, founders' social ties with other founders whose knowledge domains are different from their own, and employees with different expertise (Sako, Qian, and Verhagen, 2022). In this context, the literature mentions that different types of knowledge can be extracted using different techniques such as personality type in the knowledge acquisition process and evaluation techniques (Dehghani and Akhavan, 2017). Arguing that today's businesses require the ability to capture, manage and use knowledge and information to improve efficiency and better serve customers (Gupta, Sharma, and Hsu, 2004).

In this context, this article focuses on the absorptive capacity (ACAP) of Fintechs. ACAP is the organisation's ability to recognize the value of new external information, assimilate it, and apply it for business purposes (Muthukannan and Gozman, 2019). Therefore, ACAP refers not only to an organisation's acquisition or assimilation of information, but also to the organisation's ability to exploit it (Cohen and Levinthal, 1990; Dávila, Durst, and Varvakis, 2018). That is, to understand what are the sources of a firm's ACAP y, one should focus on “how communications between the firm and the external environment are organised,” and also on the “nature of knowledge and expertise within the firm” (Liao et al., 2009). The practices included are to acquire, assimilate, transform and apply knowledge.

Digital startups must rely on their ability to explore external knowledge and exploit it in rapid innovation (Elidjen et al., 2022). Therefore, the diffusion of knowledge in the organisation is to transfer tangible or intangible knowledge to members who lack it. (Huang, Wei and Chang, 2007). That is, diffusion involves the behaviour of sharing acquired knowledge, experience, and skills with other members of the organisation (Liao et al., 2009). Different means can be used to disseminate knowledge in an organisation, for instance, training, mentoring, project discussion, and team meeting (Manohar and Gupta, 2014). Factors affecting knowledge sharing can be individual and cultural (Huang, Wei and Chang, 2007). In summary, reducing the distance between members or organisations can improve mutual interaction, and thus enrich the improvement of knowledge sharing.

3. Methodology

As it is well known, KM has been a crucial issue for companies for a long time (Nonaka et al.i, 1995). In this ongoing research, we used a qualitative approach and the analysis of preliminary results is complemented by multiple sources of information such as documents and observations.

The company to be evaluated was selected by accessibility. We also considered its geographical representativeness in emerging markets, its size and stage of development, and its diversity of business models. The company is a specialist in laptop rental. It operates under an immediate delivery model through a monitoring and management application. It is a financial company that uses technology to offer financial services specifically for leasing. It is the only laptop rental startup featured in Forbes magazine's ranking of the best Peruvian startups. They serve more than 2,500 companies and have expanded to Mexico and Colombia. They recently achieved their first placement of private bonds to institutional investors for almost $2 million. The company defines itself as the fastest, simplest and most digital laptop rental and leasing financial solution on the market and has digital service systems of less than 24 hours that include unique requests for change, replacement and technical assistance.

Semi-structured interviews were used in this study, as it is an appropriate technique (Patton, 2014) to obtain detailed information about the absorptive capacity in the company (Rubin and Rubin, 2011), how companies work (Yin, 2017; Creswell, 2017), and how they use it to improve their performance (Denzin and Lincoln, 2011). The key issues and questions to be explored were designed, using a semi-flexible guide that allows adapting to possible emerging issues and taking into account that a relationship of trust will be established and that it will allow some aspects to be deepened during the development of the interview. The interview guide included three questions for the acquisition dimension, three for assimilation, three for transformation, and three for exploitation. The question guide was developed using questions from other previously validated instruments such as those of Inkinen et al. (2015), Su et al. (2016), Cepeda, and Leon (2019) and Flatten et al. (2011), which increases the validity and reliability of the data obtained (See Appendix A). For the research, managers and senior strategic decision-makers in the organisation who play a key role in the assimilation of information were interviewed. The participants were selected considering the relevance of their experience, the diversity of their perspectives, their systematic knowledge of the organisation, their availability, and their accessibility. The initial 4 selected participants were willing to participate in the study upon informed consent. An informed consent form was developed that described the objectives and procedure and ensured that the participants understood and signed the consent before the interviews. The interviews were carried out in a conducive environment using the designed protocol. Each interview lasted ca. 2 two hours, they were recorded on the Zoom platform while they were in the company's offices.

The interviews were transcribed with the support of the Sonix software before the authors performed a peer review of transcriptions, and the analysis process was based on content analysis techniques. The data were analysed with the support of Atlas.ti 8 software, which is in line with this study (Charmaz, 2014). Transcribed data was organised to identify relevant themes and patterns. It was coded and categorized starting with the acquisition dimension, assimilation, transformation, and exploitation. Emerging themes and ideas were identified. Codes of key concepts were created and grouped into thematic groups. The categories and subcategories found were examined, as well as relationships, similarities and differences between the answers. Data were interpreted by contrasting them with the reviewed literature.

4. Results and Discussion

4.1 Practices for Knowledge Acquisition

Knowledge acquisition is directly related to innovation performance (Papa et al., 2018). Besides, knowledge acquisition influences the efficiency of other knowledge processes, such as dissemination and application (Darroch, 2005). In line with this, in the analysed organisation, knowledge acquisition is not merely the responsibility of specialized units, but a shared responsibility among all members. This idea is confirmed by Interviewee 1, who posits that every worker initiates their pursuit of knowledge, reflecting on their day-to-day roles and responsibilities. The organisation encourages all staff, regardless of their roles, to contribute creative ideas. As Interviewee 1 explains, when a team member conceives an innovative idea, it is documented and presented to the project leader for consideration. Certain departments within the organisation, such as the commercial division, have specific responsibilities that include the acquisition of essential knowledge. This is achieved by monitoring trends, gathering information, and obtaining customer feedback to inform decision-

making processes. Previous literature posited that the gathering of market knowledge is a key practice for knowledge assimilation (Darroch, 2005).

The organisation emphasizes the importance of research, and this is a critical skill that the firm use to see when it looks for potential employees. The recruitment process plays a pivotal role in fostering the organisation's knowledge base. Interviewee 1 emphasized that new hires are selected based on their existing expertise or their eagerness to learn techniques that can spur product development. Research is part of the organisation's culture. Interviewee 2 further elucidates this, by highlighting that the organisation's culture is focused on nurturing individuals with a strong predilection for research, an attribute that drives them to continuously seek new knowledge, skills, or methodologies that can enhance their current process automation capabilities.

In terms of knowledge sources, Interviewee 2 posited that knowledge is not exclusively obtained internally; it emerges from a multitude of sources. An assistant or analyst, for instance, may identify a market need that propels knowledge acquisition. The organisation, therefore, does not strictly enforce a prescriptive approach to knowledge acquisition but encourages it to arise organically from all quarters. The organisation predominantly taps into external sources of knowledge, such as blogs, online courses, YouTube, and industry-specific newspapers and magazines, to stay abreast of current and potential market trends.

A distinct aspect of the knowledge acquisition process in the organisation under examination is the consistent identification of knowledge gaps, particularly about employees' technical and social competencies. As per Interviewee 1, the deficits are less in the realm of technical numerical skills, but more in soft skills such as presentation techniques and the effective articulation of viewpoints. Post-performance evaluations, as Interviewee 2 explains, are instrumental in assessing the effectiveness of the acquired knowledge, identifying areas for improvement, and validating the success of the approach.

In conclusion, the evidence suggests that the organisation adopts a multi-faceted strategy for knowledge acquisition. The process, while overseen by designated units, is a collective endeavour involving all employees. The focus is on self-learning, research, creativity, the identification of knowledge gaps, and benchmarking. The recruitment process is also leveraged as a conduit to acquire new or specialized knowledge.

4.2 Practices for Knowledge Assimilation

In the examined Fintech, employees are strategically utilized to incorporate acquired knowledge, as mentioned by Interviewee 2. Employees are encouraged to document, disseminate among their teams, and integrate the knowledge acquired from various training and development programs into their daily work. To assimilate this knowledge, the organisation employs practices such as formal and informal interdepartmental meetings, which are a key source for promoting knowledge sharing, and ultimately, innovation in knowledge-intensive firms (Taminiau et al., 2009).

Interviewee 2 highlighted the role of formal meetings, mentioning committees involving all managers to ensure alignment with organisational objectives. These committees also serve as platforms to integrate new knowledge with existing organisational memory, enabling appropriate action. For instance, the Risk Committee was reported as a critical unit in identifying customers who might potentially present problems for the organisation.

Informal meetings are also crucial to the knowledge assimilation process. They are like communities of practice, which are posited as key enablers of organisational innovations (Pattinson, Preece, 2014). Interviewee 1 cited the adoption of "Daily Scrum" meetings across different departments, which are daily discussions focusing on brainstorming solutions for day-to-day problems. These meetings, held in small groups with common interests or facing shared problems, are often interdepartmental, and they are aligned with the organisation's beliefs of cross-functional collaboration. As Interviewee 2 noted, these meetings can include individuals from different departments, particularly when an issue hinders the achievement of a goal. Promoting knowledge sharing across departments and individuals with different skills is in line with previous research that posited that firms with top managers that have different academic and employer backgrounds are most likely to be successful (Spigel, 2022).

Certain departments show primary responsibility for knowledge assimilation, as illustrated by Interviewee 1. The Business Management Digital Solutions and Insights departments were spotlighted as key units for processing externally generated data to understand external customer needs and for driving efficiency in the organisation's processes, respectively.

The primary objective of assimilating new knowledge, as the evidence suggests, is to adapt methods to suit the organisation's context and requirements. Interviewee 1 further elaborated on this, referring to the adoption of

the SCRUM methodology, which they do not necessarily apply in a literal sense but adapt to the organisation's needs using the best tools or criteria. Interviewees 1 and 2 also spoke about how they adapt external methods, such as a scoring system from an American company, and create their version to serve their purposes. This instance demonstrates a blend of existing technical knowledge and external information that the organisation previously lacked but sought to implement.

The collected evidence indicates that the organisation fosters a culture focused on continuously accepting new knowledge, with employees playing a pivotal role in accumulating and integrating this acquired knowledge. Formal and informal interdepartmental meetings are the most prevalent practices used by the organisation for knowledge assimilation.

4.3 Practices for Knowledge Transformation

Knowledge transformation within the examined organisation primarily hinges on the acquisition of novel technical knowledge, which is subsequently integrated to modify organisational systems or processes. Sometimes the transformation of knowledge is performed by people (Davila et al., 2016) and sometimes it is performed by ICT tools, for instance, artificial intelligence (Avdeenko et al., 2016). As illustrated by Interviewee 1's statements, the organisation seeks to merge pre-existing technical knowledge with external insights, enabling employees to identify and present potential improvements, such as software enhancements. Interviewee 2 mentioned that this process also extends to refining the final product offered to customers, wherein new customer-related information is assimilated and applied. Interviewee 1 stresses this point by mentioning an example where the organisation successfully anticipated a customer's default, leading to a brainstorming focused on the solution, and a presentation of the benefits, efficiencies, and cost savings that the proposed platform could provide. Upon approval, the proposed changes were implemented.

Interviewee 1 further emphasizes that during the knowledge transformation process, the organisation assesses the impact of proposed new practices on the overall process. This involves prioritizing initiatives that can significantly impact processes and system applications, especially since these initiatives compete for the same resources. Upon prioritization, the projects are launched with consistent monitoring from the relevant departments. It was noted that enhancing organisational systems connected to the customer service process is the primary focus of these transformation initiatives, with technical knowledge serving as the primary input.

4.4 Practices for Knowledge Application

The analysed Fintech significantly leverages the concept of minimum viable products (MVPs), which originate from small internal projects, as a mechanism for applying the acquired, assimilated, and transformed knowledge (referenced by Interviewee 1 and Interviewee 2). MVP has been described as a critical practice for knowledge management in startups (Duc & Abrahamsson, 2016), and specifically, for applying knowledge (Bandera et al, 2020). Interviewee 1 posited that these initiatives typically start internally, with the entire workforce's participation. If the concept demonstrates effective results, it is then introduced to select external customers as a pilot project, and if continued success is observed, a broader rollout is initiated.

According to Interviewee 2, the company's application of MVPs does not strictly adhere to the traditional methodology but is rather a customized adaptation that best suits the organisation's unique circumstances. This adaptation of the MVPs technique is exactly one of the results of knowledge transformation processes inside the firm. These small-scale projects within the company primarily utilize fresh customer data as inputs, which are carefully examined by several departments before implementation. As Interviewee 1 notes, there is a particular emphasis on insights that might indirectly reflect customer requests or needs. Previous literature acknowledges the importance of MVP for closing the knowledge gaps between internal units and external customers and stakeholders (Duc & Abrahamsson, 2016).

In conclusion, it can be inferred that the MVP approach is the principal technique employed by the analysed Fintech to apply new knowledge. This approach is primarily customer-focused, with customer-derived information serving as the primary input in this knowledge application process.

5. Conclusion

The analysed company employs a variety of practices for knowledge ACAP. The company defines research as a key competence of its employees and encourages self-learning and creativity, which are embedded in its organisational culture. The recruitment process is designed to acquire people with self-learning capabilities, and in some cases, to acquire new knowledge from the know-how of new hires. External sources of information and knowledge are also used, such as blogs, internet courses, YouTube, and specialized newspapers and magazines.

The company identifies gaps in workers' knowledge and addresses them through training and development programs. The practices for knowledge assimilation include formal and informal meetings, interdepartmental committees, and the incorporation of new knowledge into the organisational memory. Technical knowledge is the main input of knowledge transformations, a dimension which is mainly focused on customers. An adapted version of the Minimum Viable Product is the main technique that the analysed Fintech use for applying the absorbed knowledge. The findings suggest that the company views its employees as a strategic resource for managing knowledge and that knowledge is shared and incorporated into daily activities. Theoretically, this study contributes to the knowledge-based view by providing evidence that may be useful for the development of an ACAP framework for firms that operate in emerging countries. As a practical implication, we can posit that organisations can use a variety of practices to enhance absorptive capacity and that these practices can be embedded in the organisational culture to create a learning culture.

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Appendix A: interview Guide

	Interview guide
N	*Acquisition*
A1	How does the organisation actively seek new and relevant knowledge from external sources?

	Interview guide
A2	How does the organisation ensure that the knowledge acquired is of high quality and relevant to its needs?
A3	How does the organisation understand what is happening outside the company, is there a responsible unit, how many units, how do they do it and what are the sources used?
	Assimilation
AS1	How does the organisation ensure that the combination of internal and external knowledge is effective and efficient?
AS2	Are there practices such as formal or informal meetings between departments to discuss problems or opportunities, or to provide support? How do they do them?
AS3	How does the organisation disseminate the knowledge acquired among its units, and ensure that it reaches who it should reach?
	Transformation
T1	What are the processes that the organisation uses to transform acquired knowledge into applicable knowledge?
T2	How do employees structure the acquired knowledge, to apply it in their practical work or to make it available for a future purpose?
T3	What do you do so that your employees are able to link new knowledge to existing knowledge in the organisation?
	Exploitation
E1	What does the organisation do to apply the transformed knowledge in practice?
E2	How does the organisation support the development of prototypes of new products or processes?
E3	Who directs the application of the new knowledge? How does an area or several areas or departments participate?
	Complemantary guide
	Innovation

	Interview guide
I1	Describe some recent innovation (to have the necessary depth and link it to previous ones, for example, consider: what knowledge they had, what they did not have, in which areas the idea arose, who approved it, which areas participated in the conceptualization, execution, who validated the launch to the market, what adjustments had to be made and what results other companies participated in the development of that product and service brought)
I2	Think about the last product launched or improved process: What was the process followed, from the conception of the idea to the market launch?
	Performance
P1	Share Sales Growth Data 2021, 2022 and why
P2	Share Profitability Data 2021, 2022 and why
P3	Share Data Market Share 2021, 2022, and what happened

Risks for Knowledge-Uptake in Dutch Marine Spatial Planning: Incompatibilities Between Research and Policy-Making

Jort de Vries[1,2], Rozanne Spijkerboer[1] and Christian Zuidema[1]
[1]University of Groningen, Department of Spatial Planning and Environment, The Netherlands
[2]Deltares, Delft, The Netherlands

j.w.de.vries@rug.nl
r.c.spijkerboer@rug.nl
c.zuidema@rug.nl

Abstract: The rapid increase of Offshore Wind Farm (OWF) development in the North-Sea occurs under serious uncertainty, partly due to knowledge gaps concerning the North-Sea's socio-ecological system. The situation is particularly urgent in the Netherlands due to the intense use of its maritime zone and related conflicts among stakeholders. Optimising the placement of OWFs requires the uptake of multidisciplinary knowledge in Marine Spatial Planning (MSP) policy through ongoing adaptation of policies to new knowledge. Currently, knowledge-uptake from research into policy is widely mentioned as a challenge for MSP, but knowledge management theory has hardly been applied to it. To be useful in the multidisciplinary environment of MSP, a common language about knowledge is needed to allow for cooperation between scientific disciplines and policy sectors. However, many risks exist that may hinder knowledge-uptake between research and policy-making. This thinking-gap between research and policy-making is recognised in many fields. However, MSP and relevant knowledge about the North-Sea is rapidly developing and understudied. This results in a high pressure and dynamic situation in a developing field which can be an insightful case to apply knowledge-management theory and provide new insights for scholars of MSP. This study focuses on risks for knowledge uptake that derive from incompatibilities between researchers and policy-makers in the use and development of knowledge within the context of OWF development and MSP. These incompatibilities range from differing timeframes and uses of data to more fundamental differences in roles between researchers desiring to understand the world, and policy-makers desiring to change it. Characteristics of MSP, such as the high political pressure and relative pioneering practice of MSP may exacerbate the impact of such incompatibilities. Notably, MSP may suffer from a focus on short-term policy-making, limited cumulative understanding and fragmentation in policy. The aim of this article is to consider the effect of incompatibilities between systems of research and policy-making on knowledge-uptake in Dutch MSP and how these may be exacerbated by characteristics of MSP. Using knowledge-management literature, a list of potential incompatibilities between systems of research and policy-making is drawn. Data was collected by means of document analysis, in-depth interviews with researchers and policy-makers, and observations of policy workshops, consortium meetings, and focus groups. Findings suggest that risks to knowledge-uptake are partially caused by the incompatibilities between research and policy-making and that the context of MSP exacerbates these incompatibilities in most instances. Simultaneously, some instances were found where MSP can actually help to decrease differences between researchers and policy-makers. However, the incompatibilities between researchers and policy-makers are so enduring that risks to knowledge-uptake still persist. Better joint understanding and recognition of differences between research and policy-making are required to limit the negative effect of incompatibilities between research and policy-making on knowledge uptake.

Keywords: Knowledge management, Knowledge uptake, Marine spatial planning (MSP), Science-policy interface, Offshore wind farm governance (OWFs)

1. Introduction

Sustainable energy and energy security goals are increasingly important to European countries following the Paris climate agreement and the invasion of Ukraine (European Commission, 2022). In many countries bordering the North-Sea, a principle means of attaining energy goals is the construction of Offshore Wind Farms (OWFs). Regionwide plans aim to increase North-Sea OWF capacity from 25GW to 260GW by 2050 (Netherlands enterprise agency, 2021; WindEurope, 2021). In the Netherlands, OWF capacity is planned to double by 2030 (Rijksoverheid, 2022). However, an array of interests lays claim to marine space, including rising ecological targets, traditional uses like shipping, fishing, and sand-mining, and technical innovation increasing the feasibility of new users such as aquaculture and other forms of maritime energy production (Ehler et al. 2018). The subsequent conflict for space in the Dutch part of the North-Sea urges for careful Marine Spatial Planning (MSP) (European Commission, 2014).

MSP is a novel approach to maritime governance and widely accepted as the principal concept for maritime governance (Ehler, 2018). MSP aims to develop policy frameworks which balance the various offshore claims to space in a socially acceptable and ecologically responsible manner. To develop such frameworks, MSP requires intricate knowledge of the socio-ecological systems of the North-Sea, which, until recently, was relatively limited (Ehler et al. 2018). In response, there are increasing efforts to improve fundamental and

practical understanding of the North-Sea ecosystem and the effect of human activities (Noordzeeloket, 2016; 2021: Dutch Research Council, 2020). The development of OWFs is the prime challenge of MSP due to the high political pressure to produce more green energy. As such, most research projects concerning the North-Sea currently investigate the effect of OWFs. The rapid increase of existing knowledge requires a strong science-policy interface to ensure the uptake of newly developed knowledge. However, scholars and practitioners indicate that knowledge-uptake from researchers to policy-makers constitutes an increasingly urgent constraint in MSP (Rekola and Paloniemi, 2022; Paez et al. 2020). If knowledge-uptake in MSP remains constrained, decision-making on OWFs may have severe ecological and societal consequences (Dutch Research Council, 2020) which may hinder energy transition on the long-term. Additionally, a degree of certainty on which to base policy is often legally required due to, for example, the precautionary principle (European Commission, 2014).

Knowledge-uptake concerns *the acquisition and comprehension of diffuse information and its subsequent integration, interpretation, valuation, and application into policy* (Ryneveld and Sproule, 2006). Knowledge management research, which considers the use and uptake of knowledge, receives increasing attention in academic communities and practice (Dutch National Scientific Agenda, 2020). Knowledge management literature mentions that incompatibilities between politics and research may impede successful knowledge-uptake (Derksen, 2014, p14). Incompatibilities are implied to form risks to knowledge-uptake, but their effect on knowledge-uptake remains understudied (Paez et al. 2020; Rekola and Paloniemi, 2022). These incompatibilities derive from differences between systems of research and policy-making, and could potentially provide an explanation for the difficulties surrounding knowledge-uptake in MSP. This thinking-gap is recognized in many different fields (Christensen, 2021). However, there is reason to believe that characteristics of MSP, such as the high political pressure to produce sustainable energy, MSP being understudied, the limited knowledge and quick development of knowledge of the North-Sea's biophysical system, and MSPs early development may increase the effects of these fundamental differences, leading to heightened risks for knowledge-uptake (Keijser et al. 2020; Paez et al. 2020). As such, MSP makes for a suitable case-study to consider potential incompatibilities between research and policy-making as risks for knowledge-uptake.

This paper explores the effect of incompatibilities between systems of research and policy-making on knowledge-uptake in Dutch MSP and how these may be exacerbated by characteristics of MSP. The paper presents a framework for analysing these incompatibilities and considers how they are expressed in the specific MSP context. The framework is based on differences between the roles of politics and research mentioned in knowledge management literature (Böcher and Krott, 2016, p53; Derksen, 2014, p10-43; Oliver et al, 2014; Spaapen and van Drooge, 2011). The framework is described in section 2. Section 3 explains the methods, including document analysis, interviews with researchers and policy-makers working on the Dutch North-Sea, and observations of workshops and focus groups. In section 4, the results of the analysis are described and discussed with a focus on patterns demonstrating risks to knowledge-uptake. Section 5 provides a conclusion.

2. Theory

Böcher and Krott (2016), indicate that the ideal roles of research and policy-making as public domain tasks are much discussed and clear but can lead to incompatibilities between research and policy-making. The ideal role of researchers is to produce a (fundamental) understanding of the world or human behaviour, with the main source of efficacy being empirical proof and logic. Researchers work according to effective and efficient scientific methodologies, look for appropriate data to analyse, include and critique the findings of peers and live up to stringent codes of conduct (Böcher and Krott, 2014; Derksen, 2014). The role of policy-makers is to solve societal problems through political means, shaping and steering the world according to an agenda, with the main source of efficacy being power. This involves public participation and discourse for agenda-setting and democratic procedures for scrutiny with the ideal goal of mobilizing society behind a decision (Oliver et al. 2014; Böcher and Krott 2016).

These different ideal roles may result in important incompatibilities between systems of research and policy-making upon what constitutes knowledge, and how to use it. To explain the world around them, scientists want to consider all possible data, accumulate it and analyse it according to theoretical logic. In science it is valuable to clearly indicate where uncertainties persist and interpretations might change due to new data. In this process there is little room for wishful thinking, and it takes significant amounts of time due to the reliance on empirical proof, the need for reversibility of answers, and the cumulative assessment of knowledge

(Derksen, 2014). Policy-makers on the other hand want to solve an issue while it is still prominent in the political agenda, this requires a convincing argument for their decisions where best estimates or even wishful thinking can contribute. In such an argument there is limited space to consider all possibilities and available information, let alone to consider all accumulated knowledge. In policy-making, indications of uncertainty may undermine the argument and instead power, persuasion, and new ideas are used to gather support. Often, the possibilities for this change are restricted to short-term windows of opportunity, and political preferences. These differences have the potential to threaten knowledge-uptake between research and policy (Böcher and Krott, 2016; Derksen, 2014). The different tendencies towards knowledge and its use between research and policy in table 1 demonstrate that significant incompatibilities may exist between researchers and policy-makers.

Table 1: An Overview of Different Tendencies Between Systems of Research and Policy-Making.

Topic	Research, produces knowledge scientifically	Policy, solves problems politically	Sources
Timeframe	Take the time needed: long period necessary to observe and analyse.	Time restricted by window of opportunity: short periods to solve pressing societal problems.	Böcher and krott, 2016. Derksen, 2014. Janssen et al. 2014.
Focus	Describing and explaining the world.	Influencing and changing the world.	Böcher and krott, 2016. Derksen, 2014.
Value of data	All data for empirical testing of hypothesis.	Selective and supportive to build argumentative discourse.	Böcher and krott, 2016.
Questions	Need to be critical.	Need to be relevant.	Christensen, 2021. Böcher and krott, 2016. Derksen, 2014.
answers	Need to be reversible.	Need to be convincing.	Böcher and krott, 2016. Derksen, 2014.
Attitude on wishful thinking	Needs to be avoided.	Needs to be encouraged.	Böcher and krott, 2016.
Rely on	theoretical logic and empirical proof.	Persuasion and agreement.	Böcher and krott, 2016. Derksen, 2014.
Power use	To describe and explain the world.	to influence and change the world.	Böcher and krott, 2016.
Use of knowledge	Accumulate, to get closer to truth.	New ideas, relabelling the world, to support mobilization.	Böcher and krott, 2016. Derksen, 2014. Janssen et al. 2014.
Attitude on uncertainty	Needs to be admitted staying close to the truth.	Needs to be shrouded to prevent loss of confidence.	Derksen, 2014.
What constitutes a problem	Objective/fundamental lack of understanding.	Subjective problem in society/policy which can have its roots in a fundamental lack of understanding but does not have to.	Derksen, 2014. Keijser et al. 2020. Paez et al. 2020.

2.1 The Context of MSP

Marine Spatial Planning is a process of spatial policy formation, which relies on many different scientific disciplines, and public and private sectors for its information and management (Cormier et al. 2016). Since 2014, European Union member states, have to adhere to the European Marine Spatial Planning Directive, transposing MSP principles and goals into national law and thus putting it on the political agenda (European Commission, 2014). MSP aims to manage human activity at sea, which becomes increasingly complex due to the rising interest in marine space. In the case of OWF development, this interest in marine space is highly politicized due to the translation of climate ambitions to high OWF targets. As a result, the OWF sector has become powerful and hard to balance with other maritime uses in MSP (Spijkerboer et al. 2020). Literature indicates that the mentioned incompatibilities between researchers and policy makers are particularly apparent in MSP. For example, in goals (Keijser et al. 2020), in the conflicting understanding of concepts and language between parties (Paez et al. 2020), and the limited understanding of the biophysical system (Gazzola et al. 2015; Paramana et al. 2021). Additionally, there are indications that various characteristics of MSP can exacerbate differences between policy-making and research. For example, Kusters et al (2023) indicate that the mentioned political pressure leads to a short-term focus in policy, which can increase incompatibilities in timeframes. Gusatu et al (2021) demonstrate limited knowledge bases of the North-Sea's biophysical system and limited understanding of cumulative effects, which can affect the value of data and the (non)use of knowledge. Spijkerboer et al. (2020) show how limited experience with MSP and integrated policy-making also leads to fragmentation in policy, which can influence what constitutes a problem, or how questions are asked. This fragmentation may imply selective and partial knowledge-uptake based on sectoral interests. Therefore, these characteristics of MSP combined with high OWF targets may exacerbate the possible incompatibilities between research and policy-making, increasing risks to knowledge-uptake in MSP.

3. Methods

This study employs a qualitative case study, using 4 methods of data collection to triangulate and verify findings on the effect of incompatibilities between systems of research and policy-making on knowledge-uptake in Dutch MSP. The study focuses on the case of the Dutch part of the North-Sea since it has a comparatively long marine spatial planning tradition since 2004 and is one of the busiest sea-areas in the world. Furthermore, it is subject to various large ecological research programs to improve understanding of the influence of OWF on marine ecology, and relatively detailed MSP (Ministry of Infrastructure and Water management et al, 2021; Ministry of economic affairs, 2015; Overlegorgaan Fysieke Leefomgeving 2020). As such, there is a large amount of new knowledge to potentially take up in Dutch MSP policy. Additionally, the aggravating characteristics of high political pressure for OWF development, limited space, policy fragmentation, and short-term focus are present in the Dutch context (Spijkerboer et al. 2020; Kusters et al, 2023; Gusatu et al, 2021). As such, the case of Dutch MSP is particularly suitable for considering the risk of potential incompatibilities between research and policy-making on knowledge-uptake and the aggravation of these risks in MSP.

Data collection and analysis in this study consisted of 4 steps: (1) Official documents concerning Dutch MSP and related knowledge programs in the last decade were selected from public websites and analysed to gain insight in recognized knowledge (gaps) and risks to its uptake; (2) observation of consortium meetings (n=5) and focus groups (n=2) regarding knowledge use in Dutch OWF development; (3) Based on findings from observations and document research, in-depth interviews were held with scientists (n=13) ranging from hydrologist to marine governance experts, and policy-makers (n=7) from different public sectors relevant for MSP; (4) Transcripts and policy documents were analysed in Atlas ti, based on coding guides developed with insights from the theoretical framework, and findings from observations and interviews with researchers and policy-makers. Outcomes were validated with participants, and full anonymity was guaranteed.

4. Results and Discussion

Findings from the analysis of documents and participant's experiences demonstrate that the incompatibilities between research and policy-making can constitute risks for knowledge-uptake in MSP, see table 2. From table 2, four patterns emerge which demonstrate the effect of incompatibilities between systems of research and policy-making on knowledge-uptake in Dutch MSP and how some of these effects can be exacerbated by characteristics of MSP.

The first pattern shows that risks for knowledge-uptake arise from the manner in which uncertainty is dealt with in decision-making in MSP. This risk stems from the different attitudes on uncertainty between

policymakers and researchers. Researchers want uncertainty to be admitted, see figure 1. However, due to this uncertainty, policy-makers lack the certainty needed for legitimate political arguments, or do not have the capacity to develop fitting policy-measures in the light of this uncertainty and thus decide to shroud uncertainties, see table 2. Secondly, uncertainties in knowledge may cause policy-makers to ignore it completely. Thirdly, the thinking gap between researchers and policy-makers may cause misunderstanding concerning the level of certainty, potentially increasing the inclusion of uncertain knowledge. The inclusion of uncertain knowledge, lack of transparency of the degree of uncertainty, and the exclusion of other uncertain knowledge diminishing the quality and completeness of knowledge taken up, and thus constitutes a risk to knowledge-uptake. Additionally, this characteristic increases differences in timeframes since scientists need more time to find certain answers due to a lack of existing knowledge. Finally, the high amount of uncertainty also influences the other patterns as explained below. As mentioned by Kusters et al (2023), apart from a risk for knowledge-uptake, this constitutes a strategic deficit in policy, since shrouded uncertainty in decisions made today can lead to long-term problems in the socio-ecological system.

A second pattern is how a risk to knowledge-uptake arises from the marginalization of knowledge, with certain knowledge being actively excluded from policy. As can be seen in table 2, such marginalization partially results from the legal constraints on the formulation of questions. As mentioned, certain levels of uncertainty can cause knowledge to be marginalized. Findings show instances where knowledge which contradicts political interests may be dismissed through wishful thinking, e.g., despite research indicating the devastating effect of mixing water layers which can be a result of OWF development, this is limitedly considered in policy documents. The focus on legally relevant and 'fitting' knowledge also results in an underuse of other types of knowledge and a simplistic framing of what constitutes a problem in MSP. Additionally, policy-makers indicate that they lack the time and expertise to process often complex research reports, causing them to selectively include knowledge with political and legal relevance. E.g., knowledge concerning protected species like birds, seals, and porpoises was included, while unprotected species were largely left out (Ministry of Economic Affairs, 2015; Ministry of Agriculture Nature and Food-quality and Ministry of Infrastructure and Water Management, 2022; Odinga et al. 2021). This marginalization also demonstrates that despite the appreciation of fundamental data in MSP, the incompatibilities in data valuation between research and policy are so persistent that this appreciation only has effect when backed up in legal obligations. Subsequently, this pattern limits the objectivity and thus quality of knowledge uptake.

A third pattern shows how a lack of trust between researchers and policy-makers can form a risk for knowledge-uptake. As indicated strong relations improve knowledge uptake. According to participants, a lack of trust could lead to the stagnation of interaction, diminishing relations, and thus knowledge uptake. Moreover, it can cause individuals or organisations to purposefully ignore the knowledge needs of other groups. Table 2 demonstrates that policy-makers may no longer trust researchers to come with timely and clear answers to their questions (focus), resulting in the marginalization of knowledge and researchers losing trust in policy-makers. This is also visible in how answers to scientific and societal questions are used in systems of science and policy-making. Examples from the analysis demonstrate that policy-makers want scientists to focus on policy-relevant knowledge like protected species, but in some cases receive little useful information and very limited updates, which diminishes trust in research organizations.

Finally, differences in understanding, interpretation and valuation of knowledge also create a pattern of risk for knowledge-uptake. This is related to the topics 'focus', 'answers', and 'power uses' in table 2. These differences can constitute a risk for knowledge-uptake when the same knowledge is interpreted in a different way by scientists and policy-makers, causing policy to be based on potentially faulty assumptions. An example is that policy-makers can be more positive about the effect of OWFs on native benthic communities than indicated by scientists due to a lack of understanding of the ecological system and the particularities of species. This can cause researchers and policy-makers to assume entirely different characteristics about the North-Sea, causing misunderstandings to seep into processes of knowledge uptake which constitutes a serious risk for its quality.

A couple of the risks we find are in line with other research regarding threats for knowledge uptake (Bocher and Krott, 2016). However, in the case of uncertainty we see a specific link between characteristics of MSP and increased risk for knowledge-uptake. Additionally in table 2 we see how the characteristics of MSP exacerbate other risks for knowledge uptakes discussed above. Examples of such characteristics are high political pressure, limited understanding of the North-Sea, short-term tendencies in MSP, the fragmentation of policy, and limited cumulative knowledge of the North-Sea's biophysical-system. Despite the challenges MSP poses, it may also have certain benefits. For example, fundamental understanding being included in policy goals has a

balancing effect on the valuation of data and problem definitions by researchers and policymakers. We see evidence that researchers and policy makers come closer together in some cases, see table 2. Regardless of some of the characteristics of MSP helping to bridge the science-policy interface, the fundamental incompatibilities between research and policy-making are severe to a degree where the risk for knowledge-uptake persists.

Table 2: Findings Concerning the Risk of Potential Incompatibilities for Knowledge-Uptake Between Researchers and Policy-Makers in MSP and the Implications of the MSP Context on These Incompatibilities

Topic	Findings
Timeframe	The high political priority of OWF development demands quick results and thus limits the available time for research. Conversely, limited knowledge of the North-Sea increases the required time to find acceptable levels of certainty in research. As such, the timeframes of researchers and policy-makers are pushed further apart resulting in policy based on incomplete and uncertain knowledge.
Focus	MSP and the understanding of the North-Sea's biophysical system are in their infancy, increasing the pressure for their development. Analysis demonstrates that the rapid development anthropogenic use of the North-Sea incurs changes in the system, complicating the development of system-understanding by scientists. Conflicting goals between systems of research and policy-making lead to a lack of trust and differences in the understanding, valuation, and interpretation of knowledge.
Value of data	The need to balance accumulated data in MSP leads to better understanding of multidisciplinary insights among stakeholders. Since fundamental understanding is more often included in political goals, differences in data valuation are reduced. This incentivizes trust and direct contact. However, the fragmentation of policy makes it hard to include complex data from various fields.
Questions	Due to the array of interests, disciplines, and sectors involved, there are more questions relevant for policy-making. Therefore, the amount of relevant knowledge can surpass the capacity of policy-makers to take up knowledge, particularly since the fragmentation of policy-process reduces experience with multi-disciplinary knowledge. This increases the workload for policy-makers.
Answers	The long operation time of OWFs (30-40 years) limits the reversibility of decisions. This increases the need to convince parties about OWF goals in the policy arena, which often creates a short-term window of opportunity. Thus, increasing the gap with long-term research interests. Additionally, scientists prefer to publish results instead of presenting them in panels or discussions, limiting direct connections to policy makers.
Attitude on wishful thinking	The high uncertainty in MSP encourages wishful thinking. Especially the short-term policy focus, desired in OWF targets leads to the dismissal of long-term negative effects. Wishful thinking often ignores contradictive evidence and uncertainties, possibly leading to the marginalization of knowledge, more decision-making under uncertainty, and diminishing the trust of researchers in the policy-process.
Rely on	The lack of knowledge about the North-Sea increases uncertainty. The development of OWFs therefore relies on persuasion and agreement. Similar, to wishful thinking, this reliance on persuasion may limit the inclusion of contradictive evidence and thus cause marginalization of knowledge, decision-making under uncertainty, and distrust.
Power use	Policy-makers indicate that in MSP their focus lies on high priority political goals, which are mostly short-term. This is partially due to the limited capacity to take up knowledge. This leaves less time to consider the fundamental understanding of the North-Sea, increasing the differences in understanding, interpretation and valuation between researchers and policy-makers.
Use of knowledge	The thorough use of accumulated, multidisciplinary, and complex knowledge fits with the research system and is necessary for decision-making in MSP. The inclusion of this knowledge use legal requirements should lead to more thorough use of knowledge by policy-makers. However, in practice this only occurs in particular topics with high political priority. As such this difference can lead to the marginalization of knowledge.

Topic	Findings
Attitude on uncertainty	The many different sectoral and disciplinary interests vying for limited space led to a rise in relevant factors for policy-making in MSP. This complicates predictions and increases uncertainties. As such, it becomes increasingly important to admit uncertainties but these uncertainties are pushed aside by high political pressures. This causes a rise in the level of decision-making under uncertainty.
What constitutes a problem	The fragmentation in MSP policy and other parties involved in MSP limits the joint formulation of problems. While the inclusion of fundamental understanding in policy-goals does bring researchers and policy-makers closer together in formulating problems, these goals are often still restricted to legally protected species, causing the marginalisation of knowledge.

5. Conclusions

This paper reinforces the initial insights by Paez et al (2020) and Keijser et al (2020) on how knowledge-uptake within MSP faces important risks due to incompatibilities between research and policy-making. It furthers these insights, in showing why and how such incompatibilities are expressed in the context of MSP. Notably, the need for timely, clear and policy-relevant information as desired by policy-makers cannot reasonably be expected from researchers in the dynamic and understudied context of OWF and MSP. The result is a mismatch and a – sometimes-purposeful – underutilization of available knowledge. This conclusion emphasizes a need for direct efforts to improve understanding and acknowledgement of the differences between scientists and policy-makers to improve knowledge-uptake in MSP. Apart from a risk to knowledge-uptake, the incompatibilities found between research and policy-making lead to patterns that hinder knowledge-uptake. However, as mentioned in MSP literature they also constitute a strategic deficit in policy which needs to be overcome. This conclusion also points to the necessity of investments in a better science-policy interface within MSP to diminish the identified risks to knowledge-uptake, notably regarding the ecological impact of a swift roll-out of OWFs. Central in such attempts should be attention for how policies may better anticipate and handle uncertainties and how a bias to legally relevant information can be avoided. Likely, such attempts will require investments in a) the collaboration between policy-makers and researchers in developing knowledge sharing, and practical decision support tools, b) the interfaces where knowledge needs are matched with both existing research activities and forms of reporting, and c) the increased awareness of how differences between researchers and policy makers may influence knowledge sharing to develop a better understanding of the situation partners find themselves in.

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Knowledge and Innovation Performance in Czech Firms: The Influence of Decision-Making Structure

Denys Dmytrenko and Viktor Prokop
Science and Research Centre, Faculty of Economics and Administration, University of Pardubice, Czech Republic

denys.dmytrenko1@gmail.com (Corresponding author)

Abstract: There are plenty of factors that influence a company's innovation performance. They include, for example, the firm's strategy, organizational culture, size, and availability of resources. Besides these factors, a lot depends on the firm's leadership, attitude towards innovation, experience, and knowledge. The influence of external knowledge, like patents and inventions from other businesses, has been studied by researchers many times. However, previous scientific publications contain mixed evidence on the impact of external knowledge on a firm's innovation performance. Many of them defined separate factors, like innovation orientation or knowledge sources, as influential for the firm's innovativeness. However, not enough studies were made on firms' decision-making structure. Scholars suggested that decentralized companies are more likely to experiment in their innovation activities than centralized ones. We aim to determine the role of the decision-making structure in innovation performance by gaining external knowledge among firms in the Czech Republic. We contribute to the existing literature by distinguishing the firms by their legal statuses (sole proprietorship, partnership, shareholding company) and the presence/absence of a supervisory board. Our research is done by applying a quantitative method with empirical data. We use multiple linear regression and SPSS software to determine the influence of external knowledge acquisition and other related factors (R&D inside and outside the firm, age, size) on innovation performance, with decision-making structure indicators included. We divide innovations into process and product ones. The study uses the World Bank Enterprise Survey data for the Czech Republic. The results of this paper present important outcomes for practitioners. They will prompt more efficient innovation strategies for firms, depending on their management type.

Keywords: External knowledge, Innovation performance, Decision-making structure, Czech firms, Product innovations, Process innovations

1. Introduction

Innovations are very important for the development of businesses, as well as for triggering their competitive advantage and achieving economies of scale (Prokop, Kotkova Striteska & Stejskal, 2021). Competition in many areas leaves no other choice for companies except to innovate if they want to stay afloat (Williams, 1992). There are many determinants that influence the innovation process in the companies. External knowledge, which companies acquire to complement the existing internal knowledge in the company, represents one of the most influential groups (Belderbos et al., 2004; Prokop & Stejskal, 2019). It is clear because firms cannot solely rely on their technologies and knowledge. To stay competitive, firms must acquire knowledge from the outside. As Chesbrough states (for example, Chesbrough, 2012), "not all smart people work for us, and not all smart ideas originate in our company". Therefore, external knowledge is one of the main components that help companies introduce new products and services, as many researchers emphasize (Cassiman and Veugelers, 2006; Trantopoulos et al., 2017; Stejskal et al., 2018). One of the options for how external knowledge can be obtained is a collaboration with other firms (Das and Teng, 2000). However, there are also other ways. R&D activities, expansion to foreign markets, education of employees, and investments from the outside are often cited as the most influential factors for innovation. (Ehrenberger et al., 2015; Lin, J.Y., Yang, C.H., 2020).

Many researchers previously studied the influence of external knowledge on innovation. Regarding examples, Duong et al. (2022) studied whether family or non-family firms use external knowledge more effectively in Belgium. Yu and Lee (2017) found that collaboration with research organizations positively influences the innovativeness of companies in Korea. Concerning the country of our study, Ehrenberger et al. (2015) were looking for factors influencing innovation in small and medium enterprises in the Czech Republic. It's an important observation as research organizations are among the main sources of external knowledge for businesses. Yu and Lee (2017) defined that a firm's innovation orientation, age, and size significantly impact innovation performance. Larger and older firms have better abilities to use external collaboration to increase innovation performance. Authors also suggest differentiation by the decision-making structure of the company to test the effect of research collaboration on innovation performance, based on the conclusions of Jansen et al. (2005), who came to the conclusion that less decentralized companies are more likely to explore and implement innovations than centralized ones.

Numerous researchers tested the influence of the organizational structure of the company on innovativeness (Cosh et al., 2012; Yang et al., 2015; Sari et al., 2022). As previous studies showed, the influence of the decision-making structure on innovations in companies is not obvious (Yang et al., 2015; Sari et al., 2022). Also, there are discussions on the significance of external knowledge in the company's innovation process depending on the company's characteristics (Trantopoulos et al., 2017; Duong et al., 2022). It motivates us to find out whether the acquisition of external knowledge is an influential factor in the company's innovation performance and define which conditions facilitate the efficient use of external knowledge.

Summing up, *the first aim of this study is to test whether the acquisition of external knowledge is an influential factor for innovation performance in Czech companies*. *The second aim is to determine if the decision-making structure of Czech companies matters when it comes to the acquisition of external knowledge for innovation*. Our research delivers important results that will help to better understand the nature of external knowledge acquisition by companies by adding valuable distinctions between firms of different legal statuses and decision-making structures. A firm's management structure may speed up or slow down processes inside the firm, including the innovation processes. We test the effectiveness. It will allow us to define more precisely the main factors that influence the effectiveness of external knowledge acquisition.

The rest of the paper is organized as follows: Section 2 contains an overview of the literature with the innovation theories and studies that mention the effect of external knowledge and other factors on innovation. Section 3 contains data and methodology description. Next, we present the results and their discussion in Section 4. In the last part, we conclude our paper, including a summary of contributions and suggestions for future research.

2. Hypothesis Development and Literature Review

External knowledge is usually defined as all the know-how, patents, and inventions obtained by a company outside its borders, including from other businesses and organizations (Loree et al., 2011). In this study, we therefore understand external knowledge as patents, know-how, inventions, and other types of knowledge acquired from other businesses and organizations. This understanding reflects the definition by the World Bank Enterprise Survey that we use as our data source. Several scientists proved the important role of external knowledge in the innovation processes in enterprises. Laursen and Salter (2006) found proof that the implication of external knowledge has a positive impact on innovations in the UK manufacturing industry. Ahuja and Katila (2001) noticed the same link for the leading world's chemical enterprises, and Un et al. (2010) discovered the positive influence of R&D collaboration on product innovation. Ben Arfi et al. (2018) discovered that the positive impact of knowledge on green innovation in firms depends on a combination of internal and external sources of knowledge. Chatterji and Fabrizio (2014) define that not only other firms and universities may be the sources of external knowledge but also the customers. And the acquisition of user experience positively influences product innovation in the medical industry. The mentioned research outcomes lead to the formulation of our first hypothesis when we examine if such factor as external knowledge is important in the innovation process. Here, we understand the innovation process as the introduction of innovation of two types (product or process). Moreover, we will use internal R&D activities and R&D activities with contractors as additional independent variables (described below).

> *H1: Acquisition of external knowledge positively affects the implementation of product and process innovations by enterprises.*

This type of analysis is highly relevant to our chosen territory, i.e., the Czech Republic, which belongs to the group of Central and Eastern Europe (CEE). CEE countries are generally understood as countries where innovative firms often depend on external knowledge and technology (see, for example, Prokop, Stejskal, Klimova & Zitek, 2021). Moreover, against policymakers' expectations, these countries do not grow based on research-driven innovation (Radošević, 2017).

As Jansen et al. (2005) and Yu and Lee (2017) suggested, decentralized companies are more willing to explore and implement new technologies. However, Yu and Lee (2017) mentioned that there is still a gap in understanding how the decision-making structure of the firm may influence its innovation activities and suggested this direction for future research. Decentralized companies are more willing to innovate, as evidenced by Cosh et al. (2012) for UK firms. The role of the supervisory board in the innovativeness of the firm, by which we differentiate the firms, was studied by Jasinski (2019). Yang et al. (2015) discovered that the interconnection between centralization and innovation performance in Chinese companies depends on the information flow inside the company and the motivation of workers. This study is close to our research, as it also deals with knowledge as an influential factor in innovation performance and divides companies by their decision-making

structure. Sari et al. (2022) proved the positive influence of the time in power of the supervisory board on innovation performance in Indonesia. However, there is still a lack of studies that would directly test the influence of organizational structure on innovativeness (as suggested by Jansen et al. (2005) and Yu and Lee (2017)). From here, we formulate our second hypothesis.

> *H2: Less centralized companies (with supervisory boards, those that have market shares) are better at exploiting external knowledge to create innovations.*

Except for the primary independent variable, we also investigate the influence of other related indicators on innovation performance, namely R&D activities inside and outside the firm. These variables were used, in particular, by Ehrenberger et al. (2015) and Prokop et al. (2021). Ehrenberger et al. (2015) found R&D activities inside the firm as the most significant contributor to innovations among SMEs in the Czech Republic. Prokop et al. (2021) used many different components of internal and external R&D and knowledge to test their influence on companies' innovation performance in Central and Eastern Europe. Authors concluded that firms in catching-up CEE countries depend more on internal than external sources of knowledge and R&D in general, despite the increasing role of the foreign knowledge. We use the internal and external R&D variables to test whether they are influential, alongside the external knowledge variable.

We include age and size as control variables for our analysis. Yu and Lee (2017) found that older and larger firms benefit more from getting outside knowledge. According to Penrose and Penrose (2009), older firms tend to accumulate more resources, allowing them to support innovations to a greater extent. The opposite result, however, was found by Huergo and Jaumandreu (2004) for Spanish firms. Ettlie and Rubenstein (1987) proved that larger firms are more likely to introduce innovations than smaller ones. Sari et al. (2022) found the negative influence of the company's size on innovativeness. We seek to approve or disapprove the results of the studies mentioned above.

3. Methods and Data

3.1 Methods and Description of Data

We applied multiple linear regression and used SPSS software to get our results. This software was, in particular, used by Torres de Oliveira et al. (2022) for their research on the influence of external knowledge on innovations. Our data is divided into two and three groups based on the presence of the supervisory board and legal status, respectively. As a data source for our paper, we used the World Bank Enterprise Survey for the year 2019. The survey contains data on enterprises, including information about innovation performance, external knowledge acquisition, and on size and age of companies. In total, we included all the inputs except those with missing values – the data for 499 Czech companies. We differentiate the companies by two criteria described as decision-making structure: legal status (shareholding with traded shares, shareholding with non-traded shares, sole proprietorship) and presence/absence of the supervisory board. We follow the suggestions of Jansen (2005) and Yu and Lee (2017).

3.2 Dependent, Independent, and Control Variables

We have two dependent variables, product and process innovations. These two types of innovations are the most widespread, and both are mentioned in the World Bank Enterprise Survey. Duong et al. (2022) concentrated solely on product innovations, following the works of De Massis et al. (2015) and Ettlie and Rubenstein (1987).

We include two other independent variables, namely R&D activities inside the firm and R&D activities contracted with other companies. These indicators show whether the firm spent any resources on the research activities in the firm itself or agreed on the research with outside contractors. These variables were used by Ehrenberger et al. (2015), who found R&D activities inside the firm as the most significant factor for innovations in Czech companies. The age and size of the firm are used as control variables, based on a paper by Yu and Lee (2017). We described all our variables in Table 1. We sort firms by size according to the European Commission classification: small enterprises are those having less than 50 employees, medium-sized enterprises have from 50 to 250, and large are those counting more than 250.

Table 1: Description of Variables

Variable	Type	Description	Categories
Acquisition of external knowledge	Independent	Over the last three years, did this establishment spend on the acquisition of external knowledge?	1 = yes; 2 = no
R&D inside the company	Independent	Over the last three years, did this establishment spend on research and development activities within the establishment?	1 = yes; 2 = no
R&D with contractors	Independent	Over the last three years, did this establishment spend on research and development activities contracted with other companies?	1 = yes; 2 = no
Product innovations	Dependent	During the last three years, has this establishment introduced new or improved products or services?	1 = yes; 2 = no
Process innovations	Dependent	During the last three years, has this establishment introduced any new or improved processes?	1 = yes; 2 = no
Age	Control	In what year did this establishment begin operations? (2019-year)	1 = 0–10; 2 = 10–20; 3 = 20–30; 4 = more than 30.
Size	Control	At the end of the fiscal year, how many permanent, full-time individuals worked in this establishment?	1 = 0-50; 2 = 51-250; 3 = more than 250.

4. Results and Discussion

We divide our results into two parts. The first part is for differentiation by legal status (Table 2), the second part is for division by the presence/absence of the supervisory board (Table 3). We also divide results based on the dependent variable, whether it is product or process innovations.

Table 2. Results of Regression for Different Legal Status

	Product innovations					
	Traded shares		**Non-traded shares**		**Sole proprietorship**	
	Coefficient	**p-value**	**Coefficient**	**p-value**	**Coefficient**	**p-value**
External knowledge	0.500	0.064	0.112	0.089	0.285	0.274
R&D inside	0.068	0.762	0.223	0.000***	0.468	0.003**
R&D contract	-0.081	0.785	0.113	0.114	-0.005	0.979
Age	0.004	0.975	0.014	0.605	0.051	0.425
Size	-0.040	0.793	-0.067	0.064	-0.074	0.469
	Process innovations					
External knowledge	-0.015	0.958	0.085	0.173	-0.032	0.868
R&D inside	-0.088	0.716	0.080	0.105	0.440	0.000***
R&D contract	0.132	0.679	0.208	0.002**	0.318	0.032*
Age	-0.149	0.248	-0.046	0.084	-0.071	0.143
Size	0.080	0.623	-0.075	0.027*	0.048	0.532

Significance: * - 0.05 ** - 0.01 *** - 0.001

Results in Table 2, for differentiation in legal status, show the outcome opposite to the expected. Surprisingly, in cases of both types of innovation, external knowledge doesn't have an influence in the case of any type of legal status of a business. External knowledge, or any other factor, does not influence product or process innovations in less centralized companies, those with shares traded on the market. Therefore, we conclude that such factor as the company's legal status doesn't impact the connection between the acquisition of external knowledge and innovations. Such an outcome contradicts the outcomes discovered in studies of Yu and Lee (2017) and Jansen et al. (2005), who suggested research on decision-making structure and innovations and claimed that less centralized companies are more willing to explore and innovate, respectively. Though, the outcome could correspond to the results of Inkinen et al. (2015), who find other characteristics of a company's management, such as strategic management practices, essential for a company's innovation performance. By contrast, we confirmed that R&D activities have a high impact on innovations, and what is remarkable is more in centralized types of proprietorship than decentralized ones. The most influential among all factors turned out to be the R&D activities inside the company, and it had influence in half of the cases and with high significance. This result is in line with Ehrenberger et al. (2015), in whose study, R&D activities inside the firm were found to be the most influential factor in Czech SMEs. Regarding control variables, size was proved to have an influence only in one of the three cases, and this influence was negative. The same result was achieved in the study of Sari et al. (2022) for Indonesian companies.

Table 3: Results of Regression for Present/Absent Supervisory Board

Product innovations				
	Present		**Absent**	
	Coefficient	**p-value**	**Coefficient**	**p-value**
External knowledge	0.298	0.008**	0.094	0.188
R&D inside	0.274	0.003**	0.233	0.000***
R&D contract	0.067	0.576	0.103	0.175
Age	0.066	0.211	0.012	0.667
Size	-0.143	0.024	-0.045	0.255
Process innovations				
External knowledge	0.164	0.171	0.063	0.320
R&D inside	-0.079	0.424	0.175	0.000***
R&D contract	0.218	0.095	0.205	0.002**
Age	-0.005	0.933	-0.062	0.014*
Size	-0.054	0.429	-0.064	0.070

Significance: * - 0.05 ** - 0.01 *** - 0.001

Our results in Table 3 show that the acquisition of external knowledge has an impact only on product innovations in companies where the supervisory board is present. It partially proves hypothesis number two, which says that less centralized companies are better at innovation implementation. But, what is more important, hypothesis number one is proven here, as less centralized companies (with supervisory boards) have an impact of external knowledge on product innovations, while more centralized (without supervisory boards) - don't. These results are in line with the conclusions of Duong et al. (2022), who found that in certain types of firms, external knowledge has a positive impact on product innovations, and with the research of Jansen et al. (2005), who suggested that less centralized companies are better at using the external knowledge for innovations. Hypothesis number one is proven only in the case of product innovations, which corresponds to the results of Kobarg et al. (2019), where product innovations were studied.

Besides that, a valuable outcome is that in the case of more centralized management (non-traded shares, sole proprietorship), such factors as internal/external R&D activities have more impact in the case of process innovations than in companies with the less centralized type of management. Such results match the conclusions of Un et al. (2010) and Ehrenberger et al. (2015), who proved the significant influence of R&D activities on

companies' innovations. Nevertheless, Un et al. (2010) had such results for product innovations, and the authors explained it by a wise choice of collaborators outside the companies. Ehrenberger et al. (2015) also noticed the influence of size on the intensity of R&D activities inside the firm, as bigger companies tend to have them more. The control variables didn't turn out to be substantial in this case, as well as in the previous test. Age is significant only in process innovations when the supervisory board is absent.

5. Conclusions

In our study, we tested the role of external knowledge in creating innovations in Czech companies. We used a sample of 499 enterprises from different industries of different ages and sizes. The study resulted in several repercussions. First, no effect of separation by legal status was found. Our hypothesis that companies with decentralized structures are better at using external knowledge was unconfirmed. In this instance, other independent variables, namely expenditure on R&D activities, had an influence on both types of innovations. The unexpected part is that the influence is stronger when the company's structure is more centralized. This result contradicts our hypothesis assumption.

Nevertheless, the hypothesis on the effect of decision-making structure was proved after testing it for the supervisory board variable. However, this suggestion was confirmed only for product innovations. Control variables didn't have the expected influence. The most important outcome of our study is that the acquisition of external knowledge has a positive impact on product innovations in companies with supervisory boards. It proves the second and partially the first hypotheses of our study. External knowledge has more influence on innovation performance in less centralized companies than in more centralized ones. Such an outcome is in line with the results of Duong et al. (2022), who proved that efficiency in using external knowledge for product innovations depends on the internal characteristics of the firm.

The findings of our study are potentially beneficial for further research in the field. They show that the legal status of the firm is insignificant for the innovations using external knowledge. They also show that the presence of the supervisory board and the firm's age and size have limited influence on the company's innovations. Based on this information, researchers can define more precise aims of their studies.

Our study has certain limitations. Our outcomes are bounded by the availability of data from the World Bank. Also, we tested the influence of independent variables only in one country. In further research, more countries could be included in the analysis, for example, other countries from CEE. Moreover, other characteristics of the firm, like sector or environmental orientation, could be tested if a wider variety of data is available. Our results could also be supported in the future using more variables and a mix-method approach combining, for example, other methods, such as partial least squares structural equation modeling and fuzzy-set qualitative comparative analysis (see, for example, Prokop & Hajek, 2023).

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Shortcomings of Current Performance Measurement and Management Systems: A Literature Review

Anna Dvorakova and Michaela Kotkova Striteska
Faculty of Economics and Administration, University of Pardubice, Czech Republic

anna.dvorakova2@student.upce.cz
michaela.kotkovaStriteska@upce.cz

Abstract: The performance measurement system as a tool for knowledge sharing and continuous improvement plays a key role in the knowledge management development. Previous research indicates that performance measurement and management systems are not always successfully implemented to improve decision-making or knowledge management. Many failures relate to the behavioural aspects of performance management, but a systematic review of this topic is lacking. Therefore, the main aim of the paper is to explore the shortcomings of current performance measurement and management systems. The study conducted a systematic review of the literature of peer-reviewed articles over the past 20 years. The main shortcomings are analysed within the individual categories of technical and social control, especially in terms of design, implementation, and behavioural aspects. The findings revealed that the most common causes of shortcomings of measurement and management performance systems include technical problems, insufficient or late knowledge sharing, or the inability to effectively implement the entire system. An ineffective performance measurement and management system encourages bad decisions and wastes resources by misallocating them. Subsequently, this results in dysfunctional employee behaviour and deterioration in overall performance, which often even increases fear, reduces employee trust, and engagement. Based on the synthesis of the results, the paper suggests how to prevent the identified shortcomings to cause a rapid change in the behaviour of employees. From a theoretical contribution point of view, the research provides a comprehensive and clear view of the currently available theory of performance measurement and management systems. In terms of managerial implications, point out the shortcomings of current performance measurement and management systems and outline how to overcome them.

Keywords: Performance measurement system, Shortcomings of performance measurement, Performance management systems, Knowledge sharing

1. Introduction

In today's world, where changes are occurring at an increasingly rapid pace, businesses need to know and be able to effectively measure and manage performance (Micheli and Mura, 2017). The need to correctly measure performance in the company is even greater than ever before (Kotkova Striteska & Zapletal, 2020), as performance measurement is an obvious but often overlooked variable that can mediate the link between knowledge management (KM) and organizational performance (Asiaei and Bontis, 2020). In the past, research has gone in the direction of the technical aspects of performance measurement (Reznakova et al., 2017), while the behavioural aspects of performance management have been neglected. This very often resulted in a mismatch between performance measurement and the organisational environment, leading to frequent failures of the contemporary performance measurement and management system (hereinafter PMMS) (Van Camp and Breat, 2016).

Although there is a considerable amount of literature on PMMSs, there is no universally accepted theory or consensus on the specific factors and contexts that influence their successful implementation and improvement. Taylor and Taylor (2014) state that it is necessary to explore the factors that significantly affect the implementation of PMMS, as to date there are only a few studies that have dealt with this topic. Similarly, Bourne et al. (2018) emphasise the inadequacy of current approaches within PMMS and Blasini and Leist (2013) point out the need to look for factors that influence successful development, implementation and functioning of PMMS in practise. To meet these challenges, it is necessary to identify the main shortcomings of the current PMMS. Therefore, the main aim of the article is to explore the shortcomings related to design, implementation, and behavioural aspects of current PMMS.

With the help of a systematic review of the literature, the PMMS concept according to Smith and Bititci (2017) is defined. Based on it, the failures of current PMMS are divided according to technical and social control, especially in terms of design, implementation, and behavioural aspects. Finally, the conclusions, limitations, and future research opportunities are outline. From a theoretical point of view, the paper deepens the understanding of existing knowledge related to effective performance measurement and management systems as tools for knowledge sharing and continuous improvement and learning. From a managerial perspective, the findings can provide inspiration on how to effectively manage PMMS in a current dynamic and turbulent environment.

2. Performance Measurement and Management Concept

The current approach to PMMS has evolved from a focus on what to measure to how to manage it (Smith and Bititci, 2017) and is recently understood in the context of organisational control theory (Nudurapati et al., 2021). In this context, performance measurement is a technical control that includes processes related to setting goals, collecting, analysing, and interpreting performance data (Bititci et al., 2015). The social control dimension is then represented by a performance management system, which encompasses processes for assessing differences between actual and desired outputs, identifying differences that are critical (thus warranting management intervention), understanding whether and why these deficiencies have occurred, knowledge sharing and, if necessary, implementing (and monitoring) corrective actions aimed at closing significant performance gaps (Melnyk et al., 2014). In the context of KM, the social control dimension plays crucial role to successfully cope with the difficulties of the management of the company's most strategic assets, i.e., knowledge resources (Asiaei and Jusoh, 2017). However, in the literature, we often find two separate concepts (performance measurement and performance management), which are not complementary (Kotkova Striteska and Zapletal, 2020).

Therefore, the key role of PMMS as a tool for KM, continuous improvement, and learning must be redefined (de Lima et al., 2013). A system must be created that uses the information and knowledge gained from performance measurement to create positive changes in corporate culture, business systems, and processes (Melnyk et al., 2014) and effectively identify, capture, and utilize relevant knowledge to enhance the overall performance (Cardoni et al., 2020). For this, companies need to establish a formal process for reviewing and revising strategic goals and performance indicators, which will ensure the dynamism and flexibility of the developed system (Kotkova Striteska and Zapletal, 2020). If PMMS is designed correctly, it can cause a rapid change in employee behaviour, which automatically leads to improved performance (Souza and Beuren, 2018). On the contrary, if this is not the case, the use of performance indicators can and does lead to dysfunctional employee behaviour, demoralisation, reduced confidence, and increased fear (Hamel, 2009). Therefore, for the purposes of this research study, PMMS is understood as a set of cultural and behavioural practises that determine the ways in which it is used (Bititci, 2015), with the goal being learning and KM rather than control (Davenport et al., 2010).

3. Methodology

Systematic literature reviews should be updated regularly to ensure they are relevant and include the latest available evidence (Tricco et al., 2021). Our systematic literature review is limited to literature published between 2000 and 2021. This time frame is considered appropriate given the great development and diversification of various aspects of performance measurement and management (Nudurupati et al., 2021). As a starting point, the question of what gaps exist in the field of business PMMS was defined. A search for peer-reviewed English articles was then conducted in the following databases: Web of Science and Scopus, which are the most widely used sources for academic publications in the field of business and management. A narrow search criterion was chosen using keywords (performance measurement system, shortcomings of performance measurement and management systems, failures, and challenges). Articles were selected for the subject areas of business, management, and business finance as searchable sources of academic publications (for the categories title, abstract, author keywords). Subsequently, the selection of studies, data extraction, synthesis of results, and interpretation of results were carried out (Machado et al., 2019). Research studies focused on public administration or PMMS for supply chain or sustainability were not included in the review due to their narrow and specific focus. In total, 25 studies were included in the research study. The entire methodological process of developing a research study is shown in figure 1.

4. Results and Discussion

To be precise, as conceptualised by Smith and Bititci (2017), diagnostic (measures, targets, feedback) and boundary (goals, policies, procedures) systems represent technical control, and belief (leadership, purpose, values) and interactive (participation, engagement, and KM) systems represent social control. Therefore, we include in the technical control aspects of PMMS design related to the selection of appropriate metrics and the use of resources to support data collection and analysis (Bourne et al., 2018) and aspects of PMMS implementation related to infrastructure and alignment of strategies (Taticchi et al., 2012).

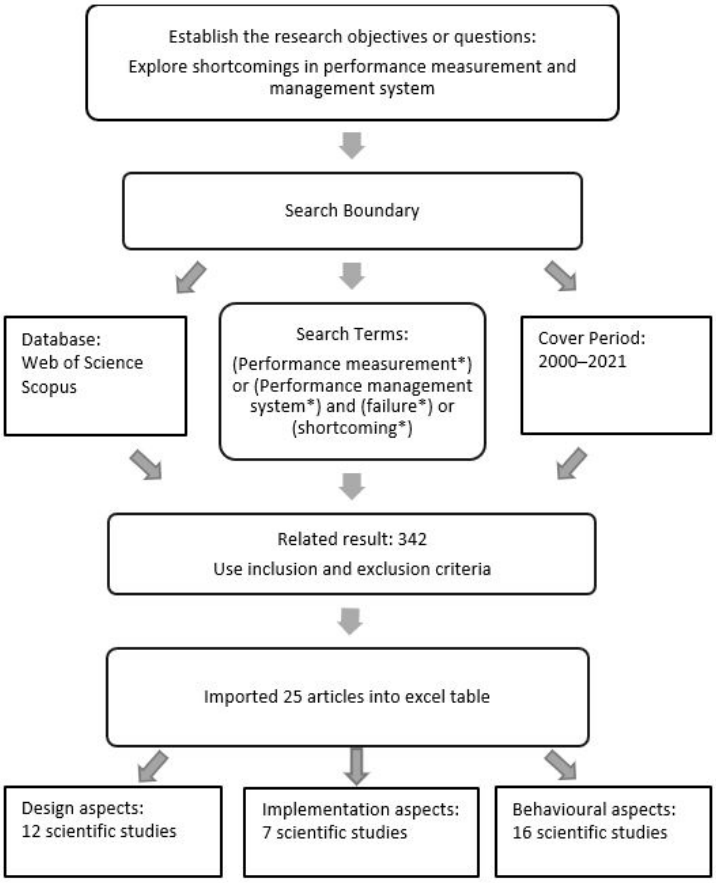


Figure 1: Methodological Process of Developing a Research Study

4.1 Technical Control

According to Bititci (2015), technical controls are more formal and explicit with specific methodologies, technologies, and analyses to achieve the objectives. The following table provides an overview of the findings of the main shortcomings related to design aspects of PMMS.

Table 1: Shortcomings Related to Design Aspects of PMMS

Scientific Study	Research Method	Key Findings
Neely and Bourne (2000)	Action research	The time, effort, and resources required to create the system make it a long and slow process, and therefore, top management must continually increase the energy level to complete the process.
Hudson et al. (2001)	Action research	Lack of consistency and objectivity; limited resources to invest in the development of PMMs.
Mol and Beeres (2005)	Action research	Environment with inadequate control of outputs; PMMS may be too focused on inputs or activities rather than outcomes; lack of appropriate incentives to motivate staff.
Folan and Browne (2005)	Literature review	Financial metrics (profitability and return on investment) are often emphasised, factors such as customer satisfaction and employee well-being are neglected; alignment with the organisation's strategic goals is missing.
Paranjape et al. (2006)	Literature review	Matric mismanagement - too many metrics and heavily weighted internal finance data.

Scientific Study	Research Method	Key Findings
Garengo and Bititci (2007)	Empirical study	PMMS in SMEs may be less effective than in larger organisations due to a lack of resources, expertise, and formal procedures.
Adler (2011)	Case study	Lack of focus on non-financial aspects of performance such as customer satisfaction or innovation.
Rahbek and Sudzina (2012)	Survey	Lack of understanding or awareness of the benefits of PMMS.
Pellinen et al. (2016)	Case study	Inability to capture intangible benefits (KM or innovation).
Van Camp and Breat (2016)	Conceptual study	Lack of a clear, unique and transparent definition of metrics, copying from others, unavailable data, difficulties in measuring intangible assets, unbalanced set of indicators, limited resources, i.e. time, people, money.
Forcada et al. (2017)	Survey	Absence of selected performance metrics, strong emphasis on price; inadequate consideration of communication performance.
Smith and Bititci (2017)	Action research	Inadequate consideration of nonfinancial factors (employee involvement, innovation, and sustainability) leading to a narrow focus on financial results.

Twenty years ago, Itner and Larker (2003) pointed out the insufficient consideration of nonfinancial aspects in PMMS. Table 1 shows that performance aspects strongly related to competitiveness, such as innovation, KM, employee engagement, and sustainability, are still not sufficiently integrated into contemporary PMMS. At the same time, it is precisely these performance measures that can effectively contribute to strategic alignment, organisational learning, and knowledge dissemination in organisations (Michaeli and Manzoni, 2017). The main reason is that measuring nonfinancial measures that usually reflects intangible value accurately, efficiently, and in a timely manner is very difficult, time-consuming, and expensive (Chow and Van der Stede, 2006). Even managers have already widely acknowledged the limitation of traditional financial measures, yet still prefer them because they consider them to be less ambiguous and more objective. The results also revealed other challenges related to PMMS, including lack of consistency and objectivity, focus on inputs rather than outcomes, and limited resources to develop integral systems.

Other factors that influence the success or failure of PMMS include the need to align measures with strategy, involve stakeholders, and use multiple perspectives (Taticchi et al., 2012).

Table 2: Shortcomings Related to Implementation Aspects of PMMS

Scientific Study	Research Method	Key Findings
Neely and Bourne (2000)	Action research	Infrastructure - the problem is that data in the enterprise come from separate databases, often in inconsistent form.
Pongatichat and Johnston (2008)	Interviews	Poor aligned with an organisation's strategy; PMMS may not effectively measure what is important to the organisation; suboptimal decision-making and resource allocation.
Garengo a Bititci (2007)	Empirical study	Insufficient alignment with the strategic objectives of the organisation, leading to a lack of focus on the most important aspects of performance - corporate governance structure, corporate culture, KM, and management information systems.
Davenport et al. (2010) Nudurapati et al. (2011)	Book / systematic literature review	Outdated, irrelevant, and inaccurate information; most of today's PMMS are outdated, not dynamic, and sensitive to changes in the internal and external environment of the enterprise.

Scientific Study	Research Method	Key Findings
Adler (2011)	Case study	Deficiencies in performance management and organisational strategy; performance measurement and management must be tailored to suit and support the implementation of a confrontational strategy.
Pellinen et al. (2016)	Case study	Vertical and horizontal integration: limited understanding of the impact of integration on performance; identification of relevant performance measures that reflect the impact of integration on performance; lack of consideration of interorganisational relationships.
Van Camp a Breat (2016)	Conceptual study	Frameworks – clear scope of implementation, choice of a range of different methods and frameworks, lack of KM, understanding, lack of feedback and learning, complex dynamics.

Table 2 confirms the importance of appropriate infrastructure to support the measurement and management of business performance (Bititci, 2015), including technologies, data management systems, and reporting (Micheli and Mura, 2017). Outdated and inaccurate information, inconsistent data, and poor alignment with strategy may neglect important drivers of future performance. Open communication, data visualization and a formalized review process of strategy, performance indicators, processes and projects are necessary to ensure an effective dialogue that enables the exchange of knowledge and the sharing of experiences between individuals (Couturier and Sklavounos, 2019).

4.2 Social Control

According to Okwir et al. (2018) or Bititci (2015), social complexity, which includes leadership, organisational structure, motivation, and culture, is critical to effective PMMS. In the same vein, Bourne et al. (2018) mention leadership support and employee engagement as key topics for the effective functioning of PMMS, among others. Asiaei and Jusoh (2017) add that knowledge-related factors can predict the design and implementation of PMMS.

Table 3: Shortcomings Related to Behavioural Aspects

Scientific Study	Research Method	Key findings
Neely and Bourne (2000)	Action research	People feel threatened; top management use performance measurement data to gain the upper hand over managers to prove that they are not delivering the required performance; blame culture.
Bourne et al. (2002); Bourne (2005)	Case study	The determining factor of success or failure is purpose; a high level of commitment from top management in favour of better management is a key element; intervention by the parent company often interrupts the implementation; culture that reduces fear of measurement.
De Waal (2003)	Literature review	Concerns about change related to staff workload or fear of failure; lack of coordination and collaboration; lack of trust in the PMMS and lack of timely feedback on performance to staff; lack of engagement and communication.
Pongatichat and Johnston (2008)	Interviews	Incentives are misaligned and employees are not sufficiently motivated.
Elzinga et al. (2009)	Case study	Resistant to change; inadequate feedback and knowledge transfer; inadequate training and support; insufficient trust and employee participation.
Davenport et al. (2010) Nudurapati et al. (2011)	Book / systematic literature review	Lack of commitment from top management to the implementation of the PMMS; problems with change management, such as resistance from people who often do not understand the objectives and potential benefits; management tends to use the PMMS as a control and attribution mechanism.
Kruis and Widener (2014)	Case study	Strong emphasis on financial indicators (to the detriment of non-financial ones); ability of managers to manipulate performance measures to achieve their own objectives and possible resistance to the introduction of PMMS (threat to managerial power).

Van Camp and Breat (2016)	Conceptual study	Governance – lack of leadership commitment, linkage to strategy, reward system, formal governance, IT support, user involvement, participation in decision making.
Pavlov et al. (2017)	Survey	Mismatch between PMMS and HR strategies; lack of communication between managers and employees about goals and performance measures; limited employee participation in the process, resulting in a lack of engagement and commitment to performance goals.
Ramberg (2017)	Case study	Individual focus on short-term goals and immediate results; lack of communication and coordination between stakeholders; difficulty in changing organizational culture and practices within the company; reluctance to adopt new practices.
Skoczylas and Waśniewski (2017)	Literature review	Achieving goals that differ from overall company goals; suboptimal decision-making and actions; manipulation of PMS-related data; information overload; short-term focus; employee resistance to change.
Smith and Bititci (2017)	Action research	Lack of integration with other practises; the limited involvement of employees in company processes (lack of employee engagement and inability to use the full potential of employees).
Striteska and Jelinkova (2018)	Conceptual study	Employee reluctance to implement new PMMS, bias, and subjectivity; overemphasis on short-term performance; lack of alignment with corporate strategy; lack of communication between employees and management.
Hassan a kol. (2020)	Quantitative study	Stakeholder engagement; leadership and quality management practices have a significant positive impact on the PMS.
Murphy (2020)	Conceptual study	Possible bias; focus on individual performance (rather than team performance); use of performance appraisals as a tool for punishment rather than development - possible fear and mistrust, lack of employee motivation and commitment.
Uddin et al. (2021)	Case study	Incentivisation to achieve individual employee goals; overemphasis on and reliance on financial indicators; employee resistance to change; lack of alignment of key performance indicators with the organisation's strategic objectives.

The Table 3 reveals that purpose, structure, culture play a significant role in the success or failure of PMMS in terms of behavioural aspects. The purpose-related results show that PMMS should primarily be used for continuous improvement, learning and knowledge sharing, not for control and command. In this context, employee engagement in the design, implementation, and use of PMMS can play a key role in spreading knowledge and creating a performance-orientated corporate culture (Kotkova and Zapletal, 2020). Management should actively support employee development and learning and create a culture in which KM is seen as an important part of corporate strategy (Pellegrini et al., 2020). Similarly, our findings correspond with research studies that consider top management commitment and a proper leadership style essential for the effectiveness of PMMS use (Razzoli, 2017; Bourne et al., 2013).

As stated by Okwir et al. (2018), well-defined roles and responsibilities, trust, knowledge sharing and transfer, and regular training are essential components in ensuring effective functioning of PMMS. Adler (2011) adds task clarity and effectiveness, along with positive relationships and minimal conflicts within the company, as crucial factors for successful PMMS. All these factors help to build a performance-driven culture that supports the right purpose of PMMS and is considered a major predictor of a company's ability to respond to the external conditions of the current dynamic environment (Dubey et al., 2017). This is another important finding that our research study outlines. Similarly, Melnyk et al. (2014) revealed that current PMMSs are often inflexible and resistant to change in today's business environment. According to Kolehmainem (2010), a balance between alignment and empowerment is necessary for the use of flexible and adaptive PMMS. Furthermore, the ability of PMMS to address KM issues and the challenges of information, flows of information and interaction mechanisms (Jordão and Novas, 2017) plays a role in greater flexibility and adaptability.

5. Conclusion

The results of the research study showed that several shortcomings related to the design, implementation, and use of PMMS have been identified in the past. A very interesting finding is that connections can be found

between them. If the PMMS is not balanced, i.e., it does not sufficiently measure nonfinancial aspects, it cannot make the necessary changes in corporate strategy, culture and KM that contribute to continuous learning and improvement. At the same time, how the company can effectively respond to changes in the surrounding environment is determined by culture, strategy, and KM (Melnyk et al., 2014). It is therefore clear that if we want to avoid PMMS shortcomings, it is first necessary to change the way we look at the company culture and, style of leadership and KM.

This study also has limitations as it includes studies selected by us in the time range 2000-2021 and there may be studies not included in the paper that would differ from our results. Articles were filtered based on the appropriateness of the selection criteria, while there may be limitations in the aspects we selected. The choice of other aspects provides an opportunity for future research. To sum up, findings of our research study support Beer a Micheli (2018) statement that future research must encourage a shift away from the technical aspects of measurement mechanisms that seek to obtain valid and reliable performance information in an objectified and standardised manner, to knowledge-based approaches that generate human-centred measurement practises and positive experiences. Furthermore, our results point to the importance of considering behavioural aspects in the performance measurement and management process, both at the level of the performance measures themselves and at the level of compliance with the organisational environment. Future research should also explore how PMMS may support and facilitate KM development.

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Data Framework for Retrieving Failure Information From Earlier Plant Engineering Projects

Robert Egel[1,2], Sabrina Karch[3], Bernd Kuhlenkötter[2] and Arndt Lüder[4]
[1]Production Automation, RIF Institut für Forschung und Transfer e. V., Dortmund, Germany
[2] Production Systems, Ruhr-Universität Bochum, Germany
[3]let's dev GmbH & Co. KG, Karlsruhe, Germany
[4] Production Systems and Automation, Otto-von-Guericke Universität Magdeburg, Germany

egel@lps.ruhr-uni-bochum.de
sabrina.karch@letsdev.de
kuhlenkoetter@lps.ruhr-uni-bochum.de
arndt.lueder@ovgu.de

Abstract: Failures in context of industrial production are not only a burden and a main reason for committee and rework but can also be a chance. When failures occur within organizations, several authors and publications have pointed out the opportunities that come with them. Through failures, an organization gets the possibility to improve corresponding processes and avoid future mistakes preventively. This is especially true for manufacturing companies. Their customers trust that products are of a continuously high quality. In addition, these companies are facing enormous challenges, for example a higher product variety or an increasing product and production plant complexity. In times of limited human and financial resources, these challenges have a huge influence on the transfer of failure information. Often, companies (are forced to) have a structured process for how to handle failures within the organization, but fail to transfer the important information gained from them to a parallel plant or to a future project. Therefore, the aim of this paper is to present a framework, which allows retrieving earlier failures at the early stage of the plant engineering phase. This serves as a basis for the further development of a supporting system in the FertiRob project. To ensure transferability in industrial practice, the framework is explained using a real-life application demonstrator. In addition, an adjusted Why-Not-Analysis with (industry) project partners is conducted. This analysis shows that there are points that need to be considered in further development while the basic implementation is possible.

Keywords: Failure management, Information management, PPR model, Plant engineering, Production, Failure retrieval

1. Introduction

The extent of the occurrence of failures in companies can be illustrated by the example of the automotive industry. Only in 2020, 30.3 million passenger cars were recalled because of safety defects in the reference market of USA. This corresponds to an average recall rate of 208 %. (Center for Automotive Management 2021) Moreover, failures can cause major damages to companies. These become particularly unpleasant when they reach the customer, and a complaint arises. For example, it can become expensive and the reputation with the customer suffers (Sitko-Lutek et al 2010). This may be one reason why a lot of research has been done on customer complaints. However, internal failures can also lead to problems, such as rising costs e.g. due to the additional effort to eliminate the problem.

Nevertheless, *"In the simplest terms, failure is the ultimate teacher."* (Maidique & Zirger 1985, p. 309). This sentence is still valid today. Therefore, it is very important that companies learn from failures and use the information generated in the production process to avoid repeating them. In addition, the later a failure is discovered, the more expensive it becomes. The so-called Rule-of-Ten describes this vividly (see Figure 1). It is therefore important to identify and eliminate (potential) failures as early as possible, ideally already in the planning phase.

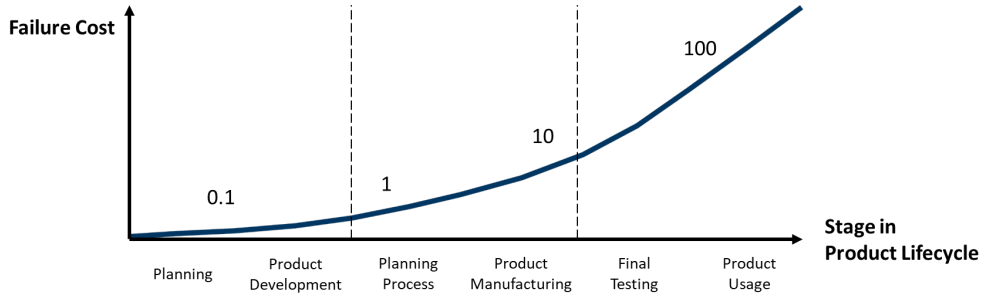


Figure 1: Rule of Ten (Schmitt & Pfeifer 2015, p. 3)

Nowadays, that is not easy. The customers' demands for product and process quality are getting higher (Günther et al 2022). On the other hand, some trends mean that companies are facing ever greater challenges with regard to failure management. For example, a high degree of product individualisation increases data complexity (Tuertmann et al 2016). Increasing complexity of products and processes also leads to more (potential) failures (Ansari et al 2020). New technologies, e.g. Digital Twins or vision-based quality assurance, can support failure management, but wherever people work or plan something, failures can and will occur.

From a quality point of view, this paper deals with the research question, how a data framework for failure information may look, so that this information can be transferred to the right person and thus be eliminated already in the planning phase. For this purpose, chapter 2 first gives an overview of failure management, information management and important basic terms. Based on this, the problem description of the paper is concretized. Chapter 3 explains the proposal of the paper with the help of an example. On the one hand, to ensure that the methodology is fundamentally practical and, on the other hand, to find out how this methodology can be improved for a real implementation, an adapted Why-Not-Analysis with industry and research experts is presented in chapter 4. In chapter 5, a summary is given, and the next planned steps are indicated.

2. Literature Overview

2.1 Failure and Failure Management

Haghi et al (2018) mentioned that there have been several attempts to define *failure* precisely. In practice, the ISO 9000 definition is mostly used. It describes a failure as a not fulfilled requirement. A requirement is a *"need or expectation that is stated, generally implied or obligatory"*. (ISO 9000 2015, p. 46) Therefore, a failure exists when a need or expectation has not been met.

With regard to failure management (specifically complaint management), a great deal of research has been carried out in the marketing field (Schmitt & Linder 2013). From a quality management perspective, failure management is the control of interdepartmental measures for the elimination of occurring failures and for failure prevention (Linß 2018). Several methods and processes for dealing with failures preventively have been established. One, which is widely used in practice, is the Failure Mode and Effects Analysis (FMEA). The aim of this method is to determine how units and processes could fail in order to find appropriate actions that can prevent potential failures. It is important to identify possible failure modes, which are related to their causes and effects on hardware, software, human actions and the influence on each other. (DIN EN 60812 2015) The FMEA can be done on product (Design-FMEA) or process (Process-FMEA) basis. In principle, the FMEA is a preventive method, but can also be used reactively when failures have occurred (Schmitt & Pfeifer 2015). It is a *"living"* document, which is why the current planning status must always be taken into account (Brückner 2019). Therefore, it is also possible, for example, to update new emerging failures. The final status of an FMEA can then be used for future similar products. Although this is a good way to learn from occurred failures in advance, it involves the risk that the file becomes very long and failures are *"dragged along"* which may no longer occur in practice.

For the description of process steps in the handling of failures, several reference models exist. One is the reference process developed in the SAFE project (Crostack & Klute 2008). Further examples are Goldszmidt et al (2011) or Kristes (2012). In practice, the 8D-Report is widely used. It has its roots in the automotive industry and consists of eight steps - Building a Team, Problem Description, Definition of Immediate Measures, Root Cause Analysis, Definition of Corrective Measures, Implementation of Corrective Measures, Avoidance of Failure Repetition and Appreciate Team Performance. (Jacoby 2022) The 8D-Report provides a systematic approach but is on the other hand very time-consuming to process (Brückner 2019). Additionally, in context of failure information storage, the 8D report does not specify a standard for how failure information must be described (Heinrichsmeyer, Schluter & Ansari 2019).

In research, several concepts on how to use failure information have been developed. Schröder (2016) developed a system that supports the troubleshooting process by using information from the current failure to find similar ones from the past. For this, he defined a fixed classification structure and then used similarity algorithms on it. In the project LeaF, a great deal of focus was placed on failure center detection based on clustering algorithms (Schmitt 2021). Heinrichsmeyer (2020) developed a system for supporting failure management, into which a failure database was also integrated. A suggestion, as to which failure can help with the current case, is not given proactively, but must be found with the help of the complaint ID. Schmitt & Linder (2013) integrated the concept of long-term knowledge transfer into the Aachener Quality Management

Model. It connects the Quality Forward- and Quality Backward Chain by flowing the information into the Quality Forward Chain after failure correction.

It can be generally stated that although the topic of utilizing information on failures that have occurred is considered important in research, there is no well-known methodology for retrieving information in the early phase of plant engineering.

2.2 Information Management and Waste

More than ever, all disciplines are facing the challenge of finding the right information in the information overload of digital age. Organizing the supply and flow of information is the responsibility of information management (Krcmar 2015).

Particularly in the case of failures, the root cause and the recognition of failures often does not belong to one person or process step, so that the challenge is to handle failure information in its life cycle. Thereby, the data and information life cycle includes all steps of data and information processing, planning, sourcing, structuring and storing, administration, use and refinement, distribution, actualization and disposal (Bodendorf 2006) (Hildebrand, Gebauer & Mielke 2021).

The following principle for flow of data and information is based on the approach of Jünemann (1989) and is described as follows: the right information at the right time in the right quantity at the right place in the right quality (Augustin 1990). Therefore, the information need can be seen as a key lever as well as a standardized management and flow of data and information (Karch, Schleipen & Lüder 2023). In detail, it is necessary to identify and eliminate inefficiencies in data and information flow, starting with misinformation, which affects the quantity and quality of data and information for a specific purpose as well as the process of data collection. Once the right information has been selected, the task is to provide it efficiently to the user in a standardized workflow. (Karch et al 2023)

2.3 Concretization of the Problem Description

After clarifying the terminology and environment, this chapter details the problem addressed in this paper (see Figure 2). This paper focuses on production, which is why only the Plant Engineering, Production and Customer Usage phases are integrated demonstratively in Figure 2. Within these Product Life Cycle phases, different failures can occur. When this happens at the customer side, it is particularly significant for a company (see chapter 1). During product manufacturing, costs are also incurred, e.g. for lost materials or reworking. However, it is not as serious as a failure occurrence at the customer. A failure during planning has the lowest criticality because there is, normally, still a lot of time to prevent and avoid it. Also, because failures that have already occurred once, have the possibility of reappearing in a new project. The plant engineering phase is therefore a good time to look at these failures and define ways of eliminating them. To do this, a data framework must be defined which supports the plant engineer by transferring the correct information to this phase. This paper describes the model that can be used to isolate potentially important failure information at an early stage of the Product Life Cycle, especially at the plant engineering phase.

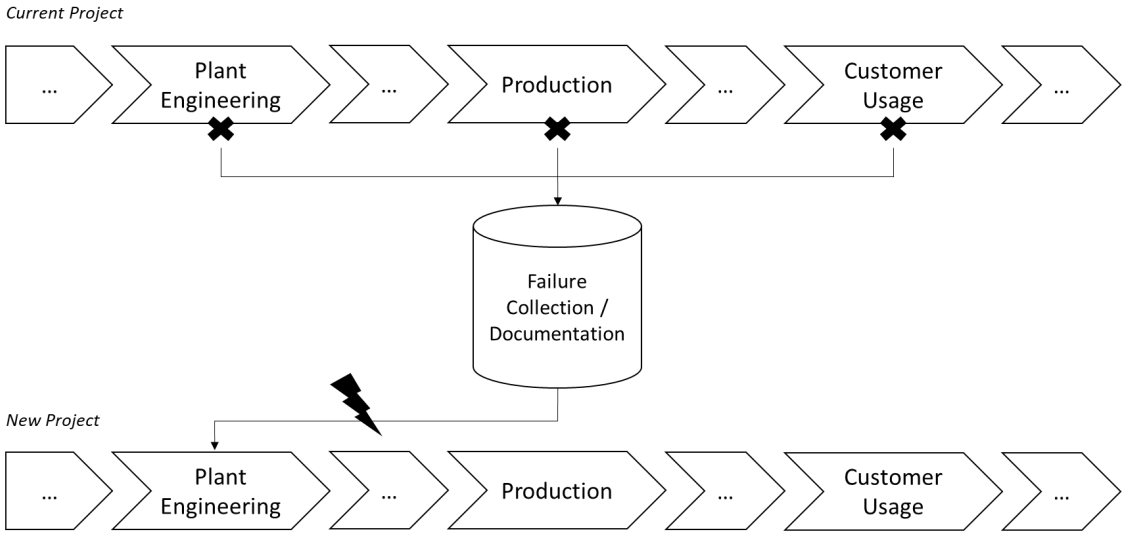


Figure 2: Illustration of the Problem Description of this Paper

3. Conceptual Implementation

3.1 Selection of Base Model

A major challenge in failure management is the fact that people from different departments in the company are involved, all of whom have different functions with different resources and skills (Wu et al 2019). Referring to Figure 2, people from the Manufacturing Engineering department are responsible for plant engineering, while Quality employees are mainly involved in failure handling. In order to develop a system that provides the right information, a model must be taken as a basis that acts as an interface between these departments and makes the needed knowledge explicit. The PPR-Model (*P*roduct – *P*rocess – *R*esource) with its focus on the essential aspects of a production plant appears to be suitable for this purpose.

Figure 3 describes the basic functionality of this model. A product, which can also be a single component within the assembly, a process that handles the product and a resource that implements the respective process are connected to each other by so-called PPR-Connectors (Schleipen & Drath 2009). It has been shown that the PPR-Model is very well suited for complex planning structures (Drath 2021). Several researchers in the context of production and plant engineering apply this model to structure and store complex plants and facilities (e.g Lämmle, Seeber & Kogan 2020, Schäffer 2021). In the context of Industry 4.0, this model serves as the basis for initial considerations on how automatic resource selection can be implemented for plant engineering (Plattform Industrie 4.0 2022). This model is also supported by AutomationML, an XML-based data exchange format for the engineering context. Through the *PPRConnector* interface class, the different objects can be linked semantically with each other. (AutomationML – Whitepaper 1, IEC 62714-1 2018)

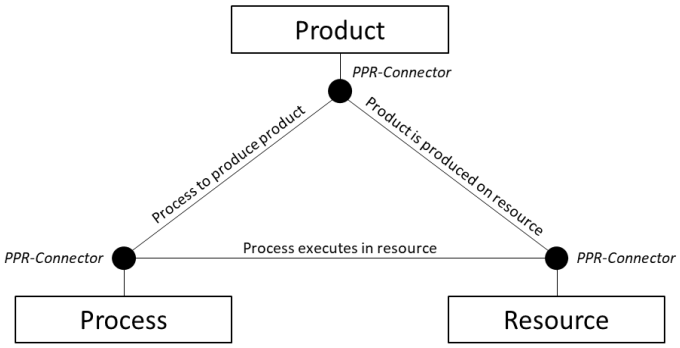


Figure 3: Elements of the PPR Model (Schleipen & Drath 2009)

3.2 Extension to Include Failure Management

The idea of this paper is based on the PPR-Model extended by the component *Failure*. To be compliant with the definitions from chapter 2, requirements describe a product. Together, this results in a uniform structure that can be saved digitally. Figure 4 illustrates the basic idea.

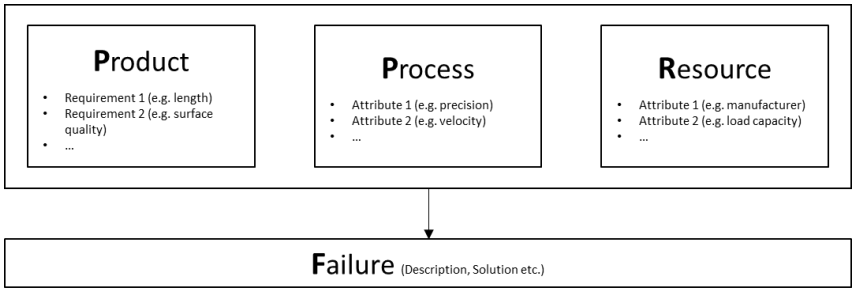


Figure 4: Connection PPR - Failure

The clear separation of the various units of information enables them to be entered in a way that is both timely and accountable separated. During the plant engineering itself, information on how (process) and with what (resources) products are handled can be saved by the production planning employee. If a failure occurs, the corresponding information is added by a quality engineer. In this way, the model combines both points of view. This addresses the problem described in chapter 3.1.

This concept will be explained exemplary through the first station of a research demonstrator, the so-called *COssembly*, which is located in the Learning and Research Factory of the Ruhr-University Bochum (Kulessa, Boshoff & Kuhlenkötter 2022). A detailed process of the joining sequence would exceed the scope of this paper, but the layout of the station and the corresponding product of the final assembly are shown in Figure 5.

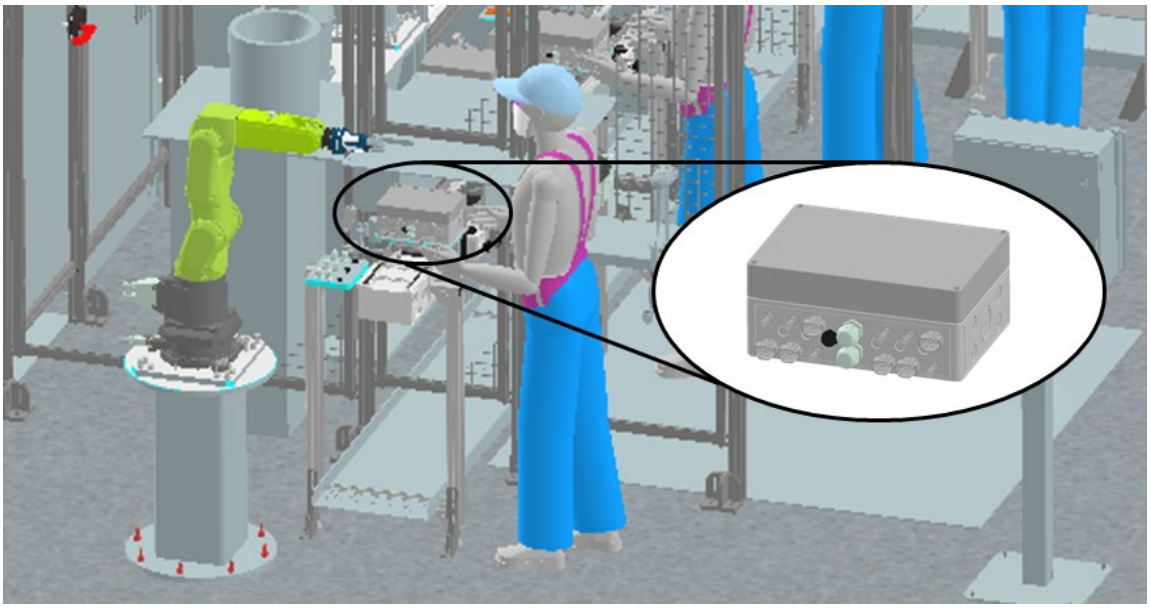


Figure 5: Layout of COssembly station 010 and assembled part

The product used as a demonstrative example is the nut with which the worker fastens a screw (black in the smaller picture) from the inside. In order for the screw to fit well through the nut without being loose, the inner diameter must be 12 (max. + 0.01) Millimeters. This represents the requirement of the product *nut*. The *worker* is the active part, therefore he or she is the resource and *fastening* is the process. If the hole diameter of the nut is too small (e.g. 11.9 Millimeters), this represents the *failure*. If the planner now searches for "nut", "fastening" and "worker" (e.g. with the help of a ready-made tool that can access the plant's data), he or she will find the indication that there has been a problem before and that he or she must pay attention to it when planning. For example, the internal dimension of the nut can be measured more frequently at the supplier's side, so that the probability of getting bad components on the system is minimized. This approach supports internal quality management because failures can now be observed preventively.

4. Evaluation Based on Expert Feedback

4.1 Evaluation Procedure

To ensure the basic practicability of the model, feedback was obtained from experts. The aim of this evaluation was on the one hand to work out possible points of criticism, but also to get suggestions for improvements from the (industry) partners. This was achieved through an adjusted *Why-Not-Analysis*. Figure 6 shows the overall procedure of this evaluation.

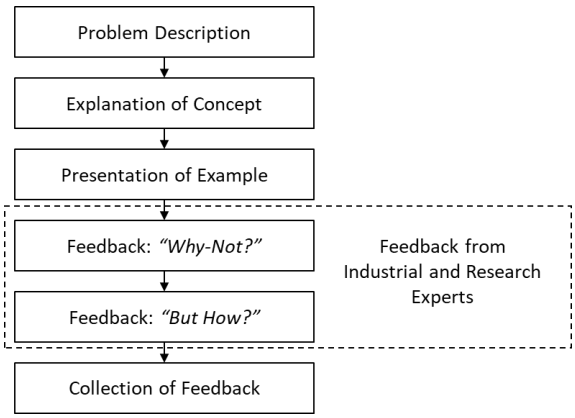


Figure 6: Evaluation Procedure

First, the problem was explained to the partners. In total, 29 people from 14 different organizations were present. Eleven of the organizations are industrial companies, three are research institutions. The experts come from the field of plant engineering, quality management, robotics and information technology. This ensured that a holistic view of the problem would be taken. Afterwards, the basic solution concept was explained and illustrated with an industry-related example. Then, a piece of paper was first distributed, which contained the following sentence: "This concept can never work because …" (*Why-Not?*) Below this, there was blank space so that the experts could give their feedback on why, in their opinion, this data framework is not suitable for practice. Then a second card was distributed, which looked exactly like the first one. Instead of the previous sentence, it now said: "But if the following is adapted, then it will be really good." (*But How?*). Now, the participants could share which aspects need to be considered for further processing. Finally, both cards were collected, and the results evaluated.

4.2 Evaluation Results

The most important challenges, which were mentioned individually by the participants, are summarized below. Immediately after that, in order to establish a direct connection between challenge and improvement, the proposed solutions are shown which were pointed out by the participants.

One of the most frequently mentioned challenges was the high amount of time probably needed. Because of the stressful daily business, entering the information seemed bureaucratic for the participants. Even if the information is important for later tasks, only what is needed for the direct fulfilment of the current task is done ("*People won't do it*!"). Feedback was also given that the information input itself can take a long time. To address these challenges, a simplification of the input, both for the PPR and the failure part, has been proposed. This can be achieved by having a predefined input mask and a standardized workflow in the later software (demonstrator). Best practice would be to get the possibility to use the information entry process within the tools that are used for the tasks anyway, e.g. CAD-Programs for Layout Planning. For the failure part, a suggestion was made that an interface for automatic failure recording in production would be useful so that information is available digitally in advance. If failure classes are defined beforehand, a lot of manual effort could also be reduced here. In the context of knowledge sharing, facilitating data entry plays a particularly important role in the method described in this paper. Only if all participants in the process provide information of a good quality, a retrieval of the right information can take place.

One point that was mentioned several times in the survey was the fact that there are failures where it is difficult to trace them to exactly one process because of different influencing factors. This can also be the case if there is a problematic chain of processes that results in a failure. This fact is especially true for failures with a high level of complexity. Feedback was that in such cases it is good to focus precisely on one root cause. Information on which further factors still exist can be integrated into the failure description as an addition.

The last, more often mentioned challenge concerns the complicated transferability of the information to other circumstances ("*Product, Process and Resource are likely to vary greatly from plant to plant ….*"). In practice, there are (almost) no two identical PPR connections. Reinforced by the individualization trend of products mentioned in chapter 1, each final product, for example, has a very high proportion of individually developed components. To meet this challenge, the idea was mentioned to find a meaningful abstraction or classification system for all necessary individual information. Explicitly, an already existing industrial classification system can be used for this, e.g. eClass for *products* and *resources* (eClass) or DIN 8580 (2022) for *processes*. Figure 7 illustrates an example of how such a classification can look for a nut (hence for the aspect *product*). Each component that is used in a final product can now be specifically assigned to the last classification level. However, retrieval does not have to take place at this hierarchy level, but e.g. at a level above it. In this way, a more general search can be made for similar circumstances.

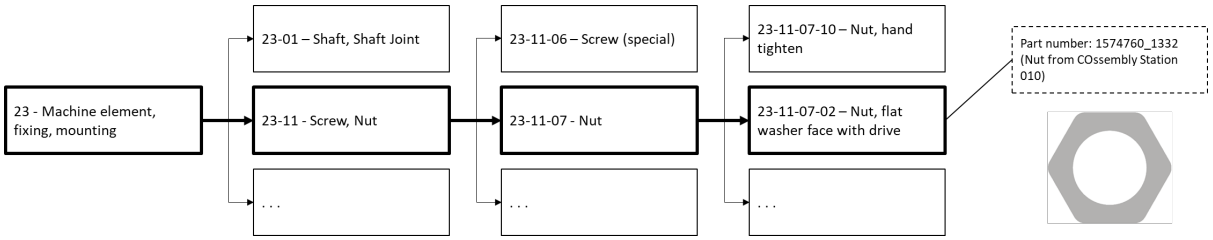


Figure 7: Exemplary Classification for the Used nut Based on eClass

One challenge was not explicitly mentioned by the experts but is very important in this context. The success of the method shown depends on the size of the database, i.e. on the number of failures that have been saved. If there are too few failures in the database, the application is not worthwhile. If there is a large number of failures, the user gets a lot of suggestions, most of which are probably irrelevant for the specific application. The challenge here is to show the user only those failures that are most likely to be relevant to his or her use case. One way of dealing with this was shown by Schröder (2016). There, a current failure was compared with failures that had already occurred using Case-Based Reasoning and similarity algorithms, and similarity measures were calculated. This logic can also be applied to products, processes and resources (at the plant engineering phase), so that in the end only those failures are displayed that have the highest correspondence with the current situation. This ensures that only relevant information is available to the user.

5. Summary and Outlook

This paper showed how a standardized data framework might look so that failures that have occurred in other projects can be accessed already in the early phase of plant engineering. For this purpose, the established PPR model is extended to include the failure component. This addressed the problem that in practice different person are responsible for plant engineering and failure management. The practicality was demonstrated on the one hand by explaining the framework on a real demonstrator. On the other hand, feedback was obtained from practitioners and research partners through an adapted Why-Not-Analysis. It was shown that, basically, the framework is suitable for describing failures in such a way that they can be found again. However, some points have to be considered for the future implementation, which would improve the whole concept and make it more practical.

This real implementation in form of a software demonstrator is the authors' next step. Care has to be taken to ensure that a holistic concept emerges that takes into account all the challenges and suggestions for improvement from chapter 4.2. Based on this demonstrator, the next step is to try out different similarity algorithms to find out which one is best suited for specific use cases. Also, one aspect which will be looked at is how the overall system can support established quality management methods (e.g. FMEA or 8D-Report from chapter 2). The goal is not to create a completely new method, but a support for the end users.

Acknowledgements

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Intelligent Virtual Assistants and New Perspectives of Knowledge Acquisition

Tomasz Eisenbardt
University of Warsaw, Poland

teisenbardt@wz.uw.edu.pl

Abstract: The objective of this article is to present a case of using artificial intelligence to support people from Generation Z in the process of assimilating knowledge. The AI-based tools aimed at improving language competence analyzed in the study included Intelligent Virtual Assistants (IVA): Google Assistant, Siri as well as web translators. The following research procedure was adopted: the experiment included an attempt to learn a foreign language using one of the IVAs or web translators. 251 Polish students decided to participate in the research. After the learning session, respondents completed a knowledge test concerning popular phrases in a given language. The results were related to the individual characteristics of the respondents and analyzed statistically. Interesting overall results were obtained. The data was also analyzed in subgroups, distinguished on the basis of gender, the tool used (web translator, IVAs: Google Assistant, and Siri) as well as the language chosen for learning a foreign language. The analyses were aimed at identifying differences conditioned by the gender of the learner. Another challenge was to identify the most effective tool and to determine which languages are the easiest and most difficult to learn using this method. In many cases, the acquisition of new vocabulary turned out to be very promising. This suggests that people's adoption of such an innovative form of learning is a rather individual matter, varying from person to person. The study is designed to show a new perspective on acquiring knowledge, improving competence and learning in an informal way. In this case, learners use artificial assistants based on artificial intelligence and learning algorithms. This is certainly a controversial issue at present, but it is likely to become a common solution in the near future.

Keywords: Intelligent virtual assistants, Intelligent personal assistants, IVA, IPA, Knowledge acquisition

1. Introduction

The representatives of Generation Z, also called "zoomers" (Dictionary.com), in the Western World are people born between the second half of the 1990s and 2010 (Words We're…, 2021). This generation currently represents a group of individuals entering the labor market. Also, Generation Z representatives use sources of knowledge which seem unconventional or non-obvious, particularly to older generations. It turns out that the young generations are very open to acquiring knowledge based on IT (Hilčenko, 2017). These digital natives, through constant contact with the virtual world and susceptibility to wide cultural changes, gain their own autonomy (Bassiouni, Hackley, 2014). Technologies are their natural environment (Dolot, 2018). On the other hand, accepting new values and understanding new patterns of behavior are very difficult for parents and teachers (Törőcsik, Kehl, Szűcs, 2014). This work has been began with the reference to generation Z, because this generation (and the next) already acquire and will probably acquire knowledge in a very different way than previous generations.

It is evident that members of Generation Z use websites, social networks and mobile applications. However, the topics discussed in this study may be somewhat controversial. The premise lies in the fact that artificial intelligence technologies can be effectively used in the field of education. Specifically, an algorithm integrated with a learning feature could support individuals in acquiring new knowledge. The study formulated a hypothesis: Can modern solutions related to artificial intelligence be used for learning foreign languages? The aim of the article was to verify this hypothesis. To verify it, an experiment was carried out, involving a brief attempt to learn words from foreign languages with the use of intelligent virtual assistants and web translators.

2. Literature Background

2.1 AI From a Historical Perspective

Artificial intelligence (AI) has its origins in the literary fiction of authors from the 18th, 19th and 20th centuries such as Mary Shelley (author of the novel about Frankenstein) and Karel Čapek (creator of the "robot" term). Later characters appeared such as: Tin Man from the Wizard of Oz and the humanoid robot that impersonated Maria in Metropolis. In the 20th century, however, artificial intelligence has become our reality.

In 1950, Alan Mathison Turing proposed that the possibility of pretending to be a human in a remote conversation should be considered a test of the intelligence of machines. This test was called the Turing test (Turing, 1950). And thus the story of Artificial Intelligence (AI) began. Here are its next milestones - see Table 1.

Table 1: The History of AI

Year	Event
1950	The Turing test idea
1956	The term "artificial intelligence" appears at the conference in Dartmouth
1966	Chatbot ELIZA can talk with the user, imitating a human.
1970	MYCIN analyzes blood disorders and suggests treatment methods.
1971	The first Standford Cart autonomous vehicle is built at Stanford University
1982	Dragon Systems enterprise is starting work on the first speech recognition system for commercial applications.
1993	The robot Polly shows visitors around the 7th floor of the MIT Building and communicates with visitors.
1997	RoboCup - 38 teams take part in the first world championship in robot football.
1997	The Deep Blue supercomputer defeats Garry Kasparov in a six-round chess match.
1998	40 million eared Furby robots are brought to Christmas trees. Plush animals learn English over time.
2009	The Wolfram Alpha search engine developed by Stephen Wolfram's team is the first semantic search engine
2011	IBM's Watson supercomputer beats the then champions in the "Jeopardy" game show, Siri (Apple) appears.
2012	Google's autonomous car is approved for traffic in the US state of Nevada.
2013	The Anki start-up presents models of autonomously controlled cars via an iPhone application, simulating the behavior of real rally drivers
2014	Chatbot Eugene Goostman - some regard as having passed the Turing test, Cortana (Microsoft) and Alexa (Amazon) release
2015	Google DeepMind's AlphaGo, a computer program that plays the board game Go, defeated various (human) champions
2016	Sophia – a humanoid robot from Hanson Robotics, the Google Home release and Google Assistant release
2018	The first version of GPT, which stands for Generative Pre-Trained Transformer was released, which is the basis of the chat bot Chat GPT

Source: own study based on (Anyoha, 2017; Artificial Intelligence, 2011; Historia sztucznej inteligencji 2013; History and Future…, 2023; Introducing Czat GPT; Reynoso, 2021; Tate, Lewis, 2014)

2.2 AI Currently

The ubiquity of artificial intelligence applications is becoming more and more real. In 2022, using car navigation, autonomous vacuum cleaners, language translators, and searching for friends on social media are completely natural activities. These digital activities have long ceased to be exclusive to individuals from the scientific community or enthusiasts of technological innovations. All these activities (and many others) are supported by the use of artificial intelligence algorithms.

As a result, a person unfamiliar with the city can now navigate it effortlessly, the apartment is automatically cleaned during our absence, a person with no prior knowledge of a foreign language is able to read the text written in it, and a long-lost friend reappears on our contact list. And this is only a small part of the possibilities created by today's artificial intelligence.

2.3 AI and Learning

AI can be used in the learning process as well (Druga et al., 2019; Renzella, Cain, Schneider, 2022). This means that individuals can learn on their own using AI tools (Ng et al., 2022). Zhou (2020) presented an example of how AI can serve as a language-learning tool. His research was primarily focused on developing an AI-based self-learning platform tailored for college-level English listening, aiming to improve students' daily self-learning

efficiency. Shu and Gu (2023) conducted an experiment in which they created a smart education model enabled by the Edu-Metaverse. They utilized the latest AI technologies and focused on teaching college English to 60 students to achieve better learning outcomes. The results showed that students who engaged in smart education using the AI-related model achieved higher scores in oral English, vocabulary and grammar, reading comprehension, English-to-Chinese translation, and writing than those who received traditional instruction (Shu and Gu, 2023).

It is worth noting that while several studies have examined the use of intelligent personal assistants for English as a foreign language learning, no study has investigated their application in the context of a non-English foreign language, as mentioned by Dizzon et al. (2022).

Recent research has indicated that the most popular AI tools for language learning purposes are web translators like Google and ChatGPT (Haleem et al., 2022; Shaji George and Hovan George, 2023).

2.4 Web Translators Versus IVAs – Intelligent Virtual Assistants

Intelligent Virtual Agents (IVAs), also known as Intelligent Personal Assistants (IPAs), gain a special place among the practical applications of artificial intelligence. Examples of such products include Google Assistant[1], Siri (Apple) [2], Cortana (Microsoft)[3], Alexa (Amazon)[4] and S Voice (Samsung). It is worth mentioning that, Google Assistant is indicated as more effective than its competitors and its predecessor: Google Now (Hachman, 2016; Koetsier, 2018; Google Assistant Beats…, 2019).

This paper examines the process of using intelligent assistants in improving competence and acquiring knowledge. The usefulness of the IVAs in terms of building language competence was compared with the application of popular online translators.

3. Research Methodology

The following research procedure was adopted: the experiment involved an attempt to learn a foreign language using one of the IVAs or web translators. Study participants were free to choose the tool they wanted to use. In fact, their choice was dictated by what was available to them at the moment. The participants were also asked to choose a foreign language, but the assumption was that it could not be a language they are already familiar with. Before learning, the participants of the study completed a pre-test, checking their initial knowledge. 255 Polish students decided to participate in the research process. After the learning session, respondents completed a knowledge test covering popular phrases in a given language.

3.1 Research Procedure

1. Respondents participating in the study were asked to choose the language. The language could not be their mother tongue or a language they had ever learned. Nor could it be the language of the country in which they stayed for more than a day as well. It could not have been English because students typically learn this language as part of the standard curriculum in Polish schools.
2. Respondents participating in the study were asked to choose a tool based on artificial intelligence. The tool of choice was IVAs: Google Assistant, Siri - operated from the phone or a web language translator (such as Google Translator) - operated by a personal computer/laptop.
3. Respondents joined the pretest, which aimed to verify whether the chosen language was indeed unfamiliar to them.
4. Then, respondents learned 20 selected phrases in a language they did not know. It took 20 minutes.
5. After the learning phase, respondents took the final test. The test checked how many phrases they managed to learn after 20 minutes of learning. The results were referred to the detailed information included in the survey questionnaire.
6. The results were related to the individual characteristics of the study participants and analyzed statistically.

During the analysis, an examination was conducted to determine the potential relationship between the results of the final test (i.e., the number of newly learned phrases retained) and variables such as the gender of the

[1] https://assistant.google.com/

[2] https://www.apple.com/siri/

[3] https://support.microsoft.com/en-us/topic/what-is-cortana-953e648d-5668-e017-1341-7f26f7d0f825

[4] https://apps.apple.com/us/app/amazon-alexa/id944011620

respondents, the specific learning tool used, and the selected foreign language. The obtained results were analyzed statistically. Descriptive statistics and calculations were used: minimum, maximum, arithmetic average and median. The obtained results were verified for statistical significance using the ANOVA ranks of the Kruskal-Wallis test and Mann-Whitney's U test.

3.2 Research Goal and Questions

The study formulated a hypothesis: Can modern solutions related to artificial intelligence be used for learning foreign languages? The aim of the article was to verify this hypothesis. In this particular case, the technologies included intelligent virtual assistants and online translators.

The following research questions were also posed:

- does gender have an impact on the final test result?
- does the choice of language determine the outcome?
- does the tool affect the result?

In order to achieve the intended goal and answer the questions asked, a statistical analysis was carried out.

4. Results

The study group was rather homogeneous, it consisted of 255 students, representatives of Generation Z (the majority of respondents were aged 19-22). Four questionnaires were rejected due to their incompleteness. Finally, 251 questionnaires were analyzed. The overall results are shown in Table 2. In the next step, data was analyzed according to :

- gender (Table 3),
- criterion of the selected language (Table 4),
- two groups of respondents: those who used IVAs in the study, and who used web applications for translating texts.

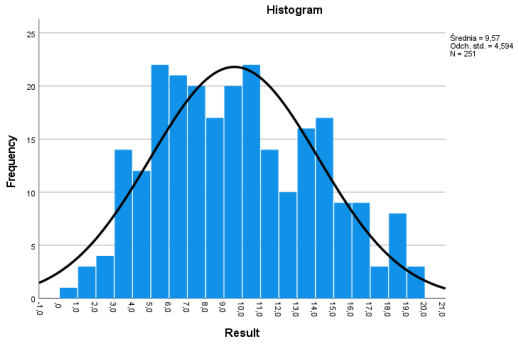
Table 2: Increase in the Number of Words Remembered for Whole Group

	Increase in the number of words remembered
scope (minimum-maximum)	From 0.5 to 20
average	9.6
median	9.0

Source: own study

4.1 General Observations

The maximum possible score to be achieved was 20, which was attained in individual cases. Conversely, the lowest score observed was one misspelled word. In the case of small errors in the answer, 0.5 points were awarded - hence the fractional results. The quantitative dispersion of the results is presented in the histogram (Fig. 1).



Source: Own study

Figure: 1. Histogram

4.2 Analysis of the Obtained Results Divided by Gender

Hypotheses:

H0: there are no statistically significant differences between men and women

H1: there are statistically significant differences between men and women

Table 3: Increase in the Number of Words Remembered According to the Gender Criterion

	number of respondents	minimum	maximum	average	median
female	144	2	20	9.9	10
male	107	0.5	20	9.1	8.5

Source: Own study

The author decided to use non-parametric tests for two independent samples (men and women). Mann-Whitney's U test did not show statistically significant differences between men and women in terms of the variables studied (asymptotic significance was 0.114). Thus, the H1 hypothesis was rejected and H0 was confirmed

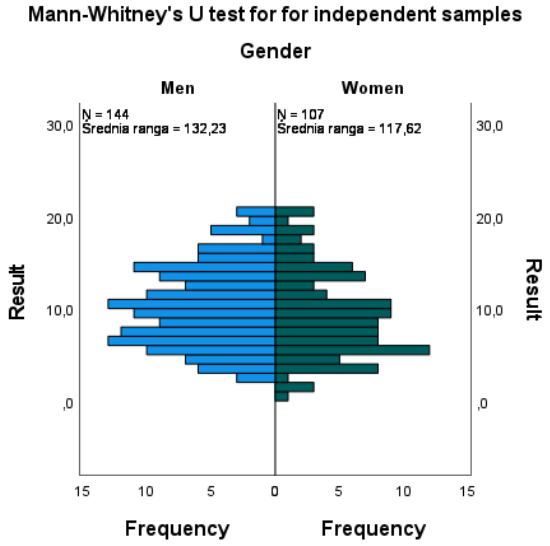


Figure 2: Mann-Whitney's U Sample Test for Independent Samples – Results Divided Into Genders

4.3 Analysis of the obtained results - the choice of the foreign language

Hypotheses:

H0: There are no statistically significant differences between results for different languages

H1: There are statistically significant differences between languages

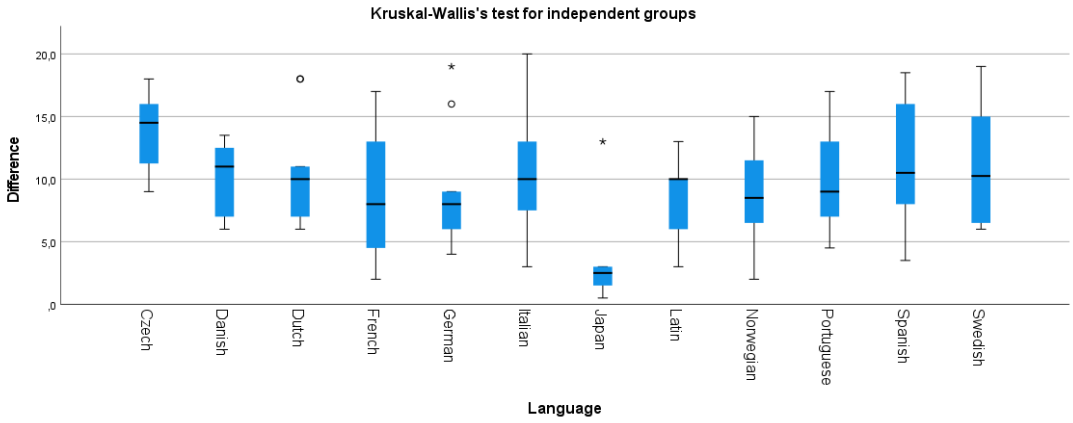
Differences were investigated using the Kruskal-Wallis ANOVA statistical test. Statistically significant differences have occurred ($p = 0.014$, i.e. $p < 0.05$). So the H0 hypothesis was rejected and H1 was confirmed.

Table 4: Increase in the Number of Words Remembered According to the Preferred Language

	number of respondents	minimum	maximum	average	median
Czech	8	9.0	18.0	13.8	14.50
Spanish	31	3.5	18.5	11.5	10.50
Swedish	14	6.0	19.0	11.0	10.25

	number of respondents	minimum	maximum	average	median
Dutch	9	6.0	18.0	10.8	10.00
Italian	45	3.0	20.0	10.4	10.00
Danish	5	6.0	13.5	10.0	11.00
Portuguese	13	4.5	17.0	9.7	9.00
German	9	4.0	19.0	9.2	8.00
Norwegian	18	2.0	15.0	8.8	8.50
French	38	2.0	17.0	8.6	8.00
Latin	5	3.0	13.0	8.4	10.00
Japan	5	0.5	13.0	4.1	2.50

Source: Own study



Source: Own study

Figure 3: Differences Between Languages

4.4 Analysis of the Obtained Results According to the Tools Used

Hypotheses:

H0: There are no statistically significant differences between learners using different tools

H1: there are statistically significant differences between learners using different tools

Table 5: Increase in the Number of Words Remembered Depending on the Tool

	number of respondents	minimum	maximum	average	median
Web translators	179	0.5	20	9.0	9.0
Google Translator	54	1.0	20	9.5	9.0
Siri	18	3.0	16	8.2	7.0
IVAs generally (Google Assistant & Siri)	72	1.0	20	9.2	9.0

Source: Own study

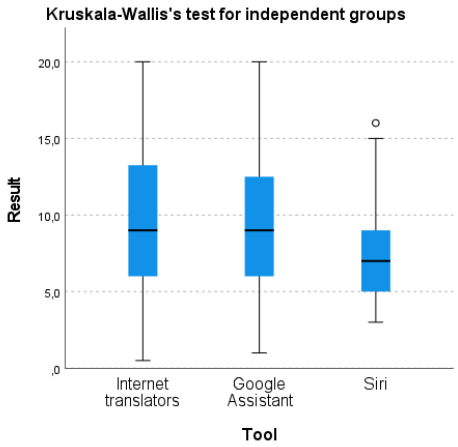


Figure 4: Differences Between Tools

Differences were investigated using the Kruskal-Wallis ANOVA test. There were no statistically significant differences found (asymptotic significance was 0.365). So, the H1 hypothesis was rejected and H0 was confirmed.

5. Discussion

The benefits of using artificial intelligence algorithms are undisputed. But there are many indications that people should be particularly careful in manipulating artificial intelligence. Not only Stephen Hawking pointed to AI as a threat that can destroy humanity. There were many outstanding minds who shared this opinion. This subject was also discussed by Antonio A. A. Casilli even referring directly to the IVA (*Casilli, 2019*). Examples of unsettling potential occurrences associated with artificial intelligence may include:

- agent becoming uncontrollable,
- autonomous military drones protested by many famous people, in 2015 Elon Musk, Stephen Hawking, and Steve Wozniak among 3.000 others signed an open letter banning the development and use of autonomous military weapons (Reynoso, 2021).
- an agent who created his own English language.

Perhaps the technological singularity - a hypothetical point in the future development of civilization, in which technological progress will become so rapid that all human predictions will become obsolete (Vernor, 1993) - will be achieved precisely through the development of AI.

Against the background of the above considerations, the proposition to employ artificial intelligence in the educational process is, on one hand, highly enticing, but on the other hand, it appears to be contentious, and perhaps even unsettling. In the context of the use of IVA, there is discourse surrounding the concept of the so-called “intellectual bubble”: fake news may be amplified and the phenomenon of an "echo chamber" may arise. Artificial intelligence has the potential to confine individuals within a very limited world of information by personalizing and filtering information in such a way that much information will not be available to the user at all.

However, there is no doubt that education will change radically in the coming years and this trend is prominently reflected in the extensive literature on the subject. The role of the teacher will be quite different from what we have been used to since ancient times. The teacher will not be the source of knowledge, but the one who uses the knowledge, and will not be the judge and oracle, but the one who can ask questions. The modern teacher will teach us exactly the same skills: searching for knowledge and asking questions. Should be the teacher replaced by AI and how perilous is this idea? This should be taken seriously into consideration.

6. Conclusions

The aim of the study was to check whether technologies based on artificial intelligence are useful in learning. In this particular case, the study concerned learning a foreign language and using web translators and intelligent virtual assistants. The considerations lead to an affirmative response in support of the research hypothesis. The

hypothesis: can modern solutions related to artificial intelligence be used for learning foreign languages has been confirmed, with the reservation that the efficiency of using AI in such a context may vary.

The results were diversified. The number of new words acquired in 20 minutes ranged from 1 to 20 (out of 20 possible). Descriptive statistics showed some differences in the results depending on gender, the tool used, and the language chosen by the study participants.

Women had slightly better results. The language translator turned out to be the most effective tool, but Google Assistant was not far behind it. However, in-depth statistical tests showed no statistical differences. However, such differences appeared in the case of selected languages.

European (Czech, Spanish and so on) languages turned out to be the easiest to assimilate with regard to the proposed method of quick learning. In many cases. the increase in knowledge of new words turned out to be very promising. This suggests that people's adoption of such an innovative form of learning is a rather individual matter.

6.1 Research Contribution

The study is designed to show a new perspective on acquiring knowledge, expanding competence and learning in an informal way. In this case, learners use artificial assistants based on artificial intelligence and incorporate learning algorithms. This is certainly a controversial issue at present, but it is likely to become a common solution in the near future.

So far, the research results described have predominantly focused on the study of the English language. This study involves learning languages other than English.

6.2 Limitations and Implications

The study involved students. The majority of the respondents, falling within the age range of 19 to 22, belonged to Generation Z. Also, it should be noted that the sample was predominantly Polish. So, they mostly speak Polish, i.e. a language from the group of Slavic languages.

It should be taken into account that the quality of translations offered by the presented tool. i.e. Google Translator, Google Assistant and Siri is improving. This affects the test results. The obtained results apply to the state of development of these tools at the turn of 2022 and 2023.

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The Impact of Knowledge and Experience on Opinion Formation: The Case of Cryptocurrencies

Monika Eisenbardt[1] and Tomasz Eisenbardt[2]
[1]University of Economics in Katowice, Poland
[2]University of Warsaw, Poland

monika.eisenbardt@ue.katowice.pl
teisenbardt@wz.uw.edu.pl

Abstract: The aim of this paper was to investigate the influence of knowledge and experience in a specific domain on the formation of opinions regarding a particular issue. The research focused on cryptocurrencies, chosen due to their relatively new and unexplored nature in terms of opinion formation. A survey questionnaire was used to collect data from 778 university students, which were then analyzed using the SmartPLS package. The survey was conducted in Poland, a country where cryptocurrencies are treated relatively neutrally, not being banned but also not widely accepted as a means of payment. The main research question addressed whether previously acquired knowledge and experience with cryptocurrencies impact opinion formation. Four latent variables were examined: Experience, Perceived Benefits, Perceived Disadvantages, and Opinion Formation. The findings reveal that Experience has the strongest influence on Opinion Formation, followed by Perceived Benefits, which has a positive effect, and Perceived Disadvantages, which has a negative effect. Therefore, the hypotheses were supported, indicating a positive association between Perceived Benefits and Opinion Formation (H1), as well as between respondents' Experience with cryptocurrencies and Opinion Formation (H3). Additionally, H2 was supported, indicating a negative association between Perceived Disadvantages and Opinion Formation. Our research results enrich the literature, particularly in the field of interdisciplinary approaches to cryptocurrencies, knowledge, and experience.

Keywords: Experience with cryptocurrencies, Knowledge, Perceived benefits, Perceived disadvantages, Cryptocurrencies, Opinion formation

1. Introduction

An opinion is a belief, judgment, or view expressed by an individual or a group of people regarding a particular matter. Opinions can be rooted in scientific facts and evidence or be subjective in nature. They are influenced by beliefs, values, experiences, and emotions (Paul, 2007). Opinions play a crucial role in shaping our attitudes and behaviors. In fact, opinions are sometimes regarded as synonymous with attitudes (Oskamp & Schultz, 2014). They are formed through a combination of personal beliefs, trust in something, knowledge, personal experiences, and individual interpretation of facts.

Opinions may be supported by arguments or expressed without any substantial basis (Festinger, 1957). They can be shaped by a person's knowledge, experience, or direct involvement in the subject matter being discussed. Opinions that are grounded in logical reasoning and personal experience tend to be closer to the truth and therefore hold more value. However, a separate issue not addressed in this paper is the credibility and substantive value of opinions. Participation in a matter can sometimes be superficial or limited, and the emotions associated with it may differ significantly from those of other individuals (Rapanos, 2023). Opinions can be influenced by emotions and, as a result, may be biased. Furthermore, opinions are subject to change over time, influenced by mood, recent experiences, and various other factors that shape one's perception of reality. Often, opinions are influenced by the views of others, particularly when those individuals are part of our social environment or are perceived as trustworthy or likable (Lee, Yang, & Kim, 2022).

The formation and consolidation of our opinions can be influenced by both rational and irrational factors. Opinions can be shaped through extensive studies, deep knowledge of the subject, practical experience, and personal engagement. While they often involve intuition, the connection between opinions and knowledge/experience may not always be obvious. However, opinions can also be swayed by prejudice, faith, personal biases, and even superstition (Berthet, 2022; Kuppens et al., 2023).

This paper addresses the issue of forming opinions based on experience and perceived advantages and disadvantages. The survey specifically focuses on people's opinions regarding a relatively new, controversial, and ambiguous topic: cryptocurrencies. Respondents were asked about their experience with cryptocurrencies, as well as their perceived benefits and disadvantages associated with their use as a means of payment. The primary objective of this paper is to investigate the impact of previously acquired knowledge and experience on

opinion formation. Additionally, it aims to examine whether perceived benefits and perceived disadvantages influence the formation of opinions.

Numerous papers have been published on cryptocurrencies, with many authors focusing on economic aspects such as national regulations, taxation, and monetary policies (Benigno et al., 2022; Marthinsen & Gordon, 2022; Raza et al., 2023). While some authors examine the domestic approach, their focus is primarily limited to economic matters (Alvarez et al., 2022; Cifuentes, 2019; Li et al., 2023). Many papers concentrate solely on Bitcoin, as it is the most widely recognized cryptocurrency (Alvarez et al., 2022; Köchling et al., 2020; Mzoughi et al., 2022; Nouir & Hamida, 2023). In contrast, our paper adopts an interdisciplinary approach to cryptocurrencies, treating them as a complex phenomenon rather than merely an economic variable. Specifically, we provide a concise overview of cryptocurrencies, which serves as the foundation for our empirical research on the impact of experience, perceived benefits, and perceived disadvantages on opinion formation. The study incorporates in-depth analysis, considering respondents' personal experiences and opinions regarding cryptocurrencies.

The paper is organized as follows: the research questions and hypothesis are followed by the research methodology; then results, analysis, and discussion are provided. The paper concludes with a summary, limitations, and avenues for future research.

2. Literature Review

The inception of cryptocurrencies is closely tied to the creation of the first cryptocurrency, Bitcoin (BTC), in late 2008 and early 2009 (Nakamoto, 2009). The trading of cryptocurrencies, which serve as digital substitutes for traditional money, relies on various technologies such as the Distributed Ledger concept, Blockchain technology, cryptography, and peer-to-peer networks. The number of cryptocurrencies has experienced exponential growth, and the cryptocurrency market has become too significant to be ignored (CoinMarketCap, 2023; Phillips & Graves, 2021).

The volume of literature on cryptocurrencies is extensive. Numerous authors discuss the benefits and disadvantages of cryptocurrencies, as summarized in Table 1. The review includes publications within the past eight years.

Table 1: The Benefits and Disadvantages of Cryptocurrencies

Benefits	Sources	Disadvantages	Sources
Decentralization: [B1 DEC, B3 NI] Where: NI-No Issuer	(Chenguel, 2021; Lee, 2019; Narayanan et al. 2016; Kopańko & Kozłowski, 2015; Bala, Kopuściański, & Srokosz, 2016)	Volatility and risk management: [D4 VOL]	(Almeida & Cruz Gonçalves, 2022; Al Guindy, 2021; Peng et al. 2018; Baur, Dirk, & Dimpfl, 2018; Klein et al. 2018; Katsiampa, 2017)
Lower transaction Fees: [B2 LTF]	(Frankenfield, 2023; Tambe & Jain 2023; Hileman & Rauchs, 2017)	Lack of Regulation: [D2 LGAP]	(Chenguel, 2021; Lee, 2019; Kopańko & Kozłowski, 2015; Bala, Kopuściański, & Srokosz, 2016, Song, Chen, & Wang, 2023; Kim et al. 2022, Dordal, 2018; Hardy & Norgaard, 2016 Böhme et al. 2015)
Security	(Thul, 2021; Zimprich, 2019; Lewis, 2018; Narayanan et al. 2016; Burniske, & Tatar, 2017; Bonneau et al. 2016; Vigna & Casey, 2015)	Security risks: [D5-SECU, D3-LOSS]	(Weichbroth et al. 2023; Yu et al. 2022; Zaghloul et al. 2020; Zimprich, 2019)
Privacy and anonymity: [B4 PRI]	(Lewis, 2018; Antonopoulos, 2017; Burniske & Tatar, 2017; Vigna & Casey, 2015; Kopańko & Kozłowski, 2015; Bala, Kopuściański, & Srokosz, 2016)	Environmental impact: [D1 ENV]	(De Vries, 2018; Hileman & Rauchs, 2017; Peck, 2017; Stoll, Klaaßen, & Gallersdörfer, 2019; Wendl, Doan, & Sassen, 2023; Vranken, 2017)

Benefits	Sources	Disadvantages	Sources
Fast Transactions	(Frankenfield, 2023; Tambe & Jain 2023; Hileman & Rauchs, 2017)	Limited Acceptance	(Bajpai, 2023; Eisenbardt & Eisenbardt, 2023; LLC, 2021)

Note: The abbreviations given in [ ] correspond to the model below (see Figure 2). The table includes additional benefits and disadvantages compared to what is displayed in the model. This is because some variables were found to be statistically insignificant ($p>0.05$) and were therefore excluded from the model.

Source: Own elaboration based on the literature sources provided.

Cryptocurrencies represent an interdisciplinary, relatively new, and rapidly evolving field. The problem of identifying the creator of BTC, the lack of an emitter, volatility, complexity and legal complexities stand in opposition to the undoubted benefits, among which the free, anonymous and rapid flow of capital can be mentioned. Notably, there have been significant cases of cryptocurrencies being used for illicit purposes, such as the Silk Road case. Moreover, the environmental impact of cryptocurrencies is a concern due to the increasing energy intensity of mining activities. The significant slump in the cryptocurrency market in 2022 serves as a reminder of the risks associated with investing in cryptocurrencies (CoinMarketCap, 2023).

Nevertheless, the pros and cons of cryptocurrencies appear to be balanced. Does this mean that opinions on this subject are divided or perhaps more sustainable? Can the assessment of cryptocurrencies be influenced by knowledge about them, involvement in cryptocurrency trading, participation in cryptocurrency mining, or access to a cryptocurrency wallet? These activities can indicate experience, and it is undeniable that knowledge and experience shape opinions. Variables related to knowledge and experience were compared with variables indicating respondents' attitudes towards the benefits and disadvantages of cryptocurrencies. All of these variables influence the opinions of respondents in the realm of cryptocurrencies.

3. Research Methodology

3.1 Research Purpose, Questions, and Hypotheses

The aim of this paper is to explore how knowledge and experience in a specific domain can shape opinions on particular issues. Cryptocurrencies were chosen as the research subject due to their relatively new and unexplored nature in terms of opinion formation. The research question is as follows:

(1) Does previously acquired knowledge and experience with cryptocurrencies impact the formation of opinions about them?

The following hypotheses has been developed:

H1: Perceived Benefits of cryptocurrencies are positively associated with the formation of opinions about them.

H2: Perceived Disadvantages of cryptocurrencies are negatively associated with the formation of opinions about them.

H3: Experience with cryptocurrencies is positively associated with the formation of opinions about them.

Based on the literature review and our previous research experience on cryptocurrencies, a conceptual framework was developed and is presented in Figure 1. The framework includes four latent variables: Experience, Perceived Benefits, Perceived Disadvantages, and Opinion Formation. Additionally, it depicts the associations between these latent variables.

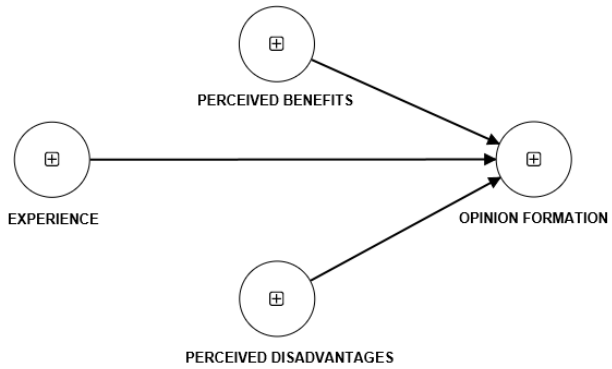


Figure 1: The Conceptual Framework

Research procedure

To address the primary research problems, answer research question, and verify formulated hypotheses, a quantitative research strategy was employed, wherein a questionnaire survey was administered. The research process comprised the following stages:

Initially, a preliminary survey questionnaire was developed to gather the opinions of students about cryptocurrencies, which included the queries about their prior experience with cryptocurrencies. The questions were constructed using a 5-points Likert scale, providing students with a list of options to choose from. In October 2021, the pilot survey was conducted, and the questionnaire underwent both substantive and methodological evaluations. Following this, the survey questionnaire was distributed online using LimeSurvey online platform, and data collection was conducted between November 2021 and February 2022. The sampling frame was deliberately restricted to university students, and the survey was conducted in two distinct university settings situated in different regions of Poland, i.e. the University of Warsaw, situated in the central region of Poland and the University of Economics in Katowice, located in the southern and most industrial region of Poland – Silesia. After screening the responses and eliminating outliers, a total of 778 accurate, complete, and valid questionnaires were obtained as the final research sample. The sample is presented in Table 2.

Table 2: Demographics of the Research Sample

Variable	Categories	Number of respondents	Percentage
University	University of Warsaw	382	49.1%
	University of Economics in Katowice	396	50.9%
Gender	females	413	53.1%
	males	365	46.9%
Age/ generation	X: 1965-1979	32	4.1%
	Y: 1980-1994	58	7.5%
	Z: 1995-2009	679	87.3%
Level of education	higher education	279	35.9%
	secondary education	499	64.1%

Source: Own elaboration.

The data were analyzed using SmartPLS package. The SmartPLS was used for estimating path models with latent variables and their relationships as well as to test hypotheses.

4. Results

4.1 Operationalization of Latent Variables

As depicted in Figure 1, the conceptual model comprises four latent variables, each of which is multifaceted and cannot be measured through a single observed variable. Therefore, we employed multiple observed items to

measure each latent variable within the conceptual model. The selection of specific items was based on the literature review. Table 3 presents the measurement items along with their corresponding latent variables.

Table 3: Measurement Items and Their Reliability

Constructs and their respective items	Factor loadings
Perceived Benefits (alpha: 0.63, CR: 0.78)	
[B1 DEC] - Decentralization	0.780
[B2 LTF] - Lower Transaction Fees	0.485
[B3 NI] - No Issuer	0.727
[B4 PRI] - Privacy	0.720
Perceived Disadvantages (alpha: 0.73, CR: 0.81)	
[D1 ENV] - Environmental Impact	0.548
[D2 LGAP] - Legislation gap	0.671
[D3 LOSS] - Potential loss	0.702
[D4 VOL] - Volatility	0.767
[D5 SECU] - Security Risks	0.720
Experience (alpha: 0.78, CR: 0.85)	
[E-min] - Experience in cryptocurrencies mining	0.571
[Ex-g] - General experience with cryptocurrencies	0.848
[Ex-t] - Experience in cryptocurrencies transactions	0.712
[Ex-w] - Experience in cryptocurrency wallets	0.888
Opinions Formation (alpha: 0.45, CR: 0.87)	
[Opi-EAG] - I am eager to perform activities aimed at cryptocurrencies	0.906
[Opi-REP] - In my view, cryptocurrencies have the potential to replace national currencies	0.668

Note: Loadings above 0.708 are recommended, as they indicate that the construct explains more than 50 per cent of the indicator's variance, thus providing acceptable item reliability (Hair et al., 2019). Alpha represents value of Cronbach's alpha, and CR represents composite reliability. As our research has partially exploratory nature and following Haier at al. (2019), reliability for exploratory research should be a minimum of 0.60, while reliability for research that depends on established measures should be 0.70 or higher.

The next step of the reflective measurement model assessment addresses the convergent validity of each construct measure. Convergent validity is the extent to which the construct converges to explain the variance of its items. The metric used is the average variance extracted (AVE) for all items on each construct. The AVE results vary from 0.5 to 0.63 and, thus, meet an acceptable AVE range that is 0.50 or higher, indicating that the constructs explain at least 50 per cent of the variance of its items (Sarstedt et al., 2022).

Discriminant validity was ensured by examining the cross-loadings of the indicators and applying the Fornell-Larcker criterion (see Table 4). Fornell and Larcker (1981) proposed that the Average Variance Extracted (AVE) of each construct should be compared to the squared inter-construct correlation, which represents the shared variance between that construct and all other reflectively measured constructs in the structural model. It is important to ensure that the shared variance among all model constructs is not greater than their respective AVEs.

Table 4: Fornell and Larcker Criterion

	PERCEIVED BENEFITS	PERCEIVED DISADVANTAGES	EXPERIENCE	OPINION FORMATION
PERCEIVED BENEFITS	0.687			
PERCEIVED DISADVANTAGES	0.027	0.686		
EXPERIENCE	0.274	-0.114	0.765	
OPINION FORMATION	0.335	-0.111	0.398	0.796

4.2 Structural Model

Figure 2 displays the structural model, indicating the beta values of all coefficients and the adjusted R2 for the dependent variables. The results regarding the estimated adequacy of the model are presented in Table 5.

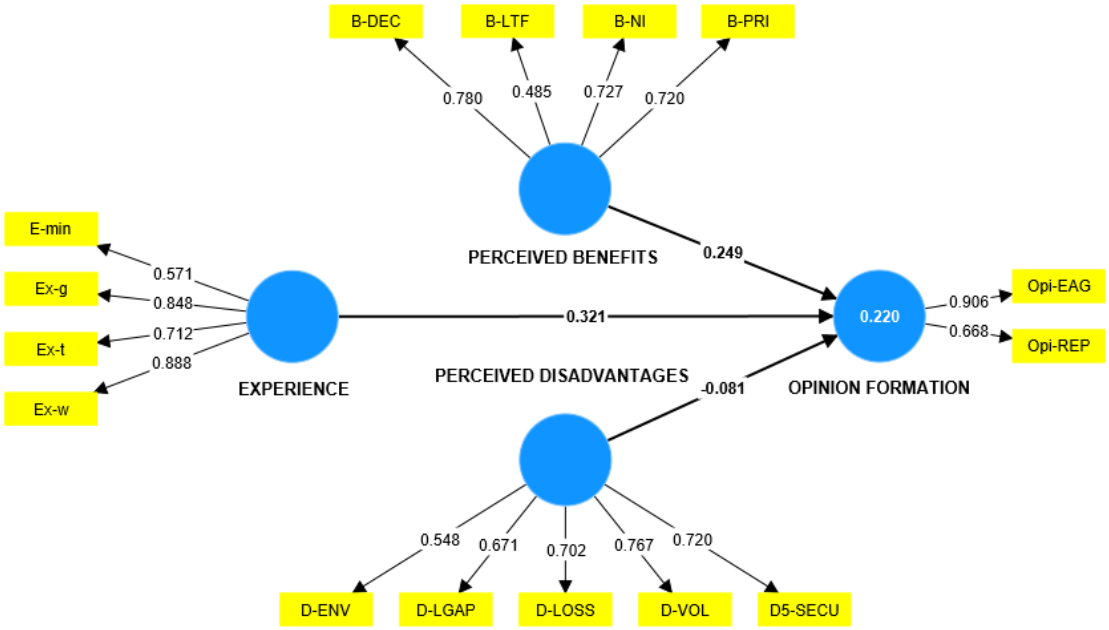


Figure 2: Structural Model

Figure 2 shows the PLS-SEM results. The numbers on the path relationships represent the standardized regression coefficients while the number displayed in the circle of the endogenous latent variable is the R2 value. An initial assessment shows that EXPERIENCE has the strongest effect (0.321) on OPINION FORMATION, followed by PERCEIVED BENEFITS (0.249) and PERCEIVED DISADVANTAGES (-0.081) for which the negative effect is displayed. These three constructs explain 22% (i.e., the R2 value) of the variance of the endogenous construct OPINION FORMATION.

Table 5: Model fit

	R-square	R-square adjusted
OPINION FORMATION	0.220	0.217
	Saturated model	**Estimated model**
SRMR	0.083	0.083
d_ULS	0.825	0.825
d_G	0.187	0.187
Chi-square	867.077	867.077
NFI	0.652	0.652

4.3 Hypotheses Testing – Bootstrapping

To test hypothesis *H1, H2, and H3* and answer *RQ1*, the Bootstrapping procedure was used. The process of bootstrapping is a non-parametric method utilized by PLS-SEM. It involves generating multiple artificial samples from the initial data using a significance level of 5%, as explained by Hair et al. (2011). In this particular study, a subset of 5,000 interactions was utilized to compute the t-values that evaluate the impact of the hypotheses relationships to be examined. The hypothesis is considered to have statistically significant results if the t-value is greater than 1.96 and the p-value is less than 0.5. The findings from the bootstrapping analysis, conducted with a 95% confidence level, including the mean, standard deviation, t-values, and p-values, are presented in Table 6.

Table 6: Hypotheses Testing

Hypothesis	Relationship	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	t Statistics (|O/STDEV|)	P Values	Decision
H1	PERCEIVED BENEFITS -> OPINION FORMATION	0.249	0.252	0.034	7.308	0.000	Supported
H2	PERCEIVED DISADVANTAGES -> OPINION FORMATION	-0.081	-0.091	0.032	2.502	0.012	Supported
H3	EXPERIENCE -> OPINION FORMATION	0.321	0.320	0.034	9.372	0.000	Supported

Table 6 presents the results, supporting all three hypotheses. H1 and H3 are supported, indicating a positive association between Perceived Benefits and Opinion Formation, as well as between respondents' Experience with cryptocurrencies and Opinion Formation. Additionally, H2 is supported, suggesting a negative association between Perceived Disadvantages and Opinion Formation.

5. Discussion and Conclusions

5.1 Research Contribution

Cryptocurrencies can be regarded as both technological and financial innovations (Kumar, 2018; Morewedge, 2021). Thus, this paper focuses on cryptocurrencies as a relatively new domain in which individuals can shape their opinions based on their experiences and the potential benefits and disadvantages.

This paper contributes to existing research on the impact of knowledge and experience on opinion formation by:

- Investigating the relationships among the analyzed constructs from the perspective of experience and knowledge within the context of cryptocurrencies.
- Exploring the association between Perceived Benefits of cryptocurrencies and opinion formation.
- Examining the link between Perceived Disadvantages of cryptocurrencies and opinion formation.
- Investigating the relationship between Experience with cryptocurrencies and opinion formation.

This study confirms that both the Perceived Benefits (path coefficient = 0.249, p-value > 0.05, t-value > 1.96) and Experience (path coefficient = 0.321, p-value > 0.05, t-value > 1.96) have a positive influence on Opinion Formation regarding cryptocurrencies. The study also confirms that the Perceived Disadvantages (path coefficient = -0.081, p-value > 0.05, t-value > 1.96) have a negative influence on Opinion Formation.

According to the results obtained and supported by studies conducted by Rapanos (2023), Lee, Yang, & Kim (2022), Berthet (2022), and Kuppens et al. (2023), individuals' experiences can influence how they form their own opinions on a particular issue.

This paper is among the first to analyze cryptocurrencies in the context of opinion formation, taking into account individuals' experiences, as well as the perceived benefits and disadvantages associated with cryptocurrencies from a broader perspective. The study aims to understand how individuals' domain experiences, perceived

benefits, and disadvantages can shape their perceptions of cryptocurrencies and the opinions they form about them.

Considering the practical implications of this study, it becomes crucial to understand the factors that influence opinion formation. As the cryptocurrency market and related issues are still new, rapidly changing, and complex for many, comprehending the factors that impact opinion formation on them can be vital for organizations seeking to manage the opinions of employees, consumers, and other stakeholders.

5.2 Limitations of the Results

There are several limitations to our study. Firstly, we only considered selected variables. This means that our findings cannot be generalized to all aspects of the cryptocurrency market. Secondly, our study was conducted among young people, specifically students. This may limit the applicability of our results to other age groups who may have different perspectives and behaviors towards cryptocurrencies. Lastly, we treated the entire cryptocurrency market as a single entity, without examining individual cryptocurrencies or their specific characteristics. Therefore, our findings may not provide a complete understanding of the nuances and complexities of individual cryptocurrencies or their impact on the market. Future research should consider examining individual cryptocurrencies in greater detail to provide a more comprehensive understanding of the cryptocurrency market.

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Knowledge Visualization for Learning in Higher Education Contexts: Systemizing the Field

Martin Eppler and Christian Spletter
Institute for Media and Communications Management (MCM-HSG), St. Gallen, Switzerland

martin.eppler@unisg.ch
christian.spletter@unisg.ch

Abstract: In contexts of higher learning, students must be supported effectively in developing their knowledge, skills, and competencies. Thus, faculty members (incl. lecturers and administrators) are faced with the management task to organize and align innovative teaching and learning formats. As we know from research, the use of knowledge visualization is both a facilitating tool for cognitive processing and learning itself, and for strategic decision-making processes within organizations. However, the literature on the types of (IT-enabled) knowledge visualization for learning in higher education contexts is highly fragmented and dispersed and includes different branches for researchers and practitioners. This makes it difficult to achieve an overview and find systematic and consistent visual approaches along students' learning paths. By highlighting the role of knowledge visualization to support organizing innovative teaching and learning, we provide a systematic, structured overview of such approaches. The goal of this paper is thus to structure the field of knowledge visualization for lifelong and university-based learning based on seminal papers. For this purpose, we present a segmentation approach with six areas to analyse the role of knowledge visualization for learning in higher education contexts, namely: Visualizing Learning Offers (e.g., Curriculum Visualization Tools), Visual Learning Environments (e.g., Metaverse), Learning Content Visualization (e.g., Visual Variation Patterns), Visual Techniques for Learning (e.g., Concept Mapping), Visual Learning Analytics (e.g., Learner Dashboards), and Visualizing Learning Outcomes (e.g., Digital Course Badges). Based on systemizing key concepts, our paper concludes with promising future research avenues for each of the six areas, as well as for the domain of knowledge visualization for higher learning itself. We conclude with specific ideas how the area of visualizing learning offers can act as a spearhead for empirical research (and practice transfer) in the knowledge visualization domain. This should help practitioners and researchers from higher education contexts who consider lifelong learning as knowledge management task.

Keywords: Higher education, Knowledge visualization, Knowledge management, Lifelong learning, Segmentation approach

1. Introduction

In higher education contexts, students must be supported effectively in developing their knowledge, skills, and competencies and designing their lifelong learning and career paths. At the same time, organizations of higher learning must deal with current challenges in educational settings (e.g., digital transformation, diversity among students, or resilience issues). To further contribute to the social "corpus of knowledge" (Galgotia and Lakshmi, 2022) successfully, faculty members as lecturers and administrators are thus faced with the management task to organize and align innovative teaching and learning formats.

Knowledge visualization seems a relevant domain to build upon. It focuses on the use of (interactive) graphics to create, integrate, and apply knowledge that can be used for developing or conveying new insights, experiences, methods, or skills (Eppler, 2011). As we know from research, the use of knowledge visualization is both a facilitating tool for cognitive processing and learning itself (e.g., Wang and Tseng, 2020), and for strategic decision-making processes within organizations (e.g., Bajracharya et al, 2018). Considering this individual or organizational perspective, we thus refer to explicit knowledge to be communicated visually (Lam, 2000).

However, the literature on types of (IT-enabled) knowledge visualization for learning in higher education contexts seems highly fragmented and dispersed resulting in different branches for practitioners and researchers as well. At first sight, this range goes from curriculum visualization (e.g., Zucker, 2009) to the use of achievement badges in university environments (e.g., Hakulinen et al, 2015). This makes it difficult to achieve an overview and find systematic and consistent visual approaches that are appropriate to design students' learning paths.

In terms of a systematic, structured overview of such approaches, we thus look at main uses of knowledge visualization in higher education contexts. The goal is to structure the field of knowledge visualization for university-based, higher learning. Hence, we review seminal papers to identify related streams and opportunities for further research.

While doing this, we distinguish between three categories for segmenting the field: *Visualization AS Learning* (Learning Content Visualization, Visual Techniques for Learning), *Visualization FOR Learning* (Visual Learning

Analytics, Visual Learning Environments), and *Visualization OF Learning* (Visualizing Learning Offers, Visualizing Learning Outcomes).

This paper is structured as follows: In section 2, we refer to the rationale of our segmentation framework with its six areas of knowledge visualization. Then, we describe the methodology we have employed for our field review (section 3), whereas section 4 presents the results that we use to derive underlying key concepts. Finally, we conclude with promising future research avenues for these areas respectively the whole domain of knowledge visualization in higher education. We argue how the area of visualizing learning offers can act as a spearhead for further research and practical transfer in the knowledge visualization domain (section 5).

2. "Vis2Learn": A Segmentation Approach for Higher Education

To create significant learning experiences in higher education settings, learning goals, learning activities, and feedback respectively assessment must be integrated efficiently (Fink, 2013). Drawing on this three-part-division of integrated course design, we thus introduce a corresponding framework to structure the field of knowledge visualization for higher learning. We summarize this segmentation approach as "Vis2Learn" (see Figure 1).

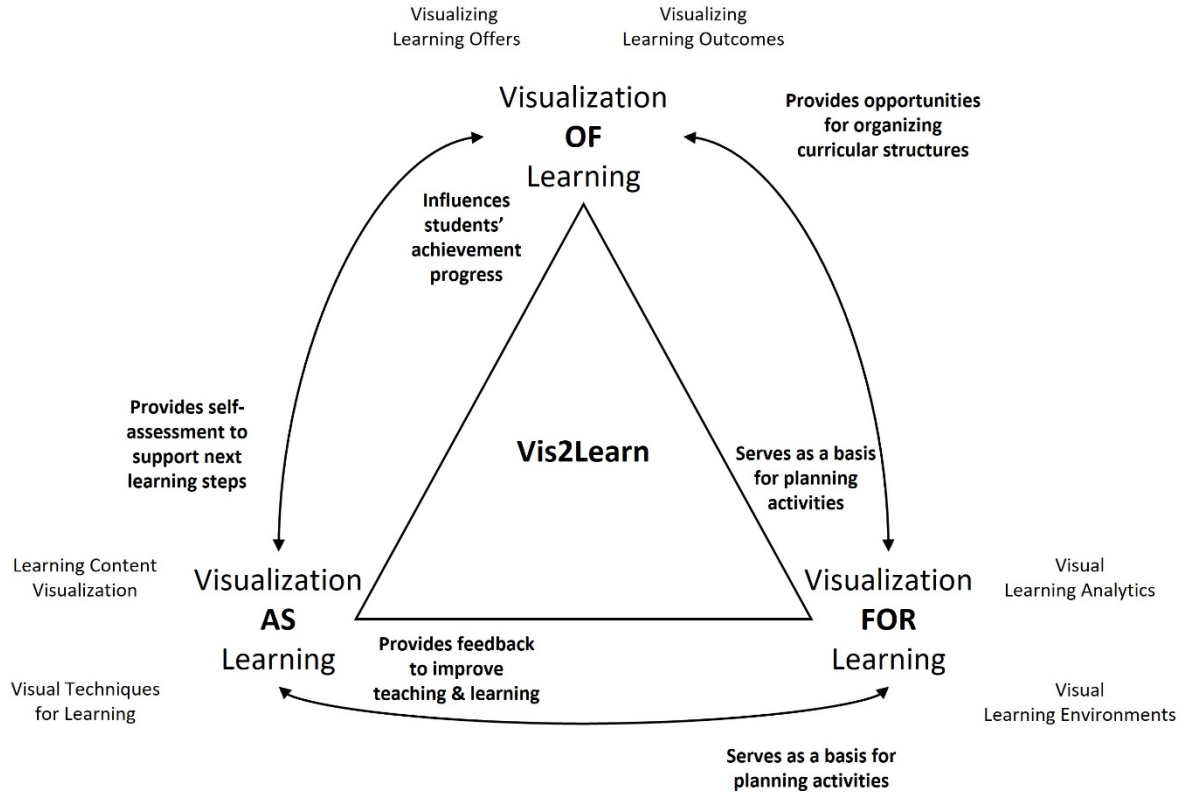


Figure 1: "Vis2Learn" in Higher Education

The categories are in line with other branches that reflect the structure of an integrated course design (e.g., Brady et al, 2019). Thus, the components of the "Vis2Learn"-Framework are the following:

- *Visualization AS Learning:* Focuses on the learning process itself. Visualization aims at causing positive learning effects in terms of student's knowledge acquisition and understanding.
- *Visualization FOR Learning:* Provides technical conditions and didactical resources to support teaching and learning activities. Accordingly, visualization is also used for (data-driven) feedback towards students.
- *Visualization OF Learning:* In terms of anticipated achievement, it shows what can be expected in a certain course of a given curriculum. Visualization can further be used to communicate learning achievement.

According to that, we presume six subfields to structure the contemporary field of knowledge visualization for higher learning. Table 1 shows the respective subsets of every knowledge visualization category with its corresponding visualization form; underpinned with a practical example. We consider these as relevant for the present task to organize and align innovative teaching and learning in university environments. Additionally, and

from a process perspective, this systematization corresponds with formative and summative evaluation aspects within the student life cycle.

Table 1: Fields of Knowledge Visualization (KV) for Learning in Higher Education

Fields of KV	Subset	Visualization Form	Example
AS Learning	Learning Content Visualization	Graphic Organizers, Infographics	Visual Variation Patterns
	Visual Techniques for Learning	Mapping Methods	Concept Mapping
FOR Learning	Visual Learning Analytics	Graphs, Diagrams	Learner Dashboard
	Visual Learning Environments	Immersive Learning in 2D/3D	Metaverse
OF Learning	Visualizing Learning Offers	Interactive Maps	Curriculum Visualization
	Visualizing Learning Outcomes	Badges, Emblems, Icons	Digital Course Badge

As depicted in Figure 1, the proposed dimensions "are not mutually exclusive" (Brady et al, 2019). For instance, the way of visualizing learning content can be influenced by certain insights from applying visual learning analytics "as the use of computational tools and methods for understanding educational phenomena through interactive visualization techniques" (Vieira et al, 2018).

3. Methodology

For systemizing the field of knowledge visualization in contexts of higher learning, we primarily used the Web of Science Core Collection and included seminal papers (based on their citation impact). Ideally, such papers have achieved at least a hundred citations (with exceptions for certain subfields). In case the search has not led to satisfactory results in the respective subfield, we also included further highly relevant papers (based on Google Scholar Rank by title search through the 8th version of *Harzing's Publish or Perish* software tool). To ensure a current view on visualization for learning contexts, we have limited our search to articles published after 2010.

To find relevant literature based on our segmentation approach, we have searched for articles by applying the following keywords listed in Table 2. We gathered our basis of analysis between 17th April and 1st May 2023.

Table 2: Search Strategy for the Review Process

Venues of Applied Keywords	Search Strategy (Web of Science)
Learning Content Visualization	("Graphic Organizer" OR "Graphic Organizers") AND Education; (Infographic OR Infographics) AND Education [Title OR Abstract OR Topic]
Visual Techniques for Learning	("Mind Map" OR "Mind Mapping" OR "Concept Map" OR "Concept Mapping" OR "Argument Map" OR "Argument Mapping") AND Students [Title OR Abstract OR Topic]
Visual Learning Analytics	("Visual Analytics" OR Visualization OR Visualisation) AND "Learning Analytics" AND Education [Title OR Abstract OR Topic]
Visual Learning Environments	("Augmented Reality" OR "Virtual Reality" OR "Mixed Reality") AND Education [Title OR Abstract OR Topic]
Visualizing Learning Offers	"Curriculum Visualization" OR "Curriculum Visualisation" [Title OR Abstract OR Topic]
Visualizing Learning Outcomes	(Badge OR Badges) AND Students [Title OR Abstract OR Topic]

Further selection criteria were the following:

- The paper was published between 2010 and 2022.
- The paper is written in English.

- Journal or proceeding papers contribute to education and educational research (e.g., Citation Topics Meso in Web of Science).
- The paper relates to university environments (e.g., university students).
- Visualizations described in the paper are considered as a (technical) solution or intervention. This means that this "review did not include papers that used visualizations only to present results of a study—e.g., a histogram used to communicate results of an experiment" (Vieira et al, 2018).

To analyse the main uses within the fields of knowledge visualization, we screened the articles along related main objects and visual approaches. We then contrasted the respective items to achieve a theoretical saturation with structural similarities. While doing this, we considered differences in type of knowledge, its purpose, domain of usage, and application context to identify the underlying key concepts.

4. A Review of Knowledge Visualization for Learning in Higher Education

The results of our review of the included literature are summarized in Table 3. It shows corresponding insights in terms main objects and visual approaches in the use of knowledge visualization for learning in higher education.

Table 3: Results of Systemizing the Field of Knowledge Visualization in Higher Education

Learning Content Visualization		
Authors	Main Objects	Approaches
Bicen and Beheshti (2022); Nussbaum et al (2019); Polman and Gebre (2015); Rum and Ismail (2017)	Argument-counterargument integration; Metacognitive support system for learning; Students' academic achievement levels; Visual culture of infographics	Argument Vee Diagram; Flipped Classroom Instructional Infographics (image-based, video-based, game-based); Graphic Organizers used for organizing information during learning (expression tree); Science infographics
Visual Techniques for Learning		
Authors	**Main Objects**	**Approaches**
Davies (2011); Liu et al (2010)	Associations between ideas, topics, or things; Relations between concepts; Inferences between claims/conclusions and support/premises	Combination of diagrams and outlines; Convergence of mapping (Specificity-Generality)
Visual Learning Analytics		
Authors	**Main Objects**	**Approaches**
Macfadyen and Dawson (2012); Williamson (2016)	E-learning data (use patterns and trends, relationship to student learning outcomes); Knowledge about education systems	Data visualization software (Tableau); Digital interactive data visualizations of massive online data ("The Learning Curve")
Visual Learning Environments		
Authors	**Main Objects**	**Approaches**
Cheryan et al (2011); Codd and Choudhury (2011); Dieker et al (2014); Khot et al (2013); Moro et al (2017); Stepan et al (2017)	Students' knowledge in anatomy; Design of virtual classrooms; Teacher education (personalized learning, suspension of disbelief, cyclical procedures as critical components)	AR, VR, and tablet-based applications with computerized interactive 3D model; Immersive Simulator (mixed-reality, avatar-based simulation environment); Virtual computer science classrooms in Second Life

Table 3: Results of Systemizing the Field of Knowledge Visualization in Higher Education *(Continued)*

Visualizing Learning Offers		
Authors	**Main Objects**	**Approaches**
Blasco Soplon et al (2014); MacNeil et al (2020); Nelson-Fromm and Fagen-Ulmschneider (2022); Siirtola et al (2013); Takamatsu et al (2019); Tee et al (2021); Quintana and Tan (2021)	Course Structure; Curriculum overlaps; Prerequisites and corequisites for courses and degree programs; Shared competences; Students' pathways through the curriculum	Bottom-up synthesis of curriculum data (courses, topics, themes, weighted connections); Course Composition Diagram; Dependencies between curriculum and student academic data; Dynamic curriculum mapping; Metro Map; Multi-dimensional and interactive curriculum map tool; Relationship between subjects and competences
Visualizing Learning Outcomes		
Authors	**Main Objects**	**Approaches**
Anderson et al (2014); Hakulinen et al (2013); Hanus and Fox (2015); Hew et al (2016); Kyewski and Krämer (2018)	Achieving badges with no elaborated description; Behavioral and cognitive engagement; Students' activity in online learning environments; Students' engagement inside and outside the classroom; Students' forum engagement in massive open online courses (MOOCs)	Badge Leaderboard (e.g., ranking with combination of badges and coins as gamified elements); Badges, points, and leader board as game mechanisms; Categorial Achievement Badges (e.g., Time Management, Carefulness, Learning); Cumulative "Milestone" and Great Achievement Badges (e.g., Bronze, Silver, Gold, Diamond); Hidden Badges; One-Time Badges (e.g., to welcome users); Varied visibility of awarded badges ("own-others" badges, "own"-badges)

Drawing on this selective review, we propose the following four key concepts that structurally define the use of knowledge visualization in higher education. The main insights are described in Table 4.

Table 4: Key Concepts for Knowledge Visualization in Higher Education

Key Concept	**Main Insight**
Knowledge Visualization considers different perspectives and interpretations.	Criteria as relevance, accuracy, adequacy, completeness, or sufficiency provide a common basis to involved stakeholders. In that sense, it serves as a boundary object (e.g., Leigh Star, 2010). Depending on the context-specific purpose, users' background knowledge and/or background experience must be considered.
Knowledge Visualization follows visual (and conventual) rules.	Depending on its communicative function, the use of knowledge visualization depends on the respective knowledge type which determines how its representation is organized (e.g., hierarchy, flow).
Knowledge Visualization allows technical flexibility in visual design.	Tools and forms of knowledge visualization and its semiotic functions must be adaptive to the application context. They then provide appropriate settings in terms of color, size, or shape and the possibility to integrate further representational elements (e.g., charts, diagrams, maps, graphs, icons, text, sketches).
Knowledge Visualization incorporates an engaging and explorative design.	Knowledge visualization considers relevant affordances of representation (e.g., bird's eye view, additional details, balance, movement, pattern, repetition, rhythm, variety). Thus, users get more involved and keep up their interest.

5. Conclusion

The aim of this paper was to structure the field of knowledge visualization for university-based, higher learning. For this, we derived a segmentation framework (Vis2Learn) that consists of six subfields to structure the contemporary field of knowledge visualization for higher learning: Learning Content Visualization, Visual Techniques for Learning, Visual Learning Analytics, Visual Learning Environments, Visualizing Learning Offers, and Visualizing Learning Outcomes. Based on our results, we identified four generic key concepts that systemize

the use of knowledge visualization in higher education contexts: *Multi-Stakeholder-Inclusiveness, Rule-Orientation, Technical Flexibility,* and *Engaging/Explorative Design*. Accordingly, this implies promising future research avenues based on related key questions for each of the six areas of knowledge visualization, as well as for the domain of knowledge visualization for higher learning itself (see Table 5).

Table 5: Research Agenda for Knowledge Visualization in Higher Education

Key Concept	Key Questions
Multi-Stakeholder-Inclusiveness	How can knowledge visualization be used to provide a common point of reference for different stakeholders in higher education contexts? What are the critical factors?
Rule-Orientation	How can users be made aware of the appropriate usage of tools and forms of knowledge visualization? How does it correspond to working or learning strategies?
Technical Flexibility	Under which conditions does the integration of additional representational elements create value? How does it affect usability issues?
Engaging/Explorative Design	Which individual or group-related effects are associated with the use of knowledge visualization? How do (motivational) affordances influence respective outcomes?

In this sense, future work on these avenues must keep track of the "cognitive, social, and emotional benefits" (Eppler and Burkhard, 2004) generally associated with knowledge visualization at different recipient levels (i.e., coordination, attention, recall, motivation, elaboration, new insights). For us, the underlying segmentation approach (Vis2Learn) also serves as an initial step to further explore and develop a "validated prescriptive framework" (Eppler and Burkhard, 2004) that links knowledge type (declarative, procedural, experimental, orientational, and individual knowledge), visualization goals (e.g., learning, assessing) and visualization format (e.g., interactive visualization) while considering the functional interplay of visualization as learning, visualization for learning and visualization of learning. This would also highlight, for instance, "how complementary visualization … can be fruitfully used" (Eppler and Burkhard, 2004).

We particularly see the area of visualizing learning offers as a spearhead for empirical research and practical transfer in the knowledge visualization domain. By now, this subfield rather focusses on exhaustively communicating curricular structures for organizational or planning activities of different higher education stakeholders. But visualization of learning offers can also relate to course electives in university environments. At this point, empirical research is planned to contribute to the choice overload debate by considering psychological effects in the use of interactive visualization to support students' course decisions. Besides, group-related effects are also worth to be analysed. For example, these can refer to the question if interacting with an interactive visualization tool can stimulate information exchange processes in higher education expert groups (Spletter and Eppler, 2023). Therefore, the derived findings and related key questions might help practitioners and researchers from higher education contexts who consider lifelong learning as an important task.

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The Impact of the COVID-19 Pandemic on the Investment Management in the Housing Market in Turkey

Celal Erdogdu[1] and Inese Spica[2]
[1]ISMA University of Applied Sciences, Riga, Latvia
[2]Scientific Institution Business Competence Centre, Riga, Latvia

celaler@yahoo.com
inese.spica@gmail.com

Abstract: COVID-19 significantly impacted the management of investments in the residential property market. Changes in property demand, shifts in market volatility, financing challenges, changes in property management and changes in local regulations and policies are presented. The pandemic created a more challenging and unpredictable investment management (IM) environment in the residential property market. However, with proper knowledge management (KM) and investment strategies, investors may have opportunities to thrive in this changing market. Investment KM refers to identifying, capturing, organising and sharing information and expertise related to investment activities within an organisation. KM in residential investment involves developing a system for gathering, organising and using information and expertise related to buying, owning, and selling a property. COVID-19 significantly affected the property market. Effective KM in residential investment can help individuals make informed decisions, identify potential risks, and maximise the value of their investment. Like many others worldwide, the Turkish residential market was hit by COVID-19. The Turkish residential market has a few key points: financing, shifts in buyer preferences, and regulation changes. The pandemic hit Turkey's residential property market, leading to property price changes. The Turkish government implemented several residential policies to support the residential market and help individuals and families facing financial challenges due to the pandemic. Those policies did not eliminate the challenges but mitigated some of the negative effects of the pandemic on the market and helped individual investors. This article discusses house price changes in Turkey during the COVID-19 period, the factors affecting price changes, and the property policies that affect property price changes. This article analyses IM challenges and explores how KM can help individual property investors.

Keywords: COVID-19, Rresidential property, Investment, Management, Methodology, Pandemic

1. Introduction

Residential property prices (RPP) in Turkey began to fall in April 2017 and began to rise gradually after January 2020. The first COVID-19 cases in Turkey were reported in March 2020. The residential market recorded the lowest sales in April and May due to full and partial lockdowns. On 3rd June 2020, the Turkish government launched a series of mortgage campaigns to take advantage of the accelerating effect of the residential market on the economy. From that date, RPP in Turkey rose inexorably until September 2022. In May 2021, measures were taken to prevent the rise of property prices and rents, leading to great societal discomfort. The concept of KM must be adopted in organisations to transform them into entities with a competitive advantage in this borderless world (Najib Razali and Juanil, 2011).

The object of the research is IM in the housing market during the COVID-19 pandemic period. The subject of the research is the analysis of the IM in the housing market in Turkey, the impact of the COVID-19 pandemic, and the KM solutions of its problems. The objective of the research is to study the integration process of the COVID-19 pandemic and IM in housing market problems, to elucidate the factors influencing it, and to develop housing IM mechanism with KM.

2. Literature Review

Global crises affect all aspects of life, including the business sector, and significantly impact society at large (Jacob, 2012; OECD, 2020). The importance of KM is particularly felt in times of crisis, such as COVID-19, when investors have difficulty making investment decisions. Property investors can make better investment decisions by using KM applications in their investment processes, whether professional or private. The speed of data flow required by KM applications is directly related to the statistical infrastructure of countries. Reducing the time, it takes to obtain, process, share, and disseminate the data collected by the public is important for investors to make the right decisions. The scientific literature on the relationship between KM and crisis management shows that the effective use of KM is helpful during crises (Ram Raj Thumiki and Jurcic, 2021). Every crisis is an important source of knowledge (Mikušová and Horváthová, 2019).

COVID-19 increased inequality between owners and renters in the residential market (Furceri, Loungani and Ostry, 2020) and wealth inequality between households (Balemi, Füss and Weigand, 2021). It reduced regular

household incomes, led to the shutdown of businesses, reduced incomes and caused mass unemployment. During the pandemic, instead of supporting those who were struggling to pay their rent, support was given to landlords (Blakeley, 2021). Although different policies were implemented in different countries, no special support was provided to those most affected by the pandemic in the residential market in Turkey (Aksoy Khurami and Özdemir Sarı, 2022).

Government policies during COVID-19 had mixed results. Residential property is important in the national economy (McCord et al., 2022). Government policies play an essential role in the Turkish residential property market. The plans and interventions presented during COVID-19 in Turkey were designed to alleviate the difficulties. As a result of the mortgage loan campaign, one-year repayment plans with a total maturity of 15 years were offered.

COVID-19 affected RPP and total residential property sales (TRPS) in China, with a larger impact on TRPS than on prices (Blakeley, 2021). After COVID-19, RPP recovered and rose rapidly (Li and Zhang, 2021). The level of RPP after COVID-19 raises concerns about a residential market recession similar to 2007-2009, but with the major difference of the Great Recession: regulatory changes and supply and demand (Afxentiou, Harris and Kutasovic, 2022). D'Lima, Lopez and Pradhan (2022) found that during COVID-19, there were large declines in TRPS during periods of closure and reopening. Following country lockdowns, RPP fell in densely populated areas and rose in sparsely populated areas. Similarly, a research study by McCord et al. (2022) shows that the pandemic increased prices in rural areas.

COVID-19 was significantly effective on rents, financing costs and deposit interest rates on RPP in Turkey. However, macroeconomic variables did not affect RPP (Kartal, Kılıç Depren and Depren, 2021). Compared to the rest of the world, Turkey experienced an increase in demand for residential property during COVID-19; demand reached record highs, and RPP and inflation rates increased (Aksoy Khurami and Özdemir Sarı, 2022). Akgündüz et al. (2021) indicate that a 1% (annual) decrease in MIR in Turkey leads to a 2.1% increase in the unit price per square metre of residential property. Residential property prices increased by 10.59% in real terms in June 2020, driven by the government's mortgage rate cut. The real growth peaked at 24.14% in November 2021. In real terms, Turkey's residential property cost increased by 2.85% in March 2020 (Erdogdu and Spica, 2022).

In their study, Jennex et al. (2022) presented findings to analyse and identify threats to information risk and to change information risk strategy in light of the COVID-19 pandemic. Information systems support people in making decisions, learning and other activities (Nissen, 2002). In this study, we analysed the impact of COVID-19 on the property market and presented findings on overcoming similar crises with KM. Sharing knowledge (Gore & Gore, 1999), looking at things from different perspectives, and redefining problems can lead to creative solutions (Sternberg, O'Hara and Lubart, 1997).

3. Methodology

We conducted a linear regression analysis to examine which economic variables affect cash residential property sales (CRPS) and mortgage residential property sales (MRPS) in the time interval between January 2013 and December 2021, with the dummy variable for COVID-19. To address heteroscedasticity in our data, we logarithmically transformed it and achieved a balanced dispersion. Evaluating both CRPS and MRPS in the same linear regression analysis could have led to multicollinearity problems and an undesirable increase in the variance inflation factor (VIF) value to 5 and above. To avoid such issues, we conducted linear regression analysis in two phases: the first phase analysed CRPS and the second phase analysed MRPS. We analysed the effect of COVID-19 and the effect of other economic variables in both phases.

We analysed which variables affect the dependent variables of MRPS and CRPS in Turkey. We used the following independent variables: non-residential property sales (NRPS), mortgage interest rate (MIR), employment, consumer confidence index (CCI) and new building permits (NBP), and the COVID-19 dummy variable. We found that the R2 of the linear regression for CRPS was 0.88, and the R2 for MRPS was 0.85.

4. Results

We analysed the independent variables that affect MRPS through regression analysis. The adjusted R-squared value shows that the change in the independent variables in the regression model explains the change in MRPS by 88.7%. The ANOVA analysis indicates that the established model is statistically significant at the 99% confidence level (sig.<0.01). Table 1 of coefficients indicates that all the independent variables, except NBP and COVID-19 periods, are statistically significant at the 99% confidence level (sig.<0.01).

Table 1: MRPS Linear Regression

Coefficients								
							Collinearity Statistics	
Model		Unstandardized	Standard Error	Standardized[a]	t	p	Tolerance[a]	VIF[a]
H_0	(Intercept)	3.407	0.052		66.077	< .001		
H_1	(Intercept)	-0.362	2.852		-0.127	0.899		
	non-residential property sales	0.681	0.087	0.316	7.835	< .001	0.719	1.391
	mortgage interest rate	-2.151	0.092	-1.065	-23.460	< .001	0.544	1.838
	employment rate	3.873	0.599	0.288	6.464	< .001	0.731	1.367
	consumer confidence index	-1.891	0.415	-0.262	-4.556	< .001	0.463	2.161
	new building permits	-0.023	0.046	-0.024	-0.495	0.622	0.528	1.895
	COVID-19 (1)	0.064	0.066		0.968	0.335		

[a] Standardized coefficients and collinearity statistics can only be computed for continuous predictors.

All variables are held constant: a 1% increase in NRPS increases MRPS by 0.68%. A 1% increase in the MIR reduces MRPS by 2.1%. A 1% increase in the employment rate (ER) increases MRPS by 3.8%. An increase of 1% in the number of NBP reduces MRPS by 0.02%. COVID-19, holding all variables constant, increases MRPS by 6.6%. Based on these results, the model for MRPS is as follows:

$$\text{Ln(MRPS)} = -0{,}362 + 0{,}681 * \text{Ln(NRPS)} - 2{,}151 * \text{Ln(MIR)} + 3{,}873 * \text{Ln(ER)} - 1{,}891 * \text{Ln(CCI)} - \\ -0{,}023 * \text{Ln(NBP)} + 0{,}064 * \text{COVID-19} \quad (1)$$

We used regression analysis to analyse the independent variables affecting CRPS. The adjusted R-squared value indicates that the change in the independent variables in the regression model explains the change in CRPS by 87.8%. The ANOVA analysis indicates that the established model is statistically significant at the 99% confidence level (sig.<0.01). Table 2 of coefficients indicates that all independent variables except NBP are statistically significant at the 99% confidence level (sig.<0.01).

Table 2: CRPS Linear Regression

Coefficients								
							Collinearity Statistics	
Model		Unstandardized	Standard Error	Standardized[a]	t	p	Tolerance[a]	VIF[a]
H_0	(Intercept)	4.313	0.027		158.082	< .001		
H_1	(Intercept)	3.343	1.572		2.126	0.036		
	non-residential property sales	0.788	0.048	0.691	16.465	< .001	0.719	1.391
	mortgage interest rate	0.201	0.051	0.188	3.981	< .001	0.544	1.838
	employment rate	1.196	0.330	0.168	3.622	< .001	0.731	1.367
	consumer confidence index	-1.791	0.229	-0.469	-7.828	< .001	0.463	2.161
	new building permits	0.068	0.025	0.133	2.675	0.009	0.528	1.895
	COVID-19 (1)	-0.125	0.036		-3.452	< .001		

[a] Standardized coefficients and collinearity statistics can only be computed for continuous predictors.

Assuming all variables are constant: NRPS increase by 1%, and CRPS increase by 0.78%. A 1% increase in MIR increases CRPS by 0.2%. A %1 increase in ER increases CRPS by %1.1. A %1 increase in the number of NBP increases CRPS by %0.06. A %1 increase in c CCI increases CRPS by %1.7. COVID-19 reduces CRPS by 11.8%, holding all variables constant. Based on these results, the CRPS model is as follows:

$$\text{Ln(CRPS)} = 3{,}343 + 0{,}788 * \text{Ln(NRPS)} + 0{,}201 * \text{Ln(MIR)} + 1{,}196 * \text{Ln(employment)} -$$

$$-1{,}791 * \text{Ln(CCI)} + 0{,}068 * \text{Ln(NBP)} - 0{,}125 * \text{COVID-19} \quad (2)$$

After the announcement of the first COVID-19 case on 11th March 2020, Turkey suffered the pandemic until December 2021, after partial lockdown, lockdown by occupation, lockdown on weekends, curfew for people over 65, and full lockdown (AA, 2023). The curfew directly impacted the residential sector in many areas, from residential construction to TRPS. The monthly average of TRPS was 100 thousand units, and the number of TRPS fell to 42 thousand units in April 2020 and 62 thousand units in May 2020. Over the 22 months between March 2020 and December 2021, TRPS fell in 8 periods and increased in 14 relatives to the monthly average. MRPS fell in 16 periods and rose in 6 periods. CRPS fell in five periods, were unchanged in one period and rose in 16 periods.

After the recession in the residential market in March and April of COVID-19, the Turkish government launched a special campaign on mortgage loans. As the data indicates, these attractive campaign terms increased the sales of mortgaged residential properties and, subsequently, the CRPS (Table 1). We compared the real change in RPP with the prices before the COVID-19 outbreak. In the first stage, we obtained the average annual real change in RPP for 110 months in the period 01/2011-02/2020. In the second stage, we obtained the average annual real change RPP for 22 months in the period 03/2020-12/2021. Comparing the differences in the average real RPP changes in the two periods, we can see the effect of COVID-19 on RPP in Turkey. In the analysis of price changes, there is a detail in the source authors use. The Turkish RPP index is compiled by the Central Bank of the Republic of Turkey (CBRT, 2023a) by aggregating RPP changes in 81 provinces into 26 regions at 12 levels. Accordingly, the price change in a city makes it appear as if the RPP in the region where that city is located has also changed.

Some studies adopted the four KM processes commonly used in the literature and defined in the European guide for good practice in KM (Chedid, 2019): Knowledge creation (Nonaka, Toyama and Konno, 2000), knowledge capture (Nielsen, 2006), knowledge sharing (Sun, 2010), knowledge application (Paliszkiewicz, 2011). Bratianu and Bejinaru (2017) created main knowledge strategies: knowledge creation, knowledge sharing, knowledge acquisition and knowledge exchange in networks. Silva et al. (2017) state that research on strategic management focuses on the relationship between strategy and KM. Many authors consider KM to be a process involving different activities: knowledge creation, capture, sharing and application (Alavi and Leidner, 2001). Following the ideals of the concept of KM allows for better management practices and the improvement of their well-being, in addition to generating more profits in the property sector through more creative and inventive techniques (Najib Razali and Juanil, 2011).

In property markets, KM applications are important for decision-makers and property investors to analyse the market accurately and predict the possible consequences of decisions. Although the effects of residential policy on property sales and prices were relatively small in the early periods of policy implementation, they became more pronounced later. The measures taken to mitigate these effects began to impact the property market after a long period, accelerating the trend towards price increases. Property investors can use KM applications in their investment processes to make investment decisions under five main activities (Figure 1): market analysis, decision-making, collaboration, continuous learning and performance monitoring. The connection between KM and housing IM is simply described in Figure 1.

5. Discussion

The effects of COVID-19 in Turkey overlap with the effects of the Turkish government's residential policy. TRPS in Turkey fell to the lowest level due to COVID-19. However, the subsequent mortgage loan campaign pushed MRPS to three times the general average. As soon as the campaign ended, the MRPS number returned to normal. The number of MRPS in three months was even higher than the number of MRPS in Turkey in a year. The increase in the MRPS increased the demand for residential property, and CRPS increased by up to 18%. If the mortgage loan were gradual and extended over time instead of a sudden reduction in MIR, the demand could have been stabilised, and sudden price increases could have been prevented (Akgündüz et al., 2021). The increased demand for property encouraged existing property owners to put their properties up for sale.

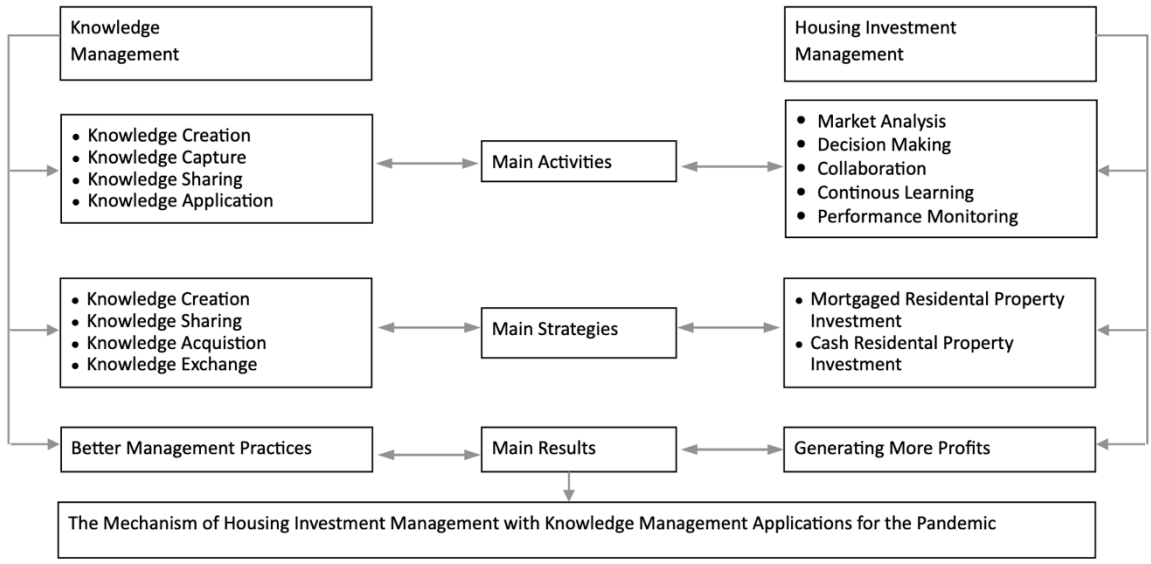


Figure 1: The Connection Between KM and Housing IM

The three-month campaign boosted demand for residential property, pushing up real RPP increases. The annual real price increase was 5.1% in April 2020, 10.7% in May and as high as 13.7% in September, when the campaign ended. However, this effect was not limited to this point, and real RPP continued to rise until September 2022. The level of annual real price increases in September 2022 was 57.5%. COVID-19 also led to a spatial differentiation of RPP changes and sales.

The real increase in TRPS and RPP started in June 2020 and continued intensively for three months. The Turkish Residential Property Price Index (CBRT, 2023b) is published monthly. However, although the frequency of data release is monthly, the data refer to the previous two months (CBRT, 2023a). The difference between the publication of the final results and the end of the reference period is 75 days. Only one of the real estate websites publishes data on the residential market, but not regularly and sometimes not for several months in a row. Bricongne, Meunier and Pouget (2021) argue that the publication period of statistical data published by public institutions makes it difficult to understand market changes.

Existing sources do not provide real-time information during periods such as COVID-19 or campaigns. This leaves consumers to fend for themselves and leads to a consensus among consumers when trends are strong (Case, Shiller, Thompson, 2012). Family, friends and the media influence residential investors who do not have access to adequate information in their decision-making process (De Bondt, 1998; Katz, 2006). However, property advertising websites are one of the most important data sources. As owners of big data, these sources, which are of direct interest to the public, share as much as they want and when they want with the public. When property advertisements were published in newspapers, users could easily create their database. With the data collected from property websites, it may be possible to monitor the market much faster than the statistics provided by public institutions (Bricongne, Meunier, Pouget, 2021). In the property market, digital channels will help increase market transparency and efficiency (Balemi, Füss and Weigand, 2021).

The main problem in the Turkish residential property market is the lack of data. The property price index in Turkey is based on values in property valuation reports prepared for financial institutions. Values estimated by real estate valuers are not sales price data. Actual sales data are not made available to the public. Erdogdu and Arslanli (2023) found that only 71 of Turkey's 3 million yearly property sales were disclosed to the public. The second problem is data inaccuracy. COVID-19 may now be a thing of the past, but the remote working practice may continue to significantly impact the residential market and the wider economy (Allen-Coghlan, McQuinn and O'Toole, 2020).

6. Conclusion

Using KM techniques, individuals can access and analyse key market information such as trends, property valuations, rental rates, and investment opportunities. KM techniques support risk assessment and management in residential investment. Residential investors benefit from KM strategies that encourage

networking and collaboration. Connecting with experienced investors, sharing experiences and working on investment opportunities can help individuals tap into the collective wisdom and gain valuable insights. In residential investment, KM techniques encourage continuous learning and adaptation. Individuals can adjust their investment plans and respond to changing market conditions by actively seeking new knowledge, keeping abreast of market trends, and reflecting on past investment experiences. Individuals can use KM techniques to track and analyse the performance of their investments. Investors can examine the profitability and effectiveness of their investment decisions by maintaining a knowledge base of investment data, financial measurements and market feedback.

The findings of this study can be used to develop strategies for two types of investors. Investors in mortgaged residential property should consider the increase in MRPS following increases in the following indicators: NRPS, employment rate, and new building permits. On the other hand, a rise in mortgage rates leads to a fall in MRPS. Investors should be particularly careful about the impact of changes in the employment rate and mortgage rates on MRPS. Cash residential property investors should consider an increase in CRPS following increases in the following indicators: increases in NRPS, mortgage rate, new building permit, and consumer confidence index lead to an increase in CRPS. Investors who pay cash to purchase a residential property should be particularly careful about the impact of changes in the consumer confidence index on CRPS.

The COVID-19 pandemic had two different impacts on sales of mortgaged residential property and cash sales of residential property. The findings of this study indicate that the COVID-19 pandemic led to a 6.6% increase in MRPS and an 11.8% increase in CRPS. Impact of the COVID-19 pandemic on residential property sales: TRPS remained at the average level for 14 months and above the average level for eight months. MRPS fell in 16 periods and rose in 6 periods. CRPS were unchanged in 1 period, rose in 16 periods and fell in 5 periods. These findings suggest that the crisis had a greater impact on the MRPS.

To ensure good KM and strategies in property investment, the relevant parties must play an active role, especially in times of crisis: rapid creation of knowledge, rapid dissemination of knowledge, sharing of knowledge and cooperation between all stakeholders. For further research, authors can highlight focus on the KM practices that influence the decision-making processes of people who want to invest in a residential property.

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Relational Capital and Media Brands

Scott Erickson[1] and Helen Rothberg[2]
[1]Ithaca College, USA
[2]Marist College, Poughkeepsie, USA

gerickson@ithaca.edu
hnrothberg@aol.com

Abstract: Continuing a research program studying new metrics for relational capital, this paper reports on a new analysis of media brands, both traditional and newer entrants. Relational capital is a key aspect of the knowledge assets or intellectual capital of the firm. Unlike human capital (job-related knowledge) or structural capital (knowledge incorporated into the firm itself), relational capital has to do with external relationships. Specifically, knowledge about handling external relationships, especially those with customers. Relational capital is not a widely studied topic in knowledge management (KM) or intellectual capital (IC), including potential metrics. Brand equity, on the other hand, is an idea from another field that is well-known and much studied. While not the same concept as relational capital, it is clearly related as brand equity comes from a history of customer interactions and the value of the relationships built by the firm. Better knowledge of what satisfies customers plays an obvious role in building brand equity. But brand equity does not have a single, recognized method for calculation. Annual reports and rankings from marketing consulting firms routinely provide estimates of brand equity for high-value, well-known brands. Most of the other brands, not so much. Even so, if we know the brands with the highest equity values and can tie some additional metrics to that status, we can begin to uncover the level of customer knowledge held by individual firms and, by extension, relational capital in a wider variety of organizations. This study focuses on a brand sentiment analysis, using commercial software from Salesforce Social Studio. The web-scraping software collects mentions of a brand (or any keyword) across the web, not only social media but reviews, aggregators, and other sources of brand commentary. From that capability, an assessment of the brand's meaning to users can be assessed at a point in time. In particular, this study looked at established media brands (New York Times, Wall Street Journal, etc.) and new media brands (Buzzfeed, Techcrunch, etc.) over a three-month period in early 2023. Data were collected on brand activity (volume), sentiment (positive/negative), sources, influencers, country of origin/language, and other indicators, including the variance of all the above measures. From there, comparisons can be made across the more established brands and the developing ones, as well as to high-equity brands from other industries (covered in other studies). As noted, some suggestions can then be made concerning what metrics to track over time to assess the ongoing value of relational capital.

Keywords: Intellectual capital, Relational capital, Brand equity, Media brands, Sentiment analysis

1. Background/Literature Review

1.1 Relational Capital

The study of knowledge assets focuses not only on identifying and leveraging such assets through sharing but also understanding them properly. With proper understanding comes a better idea on how to develop and share such assets. Consequently, not only is the distinction between tacit and explicit knowledge a common topic in the field (Nonaka & Takeuchi, 1995), but also the interest of scholars and practitioner in the different types of intellectual capital: human capital, structural capital, and relational capital (Bontis, 1999; Edvinsson & Malone, 1997).

Human capital, of course, is a central concept in knowledge management (KM) and intellectual capital (IC) as it is the stock of knowledge possessed by individuals in the firm related to performing their jobs. As such, human capital is often the main subject of KM studies. Scholars and practitioners have an interest in identifying and understanding employee knowledge about their work, then better managing it through sharing and application. From unique employee knowledge comes a unique organizational resource providing sustainable competitive advantage (Grant, 1999; Teece, 1998). This knowledge-based view of the firm is an offshoot of the resource-based view of the firm (Barney, 1991; Wernerfelt, 1984), with knowledge as perhaps the prototypical unique, uncopiable competitive resource.

Achieving that potential competitive advantage is largely dependent on recognizing and properly understanding the human capital or knowledge assets. As above, one important aspect is whether the knowledge easy-to-communicate, codifiable explicit knowledge or hard-to-explain, hard-to-codify tacit knowledge (Nonaka & Takeuchi, 1995). Whether the knowledge is more explicit or more tacit has important implications for how to manage it (e.g. through information systems vs. person-to-person) (Matson, et al., 2003; Brown & Duguid, 1991). The organizational context or social capital can also be important, with softer issues like trust, incentives, and culture bearing on KM success (Nahapiet & Ghoshal, 1998).

All of that is pretty standard KM background and clearly applies to human capital. But, as noted earlier, intellectual capital is generally seen as having three parts, human capital, structural capital, and relational capital (capital (Bontis, 1999; Edvinsson & Malone, 1997). While human capital relates to knowledge about performing one's job, structural is conceptualized as knowledge embedded in the firm, aspects like processes and procedures. If a worker leaves the organization, they take their human capital with them, but structural capital is what is retained even without all the employees (who may have originally contributed to it). Relational capital refers to knowledge about relationships with external parties such as customers, regulators, suppliers, and others (Roos & Roos, 1997). And of those, of course, customers are the most important for many firms and customer data, information, and knowledge are growing rapidly in a digital world.

Beyond definitions, IC has contributed to our understanding of knowledge assets and their differences with research on potential metrics. Well-known tools for assessing the intangible assets of the firm come out of the IC framework, tools such as the Balanced Scorecard (Kaplan & Norton, 1992) and Skandia Navigator (Edvinsson & Malone, 1997) that include human, structural, and relational/customer components. Broader measures, such as Tobin's q are easier to use when comparing across multiple firms, often contribute an estimate of the full IC holdings of the firm but can't be broken down into the individual components (Tobin & Brainard, 1979). Pulic's VAIC, popular for multi-firm studies, does include a human capital component but relational capital is combined as a single remainder with structural capital (Pulic, 2000).

Even with the emphasis on human capital and the lack of a specific metric in some frameworks, the IC community has provided some attention to relational capital. In a number of ways, it reflects a separate idea from the marketing literature, brand equity, that we'll discuss short. Conceptually, repeated satisfactory interactions between parties, in this case organization and customer, build relational capital in the same way as two employees repeatedly sharing knowledge will build human capital (Chang & Tseng, 2005; de Castro, et al., 2004). Those successful exchanges provide the organization with better knowledge of each individual customer, including their needs, wants, and buying processes. Thus, at the heart of building relational capital is engagement with customers (Sussan, 2012; Stahle & Stahle, 2012). At least the customer capital part. Again, relational capital is a wider concept concerning relationships with multiple external publics, not just customers. But in many circumstances, the customer relationships are a major part of its makeup (Gupta & Bhasin, 2014).

1.2 Brand Equity

Brand equity is a core concept in marketing, the value of a recognized brand as a business asset. Much of the value of the brand is based on accumulated positive word-of-mouth heard by and/or use experienced by the customer. In today's world, where customer interactions are recorded, stored, and analyzed by the firm, it can actually build brand equity by learning more about what resonates with customers. In effect, this knowledge about how to better develop customer relationships can be considered relational capital. As such, brand concepts may help us to better understand relational capital.

Aaker (1991) is generally everyone's first reference in branding. His initial work established the value of a brand's perceived higher quality and the price premium associated with it. Turning to brand equity, a potential value metric, he broke down the concept down into the component parts of awareness, associations, and loyalty (Aaker, 1996). One of the key points there is the associations, as brand value builds through repeated successful interactions, then leading to loyalty. The value of the brand is largely based on satisfactory exchanges with the customer. Keller (1993) made a similar case with recognition followed by repeated positive experiences establishing the brand value.

As the repeated exchanges build positive associations and loyalty, they are potentially different for every customer. The individual determines what the brand is worth to them and how much extra they would pay for it. In theory, a summation of those individual differentials would be an estimate of brand equity (Seggie, et al., 2006; Aliwadi, et al., 2003) though it fails to capture any customer surplus resulting when the customer obtains the brand for less than the value they place on it.

In practice, brand equity is more often estimated by consultancies based on proprietary methodologies including financial statements and other data sources. While they vary in their approaches (and, often, results), they do provide some idea of the magnitude of some of the largest brand equities of publicly listed firms. As with many estimates of intangible assets, the issue is found in the intangibility aspect itself. Tangible assets and firm value are included in financial reporting but intangible assets are usually not. Goodwill is an exception and included on balance sheets but is only accurate at the moment a firm is purchased and then never altered. So it is rarely useful for long.

Even so, brand equity and related concepts show a degree of interest in measuring the relationship between an organization and its customers. To the degree that continued positive exchanges build value and that ever improving knowledge about the individual customer's needs, wants, and preferences contribute to those positive exchanges, there appears to be an opportunity to connect brand metrics from the marketing side to relational capital on the KM/IC side. With the advent of contemporary digital tools such as customer relationship management (CRM) systems and digital media, perhaps the two disciplines can be brought closer together and better inform the study of each.

1.3 ICTs and Relational Capital

Digital tools are present in both brand relationships and knowledge management (including relational capital). Indeed, they are omnipresent and actually increasing in their use and impact. In the field of big data and analytics, data and information contributing to knowledge insights are increasing in volume, velocity, and variety (Rothberg & Erickson, 2017). Big data sources are varied but customer data is a big part of the volume. What potential is there in information and communication technologies (ICTs) for better understanding branding and relational capital?

ICTs are dispersed, complicated networks with identifiable users (Lechman, 2017). Communications between users or other interactions on ICTs , as in social media, generate an enormous amount of data. And, as noted above, data and information are useful in an of themselves but are also capable of becoming higher-level knowledge assets (Sigala & Chaikiti, 2014; Levy, 2009).

The DIKW (data, information, knowledge, wisdom) hierarchy is a longstanding concept in information science, dating back to Ackoff (1989) and others. As a hierarchy, the concept suggests the maturation of intangible assets, with increasing value as data and information yield insights (knowledge) and understanding (wisdom). Consequently, the wealth of data and information now available have considerable potential to add to the amount of useful knowledge or intellectual capital in organizations.

More recent work on this full range of intangible assets pulls away a bit from the hierarchical view, especially as data and information have been established as valuable assets in an of themselves. All are potentially useful and more valuable than the others depending on the circumstances, sketched out, in part, by the Cynefin framework (Kurtz & Snowden, 2006). This view brings a more KM approach to the theory, as tacit and explicit knowledge are seen as different but both of potential value. Indeed, a more recent version of the intangible asset options suggests a range moving from data/information through explicit knowledge to tacit knowledge to wisdom/intelligence (Rothberg & Erickson, 2017).

That insight raises the question of whether intellectual capital, and especially relational capital, is made up of only knowledge assets. Knowledge has value, including knowledge of customers. But so does data/information, particularly data/information on those same customers, their attitudes and their behaviors. ICTs generate a lot of data/information and understanding those better may provide insights into brand value and relational capital. Not just trying to measure customer knowledge but the full range of intangible assets associated with customers may indicate even deeper relationships related to brands and customers. ICT metrics may provide a new and better way to assess both brand equity and relational capital.

Digital media offer an especially interesting opportunity to apply ICTs to assessing brand equity and relational capital. One form of digital media would be the extensive customer relationship management (CRM) systems and the resulting deep customer databases, collecting individual data on each touchpoint with each customer. Possessing that level of detail on individual customers and their responses to interactions provides a much deeper understanding and opportunity for a much deeper relationship. Social media interactions also provide openings for deeper relationships, including user comments revealing attitudes toward brands. While sometimes uncomfortably honest about negative feelings (Royai, 2002), uncensored personal comments can provide unusually deep insights into customers' true feelings about a brand (Rizun & Kucharska, 2018). Brand equity and relational capital might remain fuzzy concepts in terms of measurement, but these new tools provide potentially valuable ways to gain a new perspective on their value.

2. Methodology

This study continues a stream of research applying new digital media data collecting techniques to assess brand value and relational capital. Past studies in this vein have looked at major consumer product brands (Erickson & Rothberg, 2017), ingredient brands (Erickson, Schmidt & Rothberg, 2020), and tech brands (Erickson, 2023). A common thread in the previous studies was the great activity and interest in the higher-valued brands. The

sentiments toward brands were actually not more positive for the high-value brands (nor more negative) but were more neutral when that choice was available. Interestingly, the sentiment for the high-value brands tended to be less variable, opinions were more entrenched and less likely to change week-to-week or month-to-month.

This study extends the methodology to the media industry. Traditional news media companies (*The Wall Street Journal (WSJ), The New York Times (NYT), The Washington Post (Wapo), and The Economist*) were tracked as were some newer, always-digital-only competitors (*TechCrunch, Buzzfeed, Mashable*). The sample was tracked over one-week, one-month, and three-month periods ending on March 31-April 1, 2023. Salesforce's Social Studio sentiment analysis program was used to gather and analyze the data, reporting on each brand mention.

Social Studio takes keywords and constructs reports over a specified time period. Major digital outlets are reviewed and included such as Twitter, Facebook, YouTube, blogs, forums (and replies), aggregators, reviews, and others. These reports include volume of mentions, sentiment (positive or negative), top influencers and their influence, country (when known), language, and the digital outlet itself. The program also provides the underlying comments themselves, allowing text analysis or additional qualitative analysis, if desired.

3. Results and Discussion

Results are presented in Table 1 (one week), Table 2 (one month), and Table 3 (three months). Included are data on the media brand's volume, sentiment, top influencers (average score of top 10 on a 0-100 scale), language, and media source. For the language and media source metrics, offering an extended list of sometimes rare possibilities, only those options with at least one reading above 2.0% were included.

Table 1: News Media Brands, Sentiment and Related Metrics (3 months)

Metric		WSJ	Economist	NYT	Wapo	Mashable	Buzzfeed
Volume		112K	356K	3.9KK	2.2KK	190K	728K
Sentiment (positive)		40.2%	48.8%	40.2%	33.1%	70.6%	62.2%
Influencers		98	98	98	98	97	98
Platform	Twitter	84.3%	85.3%	71.4%	91.6%	89.9	83.1%
	Aggregators	4.8%	1.6%	2.6%	1.7%		
	YouTube	2.0%	7.4%	4.7%	2.8%	1.9%	5.8%
	Forums	4.4%	2.6%	17.0%	1.8%		
	Blogs	2.5%		2.9%			
	Facebook					3.2%	6.7%
Language	English	54.1%	43.5%	62.3%	85.5%	91.8%	54.8%
	Spanish	19.0%	17.3%	2.5%		1.3%	2.0%
	Japanese	7.4%			4.6%	0.8%	31.7%
	Finnish			25.6%			
	Turkish		26.7%				
	Russian	2.6%					
	Portuguese	7.2%					6.1%

Over the longer period of time, some patterns relating to the brands are clear, others less so. As these are news brands, variations in volume are likely to be influenced heavily by current news topics as opposed to discussions directly related to the brands themselves. So we tracked volume but paid less attention to variance than in previous studies. Even so, the volume differences are interesting. The traditional general interest brands (NYT, Wapo) obviously have much more activity than the other new media brands. Buzzfeed shows particular strength vs. Mashable in volume between the two newer media brands. And international focus and readership (Economist, WSJ) don't necessarily translate into stronger relationships with readers, at least not when compared with the more locally/regionally focused media brands (NYT, Wapo) with both continuing to have a considerable presence in New York City and Washington, respectively. Brand connections and relational capital can apparently be stronger with more immediate connections than might be the case with a broader, more

international reach. The one-month and one-week results show similar patterns though the WSJ had a particularly active month (likely due to the arrest of one of its reporters in Russia, a major news story in which the brand was intimately involved).

Table 2: News Media Brands, Sentiment and Related Metrics (one month)

Metric		WSJ	Economist	NYT	Wapo	Mashable	Buzzfeed
Volume		45K	81K	1.3KK	773K	69K	255K
Sentiment		32.3%	43.4%	40.2%	33.1%	69.5%	67.2%
Influencers		98	98	98	98	96	97
Platform	Twitter	84.7%	85.3%	72.3%	92.8%	90.2%	84.3%
	Aggregators	4.8%	2.3%	2.6%	1.4%		
	YouTube	2.1%	5.7%	5.1%	2.7%	2.6%	5.6%
	Forums	4.0%	2.5%	15.9%	1.4%	3.1%	
	Blogs	2.5%		2.7%			
	Facebook						6.5%
Language	English	51.5%	60.4%	62.7%	87.1%	92.5%	53.5%
	Spanish	31.3%	15.2%	2.9%		1.5%	2.0%
	Japanese	5.9%			3.8%	1.0%	36.1%
	Finnish			25.9%			
	Turkish		7.2%				
	Russian	2.9%					
	Portuguese	0.8%					6.1%

Influencers show little difference between the media brands sampled. All have followers with considerable reach of their own. Even the slight differences in average top influencer rating (96 vs. 98) are so minimal as to be inconsequential. Once news media brands reach a certain level of awareness and credibility, top influencer attention seems to be a given. The one-month and one-week results show a similar consistency across all brands.

Sentiment is a different case. The results generally agree with previous findings that the more active, probably more valuable brands do not necessarily have the highest positive sentiments. Indeed, with media companies, the reach and popularity of the brand are almost inversely related with sentiment. The US-based mainstream media brands (WSJ, NYT, Wapo) are all *majority* negative sentiment. *The Economist* fares somewhat better. Interestingly, the newer, more digital-focused brands (Buzzfeed, Mashable) have very high positive sentiment, 50-100% higher than the legacy media brands. These show more movement in the one-month and one-week results but that points to the relative stability of the stronger brands, as predicted by previous research.

Table 3: News Media Brands, Sentiment and Related Results (one week)

Metric		WSJ	Economist	NYT	Wapo	Mashable	Buzzfeed
Volume		13K	18K	352K	226K	23K	53K
Sentiment		35.3%	40.1%	39.3%	28.5%	74.5%	58.0%
Influencers		98	97	98	98	96	95
Platform	Twitter	81.4%	84.8%	75.6%	95.1%	93.4%	84.4%
	Aggregators	6.8%	2.4%	2.4%	1.0%		
	YouTube	2.4%	5.9%	3.8%	1.5%	1.8%	
	Forums	4.0%	2.5%	14.3%	1.0%		4.3%
	Blogs	2.9%		2.5%			

Metric		WSJ	Economist	NYT	Wapo	Mashable	Buzzfeed
	Facebook					2.1%	7.3%
Language	**English**	75.3%	65.6%	65.7%	90.7%	93.9%	67.8%
	Spanish	3.8%	16.3%			0.9%	2.1%
	Japanese	5.2%		2.0%	3.6%	1.9%	19.2%
	Finnish			25.2%			
	Turkish		2.5%				
	Russian	5.2%					
	Portuguese	0.8%					5.5%

This difference points to some interesting capabilities of this methodological approach. As in previous studies, opinion is divided on the perceived strongest brands. Their advocates are strong supporters while the emotions engendered can be just as strong in the other direction (e.g. Apple vs. Samsung) and consistently voiced in digital arenas. But what's interesting about sentiment analysis is the ability to go deeper to investigate curious or interesting findings. Even a cursory review of chatter concerning *The Wall Street Journal* shows there is a troll who posts on virtually every tweet concerning the brand. The tweet is a canned reminder that the WSJ is owned by Rupert Murdoch's News Corp and therefore affiliated with Fox News. The constant comments aren't meant as complimentary. Similar granularity can be found when the sentiment results are paired with some of the other data, as we'll discuss shortly.

The platform results are also relatively consistent but have some noticeable differences. Twitter is by far the medium of choice for users engaging with all the media brands. The lowest percentage of activity on Twitter is 72.3% at the NYT while it ranges over 90% for Wapo and Mashable. And while a preference for Twitter is pretty consistent, there are noticeable other differences across the brands. For one, the newer digital brands (Mashable, Buzzfeed) are heavily dependent on social media for their engagement, with Twitter, YouTube, and Facebook taking the large majority of attention. The only exception is some presence on Forum pages by Mashable users. The more established media brands, on the other hand, show more of a presence in news aggregators and, especially in the case of the NYT, in forums (a starkly high 15.9%). That likely says something about the nature of the content appreciated by users (harder news?) that translates into a different brand perception. The popularity of digital media outlets doesn't vary much on the one-month and one-week results, even including the outliers such as the NYT forums.

The languages provide more context as to the brand's reach across borders, whether relational capital is localized or more global. Country metrics are available through the Social Studio system, but these are commonly limited as identification seems to be a challenge. Results often show 40-50% of source country to be unknown. But languages provide some similar and more comprehensive data. Language does have some of its own challenges (are Portuguese speakers from Portugal or Brazil? Spanish speakers from Europe or South/Central America?) but can be made pretty useful with a few reasonable assumptions. Here, Wapo, Mashable, and even to some degree the NYT are more heavily engaged with English speakers, suggesting more of a domestic brand value and relational capital. *The Economist*, unsurprisingly, has the highest following of non-English speakers with WSJ not too far behind. WSJ does have foreign editions, including a Japanese language one. Buzzfeed shows similar levels of engagement with Japanese speakers. As with the other indicators, these results are fairly stable across shorter time periods, even including the odd outcomes such as the popularity of the NYT in Finnish digital media.

The Social Studio methodology provides the interesting quantitative results reviewed but also has the capability to go deeper, on a qualitative level, into the data to explore anomalies. In the language results just covered, for example, there's an odd and consistent pattern of Finnish users engaging with the NYT brand. Given the size of Finland and its relative economic and political standing, it's just strange that it figures so prominently compared to numerous other countries. With Social Studio, that could be explored, looking in detail at what Finnish speakers are chatting about. Looking at the data also provide insights such as the WSJ troll commenting on almost every tweet mentioning the brand. One entre into the deeper analysis is text analysis, and that comes with the Social Studio results, as illustrated in Figures 1 and 2.



Figure 1: Wall Street Journal Word Cloud (one week)

Just from the word cloud summary, the WSJ (more traditional news media brand) seems more newsy, with serious topics such as their journalist Evan Gershkovich detained in Russia and more standard language such as reporting, media, etc. The Buzzfeed cloud (digital brand with a younger demographic) is more casual, with stories less about worldwide news events and politics and more about soft news topics like dogs, couples, food. Word usage is also more relaxed as illustrated by "pissed" and "prick". Again, the word clouds are more summaries of the deeper information found in the underlying qualitative results, but they indicate what general trends might be found there. And from a brand value/relational capital point of view, provide a better indicator of the nature of the relationship the brand has with its targeted customers. And what those customers value in the brand.



Figure 2: Buzzfeed Word Cloud (one week)

4. Conclusions

This study continues a research program aimed at better understanding relational capital and potential measurement approaches. In this case, the research focused on news media brands, with some long-standing, strong brand names and some newer digital-focused brands. The results show that we can identify organizations with stronger brands and relational capital by means of volume of digital media activity and sentiment levels.

The metrics can also shed light on more specifics of the relational capital. The nature of the customers, including location, global/local, and preferred digital media, can be discerned. More qualitative data, including major discussion key words and topics as well as oddities in the results, can be explored in more detail when questions come up in the more quantitative results. Overall, the approach yields a variety of different results and metrics. As a group they have considerable potential to add to our understanding of relational capital as a concept and as an organizational asset.

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Sharing Knowledge in Multi-Generational Teams in Remote Working Conditions During the Covid-19 Pandemic

Joanna Gajda
Częstochowa University of Technology, Poland

joannagajda@vp.pl

Abstract: The economic crisis caused by the coronavirus pandemic has contributed to changing the philosophy of managing a multi-generational team. The COVID-19 pandemic is accompanied by a general atmosphere of uncertainty, which creates a sense of chaos and disorganization. Its effects are felt by numerous organizations from many industries. Entrepreneurs have the opportunity to maintain business continuity by implementing remote work. Companies are increasingly opening up to remote work, seeing many new opportunities in it that they want to actively use. Hence, there is an urgent need for companies to develop effective actions that will motivate a multi-generational team to share knowledge, strengthen its skills and competences in this area, and build commitment to ongoing work for optimal performance of permanent duties. Although it requires more effort, especially from the managerial staff, remote implementation of the duties entrusted to multi-generational teams may prove effective in achieving business goals thanks to the knowledge and experience of specialists. Team management in the covid reality has taught Polish managers that in order to stimulate people to be active in sharing knowledge, it will be crucial to show care for the needs of employees and integrate them with the goals of the organization. This approach underlies how companies manage multi-generational teams efficiently in the Covid reality and will pay off in the future. The considerations in the article were based on literature studies and the analysis of the results of surveys conducted from March to November 2022 on a group of 258 people representing all generations. The first part of the study is of a theoretical nature and discusses the factors determining the efficient sharing of knowledge in multi-generational teams in conditions of remote work forced by the epidemiological situation. The second part of the study concerns pilot studies conducted in Polish companies in order to obtain and analyze the opinions of employees regarding the conditions for sharing knowledge in the situation of remote work, which came suddenly. This article is an attempt to answer the question of whether belonging to a specific generational group has a positive effect on the transfer of knowledge during a pandemic. Obtaining a cross-sectional nature of the considerations is a contribution to further and extended research in the field of the issues raised.

Keywords: Knowledge, Knowledge sharing, Multi-generational team, Remote work, Covid-19 pandemic

1. Introduction

The COVID-19 pandemic has affected many areas of human activity, making it necessary to adapt to new environmental conditions. One of the areas where changes took place was professional work. Work could be performed remotely. Moving her from the office to her home resulted in a reduction of relations with the members of the employee team. For the effectiveness of work in remote teams, it is crucial to provide them with space to share knowledge and experience.

The analyzes presented in this study were conducted on the basis of the available literature on the subject and our own quantitative research. The chi2 statistic was used to conduct the study. The results of the conducted analyzes are presented in the further part of the article. The research tool used was a questionnaire. The questionnaire was distributed via e-mail using the CAWI technique. The analysis of the survey results was carried out from March to November 2022 on a group of 258 people representing all generations. When deciding on the selection of the research sample, the method of purposive selection was used for the sake of the participation in the study of people belonging to different generational groups, performing their professional duties remotely during the pandemic.

2. Literature Review

2.1 The Essence of Knowledge Sharing

L.C. Witherspoon, J. Bergner, C. Cockrell, D.N. Stone (2013) represent the approach according to which, in the modern knowledge-based economy, sharing it is the most important process of knowledge management. As noted by the U.W. Borgoff and R. Pareschi (1997) "knowledge that does not flow, does not grow and eventually grows old, thus becomes obsolete and useless, unlike knowledge that flows, and because it is acquired and exchanged, it generates new knowledge" . According to A. Rudawska (2013), knowledge sharing is a typical situation of cooperation in which the benefit associated with achieving the desired results is obtained depending on the actions taken by the sender of knowledge and its recipients. These activities have been included in the definition proposed by E.D. Darra and T.R. Kurtzberg (2000), according to which, during the sharing of knowledge, a learning process takes place in the recipient as a result of using the experience of

the knowledge provider. According to the suggestion of the aforementioned authors, knowledge is shared through the interaction of one individual with another, which consists in learning aimed at acquiring knowledge by the recipient of this knowledge. B. Rychta (2022) emphasizes after T.H. Davenport and L. Prusak (2000) that knowledge sharing consists in the transfer of knowledge and its dissemination on at least a two-way level, where trust becomes the basis of the relationship between people participating in this process. During this process, which is voluntary and often spontaneous, individual knowledge, previously hidden in the mind of a given person, is revealed (Pietruszka-Ortyl, 2011), and consequently results in a change in the level of knowledge and behavior of the provider and recipient of knowledge (Rychta, 2022) . I. Michalik (2019) notes after M. Morawski (2017) that in the process of knowledge sharing, which is based on interpersonal relations between employees, it is transferred based on the experience gained, skills tested in practice, personal views, and professed values.

2.2 Multi-Generational Teams and Knowledge Sharing Within an Organization - A Theoretical Perspective

Multi-generational teams are part of functioning organizations. Representatives of four generations work together in them (Mazur-Wierzbicka, 2015):

- baby boomers (born in the years 1945 - 1964) started their professional life at the turn of the 1970s and 1980s,
- generation X (born in the years 1965-1980) grew up during the economic collapse in the 1970s, and their entry into professional life took place after 1989,
- generation Y (born in the years 1981-1994, the so-called millennials) brought up in times when the Internet came into common use,
- generation Z (born after 1995, post-millennials), whose constant presence in virtual reality has led to the inability to distinguish it from the real world.

Due to the fact that the formation of their system of values, attitudes and behaviors took place in different economic and political conditions, each of these generations requires understanding the different reasons for their actions (Skowronek, 2022). Regardless of their age diversity, common goals resulting from the essence of the work of multi-generational teams should be referred to, which, having diverse knowledge and experience, should be aware of the opportunity to strengthen the organization's position on the market (Smolbik-Jęczmień, 2017). The key to successful cooperation within an age-diverse team is to create conditions and an atmosphere of partnership conducive to the exchange of knowledge and experience (Jarzębowski, 2022). In order for an organization to improve the exchange of knowledge, it is necessary to tighten intergenerational cooperation, which requires the following conditions to be met:

- “non-judgmental, openness to otherness, acceptance of the diversity of attitudes, experiences and appearance, curiosity of other people, willingness to get to know each other;
- openness to mutual listening and reciprocity learning;
- creating an atmosphere of "being together", not educating, teaching;
- breaking age stereotypes, vigilance against stereotypes and dominance;
- building a sense of commitment to each other and to the environment;
- taking care of integration, looking for common "spaces" (passions, experiences, etc.);
- full participation of every generation (Wiktorowicz, 2020)”.

In the first place, the employer should ensure that all the above conditions are met, contributing to ensuring the flow of knowledge and experience between employees of different ages. Older employees pass on the secrets of the profession, institutional memory, company traditions to the younger ones, while the young ones pass on new theoretical knowledge and skills related to new technologies (Midor, Zasadzień and Szczęśniak, 2015)

2.3 Remote Work in The Context of the Covid-19 Pandemic

In the era of the covid-19 pandemic, companies faced the challenge of reorganizing their everyday life and adapting to the current situation. Remote work has turned out to be a new reality for many employers and employees, in which they have to learn to function. As it soon turned out, this is not only a technical challenge, but also a relational one (Prasołek and Kiełbratowska, 2021).

In the literature on the subject, remote work is defined as work performed at any distance from the place where its effects are expected or where it would be performed under the traditional employment system, using available IT and telecommunications techniques. Its main attribute is that the employer receives results

specific work, and the worker - beyond the gain of time and funds to travel to the company's headquarters - it has a certain contact of combining work with other activities and needs (Wiśniewski, 2014). Although the positive effects of remote work are noticeable, communication and effective the ability to manage a team of employees in the context of their effective knowledge sharing (Dojwa-Turczyńska, 2021).

In a situation of a pandemic threatening the lives of people all over the world, it was possible to work remotely under the so-called the covid law of March 2, 2020. The time of spreading the pandemic allowed employees to take a stance on this work organization model. Article 3(4) of the Act of March 2, 2020 details the employer's obligation to provide subordinates with the tools and materials necessary to perform remote work (Journal of Laws 2020, item 374).

3. Methodology

Since March 20, 2020, a state of epidemic has been in force in Poland due to the outbreak of COVID-19. This situation has contributed to a change in the way work is performed. The aim of the conducted research is to show how the COVID-19 influenced the sharing of knowledge among people from different generations working remotely. The answers provided by the respondents were analyzed in terms of belonging to a generational group.

Respondents from all over Poland took part in the survey. The characteristics of the research sample are presented in Table 1.

Table 1: Characteristics of the Research Sample

Generation	Women	Men	N = 258
Baby boomers	11	7	18
X	23	11	34
Y	57	39	96
Z	84	26	110
Total	175	83	

Source: Own research

For the given research sample, the $\chi 2$ test of independence was performed. On its basis, it was assessed whether the nature of the answer to the question asked depends on the respondent's belonging to the young generation (Y and Z) or the older generation, referred to as the Baby Boomers generation and Generation X. The null hypothesis (H0) assumes that belonging to a given generation does not affect the answer , while the alternative hypothesis (H1) indicates that the answer depends on belonging to the selected generation. The test was carried out for the significance level $\alpha=0.05$.

For the purposes of the conducted research, the following research hypotheses were formulated and verified:

H1: Employees of older generations experienced more incentives to share knowledge while working remotely in the covid reality compared to employees of other generations.

H2: With age, employees feel barriers to the exchange of knowledge and experience when working remotely in the covid reality.

4. Results

To verify the research hypotheses, correlations between the following were developed and analyzed:

- *activities of the management staff encouraging employees to exchange knowledge in remote working conditions in the pandemic reality, and belonging to a generational group.*
- *barriers to the exchange of knowledge among employees of different generations during remote work, and belonging to a generational group.*

Encouraging employees of different generations to actively participate in knowledge sharing is a basic condition ensuring the effectiveness of this process within the organization. The results obtained are presented in Table 2 below. The results presented in it show that there is no statistically significant correlation between the analyzed variables and inform that this research hypothesis is false.

Table 2: Management Activities Encouraging Employees to Share Knowledge in Remote Working Conditions During Covid-19

Specification	Baby boomers	X	Y	Z	ch2 critical= 16.919 chi2 stat = 3.69	df= 9 a = 0.05	Hypothesis
equipping employees with equipment enabling the transmission of information and online communication	77,7%	91,1%	92,7%	88,1%	0.71	0.05	H0
holding regular online team meetings	61,1%	58,8%	84,3%	80%	0.71	0.05	H0
Allowing employees to have non-work-related conversations at allotted times	44,4%	38,2%	36,4%	43,6%	1.46	0.05	H0
virtual meetings over coffee after work	66,6%	76,4%	95,8%	92,7%	0.81	0.05	H0

Source: Own research

The analysis of the research results leads to the conclusion that employees belonging to each of the generational groups experienced a high degree of incentives from the management to share knowledge while working remotely. This tendency clearly indicates the trust shown to subordinates and the perception by superiors of the benefits resulting from the exchange of experiences between employees "from different eras". By equipping employees with communication equipment, the management staff clearly focuses their attention on enabling them to cooperate for the efficient flow of information, because it is conducive to achieving the set goals. Respondents belonging in particular to the Y and Z generations point to the initiative of virtual meetings over coffee after work for a reason. This type of activity may be important enough to strengthen relations between employees and trigger greater motivation in them to share knowledge and experiences. As the vast majority of employees of the Y and Z generations have noticed, employers promote online team meetings, organized with the aim of regularly sharing valuable knowledge with each other, allowing the company to stand out from its environment, and thus enable efficient functioning in the covid reality. In last place were activities related to the consent of superiors to conduct conversations not related to work at the appointed time. The lower popularity of this type of incentives to exchange knowledge may result from the fear that the time spent during working hours on conversations not related to work may be wasted time.

The results presented in Table 3 show that there is a statistically significant correlation between difficulties in sharing knowledge and belonging to a generational group. Hypothesis 2 was confirmed.

Table 3: Barriers to knowledge Exchange Among Employees of Different Generations in Remote Working Conditions During Covid-19

Specification	Baby Boomers	X	Y	Z	chi2 critical= 21,026 chi2 stat = 34.62	df= 12 a=0,05	Hypothesis
resistance to the use of modern methods of remote communication	61,1%	26,4%	7,29%	3,63%	10.31	0.05	H1

Specification	Baby Boomers	X	Y	Z	chi2 critical= 21,026 chi2 stat = 34.62	df= 12 a=0,05	Hypothesis
no direct communication	64,7%	70,5%	40,6%	41,8%	2.46	0.05	H1
risk of loss of data and confidential information	33,3%	8,82%	1,04%	41,8%	11.58	0.05	H1
distractions - activities of other family members	44,4%	17,6%	13,54%	3,63%	5.5	0.05	H1
poor quality of the Internet connection and network equipment making it difficult to exchange files and transfer information	83,3%	61,7%	30,2%	42,7%	4.77	0.05	H1

Source: Own research

Based on the conducted χ2 test, it can be indicated that there are personal barriers of employees and independent of them, which make it difficult for them to share knowledge with each other during remote work. The older the employees, the more often they feel reluctance to share knowledge due to the lack of skills in using modern methods of remote communication - BB (61.1%), X (26.4%). Employees of the BB (64.7%) and X (70.5%) generations, due to the inability to establish a face-to-face conversation, more often than younger employees see difficulties in establishing contact via the Internet in order to share knowledge with other people. Mainly employees from the BB group (33.3%) and Z group (41.8%) perceive conversations via messengers as an obstacle to the exchange of knowledge due to the risk of losing confidential information. The older generation of employees (BB - 44.4%, X-17.6%) are reluctant to share their knowledge with other people at work when family members are in their company. From the perspective of employees of all generations, those who use their own Internet equipment, its inefficient operation made it difficult to quickly exchange information with other members of the organization.

5. Discussion

The conducted research leads to the conclusion that working remotely was conducive to sharing knowledge in the covid situation, but not to a sufficient extent. The managerial staff should encourage employees to share knowledge through the use of instant messengers for online communication for the intergenerational exchange of knowledge. The essence of this aspect is pointed out by K. Kirchner, Ch. Ipsen, A. R. Andersen (2023), who believe that they can effectively communicate with employees. Digital tools turn out to be useful for organizing and conducting online meetings that enable frequent remote contact with employees, conducting discussions conducive to generating many new ideas facilitating the exchange of information. The opinions of the quoted authors are confirmed in this study, which shows that a significant percentage of respondents who have been equipped with equipment enabling them to communicate online with other team members send them important information showing what they are currently working on; share files to gain knowledge about the progress of tasks. It can be assumed, as indicated by this research, that Polish managers attach great importance in their online work to organizing regular team meetings that foster the ongoing exchange of information and working out joint actions in the context of bothering problems and important matters. Kirchner and N. Forsberg (2021) came to similar conclusions in the presented context, placing a strong emphasis on creating an alternative to the real environment, which can be a virtual space for knowledge exchange. It can be a good way to promote spontaneous cooperation in which employees willingly share their knowledge and share experiences. Management aware of its role in the knowledge exchange process should not forget to encourage employees to participate in virtual meetings over coffee. Being able to talk to each other freely during informal meetings will help to strengthen bonds in the team. The freedom to be together

and talk about everything would avoid many of the barriers to sharing knowledge that the participants of this study encountered. As emphasized by M. A. Rafique, Y. Hou and co-authors (2022), despite the fact that modern technologies have an impact on improving work efficiency, they must face some challenges, such as communication barriers. Remote work involves isolating employees. As a result of the lack of direct face-to-face contact, superiors may not see the problems faced by their subordinates, such as lack of motivation to share knowledge and low involvement in this process.

Referring to the aforementioned research by K. Kirchner, Ch. Ipsen, A. R. Andersen, it is worth noting here that due to the mandatory home isolation caused by the pandemic, employees experienced a lack of spontaneous interactions with their colleagues, which in turn contributed to the emergence of many problems related to the transfer of knowledge. The quoted authors observed that in the face of the pandemic situation, employees are less likely to focus on transferring their knowledge to others, thus closing the way for themselves and others to gain this knowledge.

Difficulties related to the exchange of information also result from the reluctance to use modern methods of remote communication. In order to prevent this, superiors should engage subordinates to cooperate on-line on the implementation of the tasks entrusted to them, in order to overcome resistance to the exchange of knowledge and active discussion. A. Jeran (2016) draws attention to an important area of remote work effectiveness that concerns technical issues. This aspect of remote work was also reflected in this research. For the dissemination of knowledge, “quality, reliability are extremely important and bandwidth of used connections (e.g. broadband Internet), as well protection of sensitive company data. The above factors were the reason for the difficulties faced by the respondents, regardless of their age, in the knowledge exchange process. Technical problems, such as: low quality of the Internet connection and network equipment constituted a barrier to the exchange of knowledge, and even an increased risk of data and confidential information loss.

To sum up, remote work should be performed in social and organizational conditions that minimize the feeling of uncertainty and social isolation. To this end, space should be created for the exchange of knowledge and experience in virtual teams performing remote work in order to counteract the feeling of social isolation and the lack of support in the implementation of this process.

6. Conclusions

The first part of the study made it possible to determine, from the employee's perspective, the type of actions taken by the management towards subordinates belonging to different generational groups to encourage them to share knowledge in remote working conditions during Covid-19. The results show that belonging to a generational group is negatively correlated with the activities of the management staff. This means that regardless of the age of the employees, the superior takes specific actions to encourage subordinates to be active in the field of knowledge sharing. The summary of the research results gives the opportunity to identify those activities that are conditioned by the form of employment that appeared in the regulations in 2020 - remote work. As a result of the pandemic, many companies have moved their activities online. Therefore, the employees were equipped with equipment enabling the transfer of information and online communication. Despite the lack of face-to-face contact, it is worth taking care of strengthening the bonds between employees. For this purpose, superiors regularly organize team meetings on-line, encouraging them to share information in the context of what is currently happening in the company. In addition, some companies allow employees to have non-work-related conversations at certain times. What's more, employee teams conduct conversations and share information during virtual meetings over coffee after work. This may indicate that they make a well-coordinated team. Although for some remote work has become a convenient form of employment, for others it turned out to be a challenge. The results from the second part of the study show that belonging to a generational group is positively correlated with the barriers that employees experience in the context of knowledge exchange during remote work. The hypothesis was confirmed that with age, employees experience difficulties in sharing knowledge and their experiences while performing their professional duties remotely in the difficult covid reality. The main barriers include: poor quality of the Internet connection and network equipment, which make it difficult to exchange files and transfer information; no direct communication; resistance to the use of modern methods of remote communication; activity of other family members, distracting attention during the exchange of knowledge; fear of losing data and confidential information.

The conclusions of this research provide feedback to the staff responsible for managing employees of different generations that employees notice their actions to share knowledge. Moreover, the analysis of barriers to the

exchange of information and sharing one's own experience with others should contribute to the search for and indication by employers of ways to reduce them.

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A Panel Regression Analysis of the Role of Globalization and Internet Penetration on Economic Development in the Czech Republic and Slovakia

Mohammed Ibrahim Gariba and Romana Provazníková
Institute of Economic Sciences, Faculty of Economics and Administration, University of Pardubice, Czech Republic.

Garibaibrahimbabangida@gmail.com
romana.provaznikova@upce.cz

Abstract: It is evidently clear that globalization is seen widely in recent times as a means of knowledge-based economy, and more importantly, an instrumental indicator to influence economic development. For this reason, some researchers are increasingly interested in how globalization impacts our society leading to economic growth. In this paper, we investigate the relationship between globalization, internet penetration, and economic development in Czech Republic and Slovakia. Panel Regression analysis is employed to analyze a twenty two-year panel data (from 2000 to 2022), using secondary data from the World Bank, OECD, and UNDP database of the selected countries. We analyze globalization variables such as trade openness, internet penetration as independent variables and used infrastructural investment, political instability index, and labor force participation rate as control variables. Also, with economic development as a dependent variable, we used Human development index, and GNI per capita to ascertain the effect of globalization and internet penetration on economic development. The results showed a significant positive correlation between trade openness with HDI and GNI in both Czech and Slovakia. The analysis also found that internet penetration has a significant impact on HDI and GNI in Czech, but not on GNI in Slovakia. This study highlights the important role that globalization and internet penetration play in economic development and provides valuable insights for policymakers in Czech and Slovakia. The findings of this study contribute to the existing literature on the relationship between globalization, internet penetration, and economic development.

Keywords: Globalization, Internet, Economic development, Knowledge, Regression analysis

1. Introduction

The integration of nations through globalization and the development of digital technologies have resulted in significant changes in the world economy (Malik, 2018). Countries have been seeking to participate more in the global economy to improve their economic development. Trade, capital flows, and technological advancements have provided new opportunities for economic growth and development. The internet has revolutionized how businesses operate, allowing individuals and firms to engage in global trade and exchange information (Kagermann, 2014). The Czech Republic and Slovakia, both former socialist countries, faced challenges during their transition to a market-oriented economy, including high unemployment rates, inflation, and political instability (Leff, 2018). However, both countries have made considerable progress in recent years, and their economies have been growing steadily.

Globalization refers to the integration of economies, societies, and cultures through trade, communication, and the exchange of goods and services (Marginson, 1999). With the advent of the internet, the process of globalization has accelerated, making it easier for countries to engage in international trade and collaborate on various projects. The Czech Republic and Slovakia have taken advantage of the opportunities offered by globalization and the internet to achieve significant economic growth (Carayannis & Popescu, 2005).

Internet penetration refers to the extent to which a country's population has access to and uses the internet (Brandtzæg, et al., 2011). The internet has transformed the way people interact, communicate, and access information, and has also had a profound impact on businesses and the economy. The Czech Republic and Slovakia have experienced a rapid increase in internet penetration in recent years, with both countries according to the world bank data ranking for 2021 showing 89% for Slovakia and 83% for Czechia and these figures are amongst the highest levels of internet usage in Europe. Bayar et al. (2021) in their research on the effect of internet usage on financial inclusion in 11 countries of European Union using data between 1996 to 2017 in a causality analysis. Found that internet usage poses both negative and positive effect on financial inclusion. The researchers indicate limitation of the study to sample size and data availability. This research responds to the call for future research to explore further the recent trend analysis using current data.

Moreover, research exploring the role of Information communication technology and globalization play on economic development in Organization for economic cooperation and development countries through the

ordinary least square analysis found that, ICT and globalization positively contribute to economic growth. The weakness of this study is the reliance on OECD countries without recourse to a comparative analysis (Kurniawati, 2020). By way of filling the gap, the current study employs a comparative analysis for the selected CEE countries. Myovella, et al. (2020) in their paper examined the contribution of digitalization to economic growth of Sub-Saharan Africa (SSA) in comparison with the OECD economies. The results show that digitalization has a positive contribution to economic growth in both countries. The limitation of the data on digital transformation restricts the studies to only use ICT usage. The need to explore more Digital transformation variables was highly recommended of which this study employs.

As elaborated, most of the studies have concentrated on just Globalization impact on economic development and most often relied on a measure for digitalization using ICT or the effect of globalization on economic development. However, the question of whether the knowledge of globalization (Trade openness) and internet penetration affect economic development in a model remains unanswered. To address the above-mentioned gap, *we aim to examine the role of globalization and internet penetration on economic development in the Czech Republic and Slovakia.* By using composite variables which were calculated from different set of factors based on a secondary data set. Specifically, we examine the impact of a key globalization variable: trade openness and internet penetration on economic development. We also use infrastructural investment, political instability index, and labour force participation rate as control variables. Economic development is measured through two indicators: the Human Development Index (HDI) and Gross National Income (GNI) per capita.

To the best of our knowledge, less to no study explores the link between knowledge of Globalization and internet penetration and economic development in Czech Republic and Slovakia. This study will give policy experts and the EU some implications to support and improve the ways in which globalization and digital technologies can contribute to economic development. We contribute to science by adding empirical and practical recommendations based on our review of the existing literature and econometric analysis.

The rest of the paper is organized as follows. The next section provides a brief review of the existing theories and literature to distinguish our paper from existing studies and help explain the contribution of our paper. In Section 3, we briefly describe our methodology and data sources. Section 4 outlines the empirical findings and In Section 5, we present Discussions and the conclusions and recommendations presented in chapter 6.

2. Theoretical Background and Literature Review

The theoretical background of this research topic, "The Role of Globalization and Internet Penetration on Economic Development" delves into the understanding of globalization and the internet, and their impact on economic development (Marginson, 1999; Brandtzæg, et al., 2011). The study of globalization and its impact on economic development has been a topic of interest for many economists (Gurgul & Lach, 2014). Some have argued that globalization has led to increased economic growth and development (Ali & Malik, 2021; Boriçi, 2016; Brown, & Lauder, 1996), while others have argued that it has led to increased inequality and destabilization (Milner, 2021; Sachs, 1998). In the context of this research, the focus will be on the relationship between globalization and internet penetration and their impact on economic development.

One of the key theoretical frameworks used to understand the impact of globalization on economic development is the New Economic Geography (NEG) theory. According to this theory, globalization leads to the concentration of economic activity in certain regions (Fujita, et al., 2001; Martin & Sunley, 1996). The theory suggests that globalization leads to increased competition, which leads to a reallocation of economic activity to regions that have a competitive advantage.

The impact of the internet on economic development has also been studied (Czernich, et al., 2011; Koutroumpis, 2009). The internet has been identified as a key driver of economic development, with many countries investing in internet infrastructure and technology to enhance their competitiveness (Salahuddin & Gow, 2016). Internet penetration has also been seen as a tool for reducing information asymmetries, leading to increased efficiency and productivity (Aboody & Lev, 2000).

In the context of the Czech Republic and Slovakia, this study is particularly relevant for both countries as they have undergone significant economic transformation since the fall of the Soviet Union, with both countries becoming integrated into the global economy and investing in internet technology (Roztocki & Roland Weistroffer, 2008).

2.1 The Role of Trade Openness and Economic Development

In this chapter, we reviewed the trade theory of factor proportions. According to this theory, countries will tend to specialize in producing goods that use their abundant factors of production relatively intensively, while importing goods that use their scarce factors relatively intensively (Samuelson, 1948). This suggest that openness to trade may also be related to the intensity of capital and knowledge, which are both important production factors (Agénor, 2004). This is consistent with the idea that trade involve the exchange of not just final goods, but also the production factors used to create those goods (Faeth, 2009). literature on Trade openness and economic development has grown significantly in recent years (Xu, et al., 2021). Researchers have been examining the impact of trade openness as a measure of globalization and other factors on economic development (Munir & Ameer, 2018; Silajdzic & Mehic, 2018; Tahir, et al., 2014). Studies on this topic have consistently shown that increased trade openness is either positively or negatively correlated with higher levels of economic growth. On the one hand, Hye & Lau (2015) in a study of trade openness and economic development in India, used an auto regressive analysis and the results reveals that, trade openness in a short run is found to be positively related to economic development. Researchers explored the link between trade openness and human development index and the findings reveal that, trade openness is positively related with human development index (Hamid & Amin, 2013). This relationship has been found to be particularly strong in developing cities, where trade openness is a critical factor for economic development. Yakubu & Akanegbu (2018) in their study of trade openness and economic growth found that trade openness significantly influences per capita income.

On the other hand, some studies have found a negative influence between trade openness and economic development. For example, Wang, et al. (2018) found that, improved openness in trade influences human development negatively. Silajdzic & Mehic (2018) in their research contend that trade openness may not necessarily lead to positive economic outcomes, particularly in less advanced transition economies like the CEE countries. Similarly, Atici (2009) in the research of CEE countries found that, trade openness is negatively related to human development. For our study, we will explore two measures of economic development: Gross national income and human development index. Based on the above existing literature, we hypothesize that:

> *H_1: Trade openness significantly affects the Human development and Gross national income per capita in Czech and Slovakia.*

2.2 Internet Penetration and Economic Development

The Internet has become a crucial component of modern society, with the number of devices connected to it growing rapidly. The Internet of Things has emerged as a significant trend in the digital transformation of businesses and the economy in recent years (Chan, 2020). The portion of the population with access to the Internet is measured by Internet penetration. The higher the Internet penetration, the greater the potential for people to access and share knowledge, thereby enabling new ways of doing business. In this context, trade openness can be compared with Internet penetration to see how traditional economies relate to the "new" economy (Guillén, & Suárez, 2005). high levels of Internet penetration can lead to increased access to knowledge. Thus, as traditional economies transition to the "new" economy, higher levels of both trade openness and Internet penetration could potentially drive economic growth (Urban, Oosthuizen & Chen, 2022). In terms of internet penetration, research has shown that higher levels of internet access are positively correlated with higher levels of economic growth and development. This relationship has been observed across different countries and regions (Billon, et al., 2018).

Several studies have examined the relationship between internet penetration and economic development in different countries and regions. A study by Qiang and Rossotto (2009) found a positive relationship between internet penetration and economic growth in developing countries. The study argued that the internet has the potential to increase productivity, enhance innovation, and facilitate trade, all of which can contribute to economic growth and development. a study by Salahuddin & Gow (2016) examined the impact of the internet on economic growth and development. The study found that internet penetration has a positive and significant effect on economic growth and development, as measured by GNI per capita. The study argued that the internet provides access to information and enhances communication, which can lead to increased productivity, innovation, and competitiveness.

Another study by Czernich et al. (2011) analysed the impact of broadband internet on economic growth and development in OECD countries. The study found that broadband internet has a positive and significant effect on economic growth and development, as measured by HDI and GNI per capita. The study argued that

broadband internet can enhance productivity, increase innovation, and facilitate access to markets, all of which can contribute to economic growth and development.

In contrast, a study by Amaluddin (2020) found a mixed relationship between internet penetration and economic growth in African countries. The study argued that while the internet has the potential to increase productivity and facilitate access to markets, it can also lead to increased inequality and social fragmentation, which can negatively affect economic growth and development. Bahrini & Qaffas (2019) found a negative relationship between internet penetration and economic growth. Based on the literature review, we propose the hypothesis that:

> ***H_2:*** *Internet penetration significantly affects the Human Development and Gross national income per capita in Czech and Slovakia*

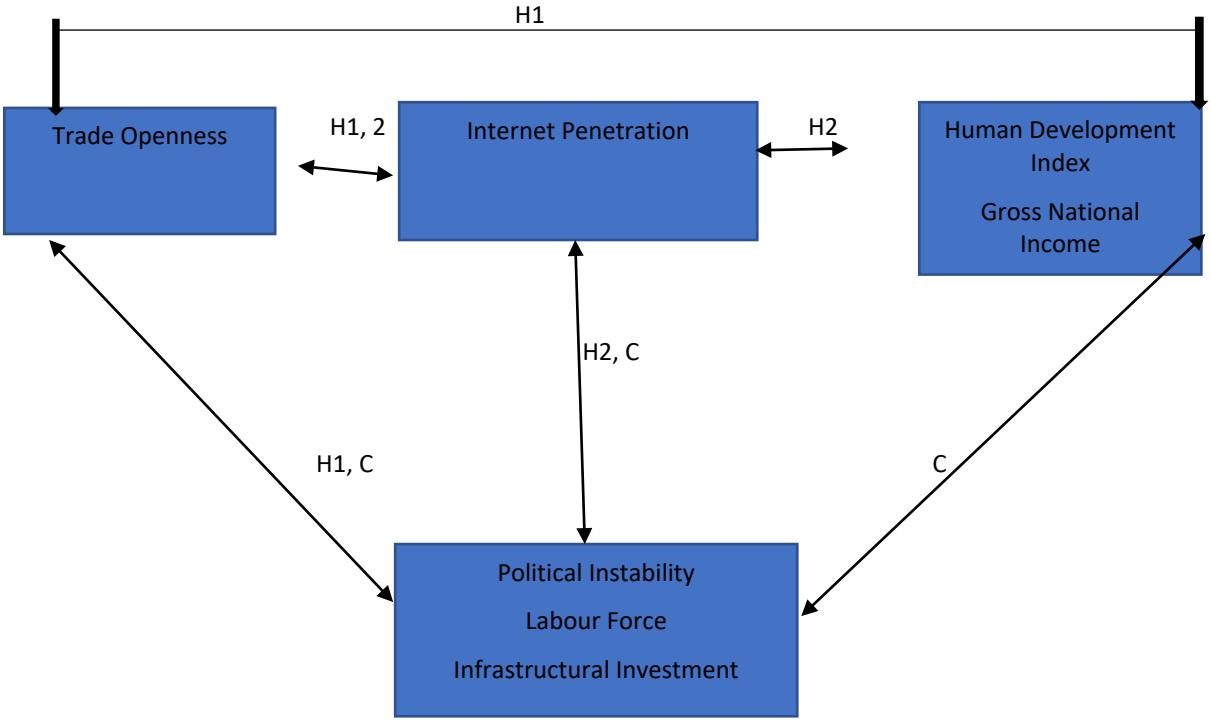


Figure 1: Conceptual Framework

The above figure 1 shows the depicted conceptual framework of the analysis on possible patterns of the causal relationship between globalization and Internet penetration contributions to improving economic growth within Czech and Slovakia. Based on the reviewed literature, the following hypotheses have been formulated.

> *H_1: Trade openness significantly affects the Human development and Gross national income per capita in Czech and Slovakia*

> ***H_2:*** *Internet penetration significantly affects the Human Development and Gross national income per capita in Czech and Slovakia*

3. Data and Methodology

3.1 Research Design

The main objective of this research is to ascertain whether knowledge of globalization and internet penetration contribute to economic development in the Czech Republic and Slovakia. We relied on quantitative research design in conducting this research using the panel regression modelling (Martinez-Vázquez, Lago-Peñas and Sacchi, 2017) in accordance with Montgomery et al. (2012), the panel regression analysis is adopted to have accurate and robust results when dealing with both dependent and independent data that are linear in nature.

3.2 Data Collection and Description

Empirical analysis is based on a panel dataset from the United nation's development program, World bank and the organization for economic cooperation and development. The research uses UNDP website for data

collection purpose on Human development index. OECD data on Gross national income per capita, trade openness, internet penetration, infrastructural investment, and labour force participation rate. World bank data on the political instability index was resorted to (Tang et al., 2019). We adopted the data and methodology initiated by Czernich et al. (2011). We used pooled data sets spanning twenty-two calendar years, specifically 2000 to 2022, and a sample of two countries as is the case of (Krishnan and Lymm, 2016). The sample used for the empirical model specification consisted of the Czech Republic and Slovakia. the reason being that these economies are in transition to the open capitalist market system, and with their historical connections, as well as poor recent performance score from the globalization ranking. The analysis realized twenty numbers of observations. The table below shows the variables used for the empirical, analysis.

Table 1: Descriptive Statistics of Variables

Variables	Description	Sources
Human Development Index (HDI) **(Dependent)**	The HDI is a composite measure that takes into account factors such as income, education, and health, to provide a comprehensive assessment of human well-being.	UNDP, 2022
Gross National Income per capita (Dependent)	GNI per capita is the average income per person in a country and is used as an indicator of standard of living	OECD (2023)
Explanatory variables		
Trade openness	It is defined as the sum of exports and imports divided by the GDP at current prices.	OECD (2023), Feenstra, et al. (2015)
Internet penetration rate	This measures the percentage of the population that has access to the internet	OECD (2023)
control		
Infrastructure investment	This indicator is measured as a share of GDP for total inland investment and in euros for the road, rail, air, inland waterways and sea components.	OECD (2023)
Political Instability	Measures Perceptions of the likelihood of political stability/ political motivated violence, including terrorism.	world bank. (2023); Tang et al., (2019).
Labor force participation rate	measure of the proportion of a country's working-age population employed or actively seeking employment	OECD (2023)

Source: Author's own adaptation

Mathematically, the Panel regression model is defined as:

$$y = \beta o + \beta ix + \varepsilon i \quad (1)$$

Where:

'Y' = dependent variable, i.e., control of corruption and corruption perception index

'βo'= dependent variable value, that is, the y intercept

'βi'= slope coefficient of each of the explanatory variables.

'x' = represents the value of the independent variable or the input variable

'εi'= represents the error term.

We use the pooled panel data in a panel regression model to examine variations in economic development contributions based on changes in predictor variables. The model assumes that the dependent variables are a function of the independent variables, and the error term is not normally distributed and is indicated by (εi). Hence, a nonlinear relation and function of these associations are mathematically given as follows for each of the models:

$$HDIy = \beta oHDI + \beta iGNI.C + \beta 2internetpent + infr.\ investment\ .invest + pol.inst + labour\ force + \varepsilon i \quad (2)$$

GNI.Cy= βoGNI.C+ β2internetpent+infr. investment .invest + pol.inst +labour force + εi (3)

3.3 Model Fit

We measured model fitness using collinearity analysis. We used the Variance Inflation Factor (VIF) for this purpose. The model showed the highest value of 5 which indicates no multicollinearity issues among the variables, with all variables showing less than value ten as opined by (Hair et al., 2017). Our analysis also shows that about 72% and 83% of the variance is explained in both models based on the R-squared figure.

4. Results and Findings

As stated above, the predictive accuracies power of our analysis shown in Table 2 are 72% and 83%, respectively using the Cohen's R-squared, for the models. These accuracies in our model explained can be said to be substantial and robust (Cohen, 2013). This study investigates how knowledge of globalization contributes to increasing economic development of the Czech Republic and Slovakia. We first analyze empirically the impact of globalization thus trade openness and internet penetration against HDI and GNI per capita to ascertain the nature of the relationship and the effect it has on economic development within the Czech Republic and Slovakia.

The results of the impact of each of the measures of globalization on economic development are shown and presented in Table 2. We evaluate the hypothesis 1 that *Trade openness significantly affects the Human development and Gross national income per capita in Czech and Slovakia*. The statistical results suggest that there is a significant relationship between trade openness and both Human Development Index (HDI) and Gross National Income (GNI) per capita as measures of economic development in Czech Republic and Slovakia. Specifically, the results show that trade openness has a positive and significant effect on both HDI and GNI per capita in both countries at a 99% and 95% confidence interval. In Czech Republic, the coefficient is high at 0.12, indicating that the relationship between trade openness and economic development is strong. In Slovakia, the coefficient is also significant at 95% and 99%, with a coefficient of 2 and 4 respectively, suggesting that the impact of trade openness on economic development is substantial in this country as well. Overall, these results support the hypothesis that trade openness significantly affects economic development in both Czech Republic and Slovakia.

Subsequently, we also tested for hypothesis 2, by testing the preposition that *Internet penetration significantly affects the Human Development and Gross national income per capita*.our study found that there is a significant positive relationship between internet penetration and both HDI and GNI per capita in the Czech Republic. This relationship is significant at a 99% confidence interval, indicating a high level of confidence in the results. The coefficient of 5 for HDI and 3 for GNI per capita in the Czech Republic suggests that for every unit increase in internet penetration, there is a corresponding increase in HDI and GNI per capita. In Slovakia, the study found that internet penetration is significantly related to HDI at a 90% confidence interval with a coefficient of 2. This suggests that for every unit increase in internet penetration, there is a corresponding increase in HDI. However, the study did not find a significant relationship between internet penetration and GNI per capita in Slovakia. Overall, the results support the hypothesis that internet penetration significantly affects human development and gross national income per capita, but the relationship may vary across countries.

Table 2: Regression Analysis Results for Czech and Slovakia Republic

Dependent Variables→	**Czech Republic**		**Slovakia Republic**		**VIF**	
	HDI	GNI	HDI	GNI		
Independent Variable/ Control	Coefficient	Coefficient	Coefficient	Coefficient		
Constants	31.33***	40.42***	31.33***	32.10***	**Czech**	**Slovak**
Trade openness	0.1297 ** (0.0230)	0.962*** (0.1248)	2.805** (0.018)	3.586*** (2.713)	5.361	2.029
Internet penetration	5.2150*** (0.0045)	3.347*** (0.0247)	2.261* (0.0102)	1.832 (0.087)	3.099	2.854

Dependent	Czech Republic		Slovakia Republic		VIF	
Political Instability -C	−2.4620** (0.0270)	- 2.274** (0.1466)	−1.467 (0.018)	−2.002* (0.156)	1.518	3.378
Labour force participation -C	3.2580*** (0.0199)	12.86*** (0.1079)	−1.777 (0.0702)	2.634**	4.012	3.015
Infrastructure -C	2.2070* (0.0038)	5.261*** (0.0206)	1.496 (0.006)	2.496** (0.599)	2.751	2.075
No. of Obs.	20	20	20	20		
R-squared	0.752040	0.7154	0.8540	0.8440		
Adjusted R-squared	0.715410	0.7080	0.8330	0.8130		
F-statistics	82.56703	68.4650	70.490	70.490		
Prob(F-statistics)	0.000000	0.0000	0.0000	0.0000		
(Homoscedasticit	4.57108	3.5964	4.0123	4.1123		
Akaike criterion	2471.179	2144.567	2040.400	2370.155		

***p<0.001, **p<0.01, *p<0.1. Note: *** Parameter significant at 99 % level, ** significant at 95 % level, * significant at 90 % level, standard errors are in curly brackets.

To reduce the level of bias in our empirical results, we controlled for economic development using labour force participation, political instability, and infrastructure investment. In the absence of bias, our control variables showed both positive and negative coupled with high and medium significance in modules one and two. Within all models, the control variables helped to ascertain the clear effect of the explanatory variables.

5. Discussion

The results of the study suggest that both trade openness and internet penetration are significant predictors of economic development in the Czech Republic and Slovakia. The results of the study confirmed the hypothesis that trade openness significantly affects both the human development index (HDI) and gross national income per capita (GNI) in both countries. This suggests that the more open the countries are to trade, the more likely they are to experience economic growth and development (Keho, 2017). This result is grounded in the new economic geography theory as expressed by Martin & Sunley (1996) who contend that, globalization leads to increased competition and reallocation of economic activity to regions that have a competitive advantage. Our findings also compliment the trade theory, which contend that countries will tend to specialize in producing goods that use their abundant factors of production relatively intensively, while importing goods that use their scarce factors relatively intensively (Samuelson, 1948). This suggest that openness to trade may also be related to the intensity of capital and knowledge, which are both important production factors (Agénor, 2004). Our results Is again consistent with previous studies that have highlighted the importance of trade openness in promoting economic development like Munir & Ameer (2018). Hye & Lau (2015) in a study of trade openness and economic development revealed that, trade openness in a short run is found to be positively related to economic development.

This study also found that internet penetration is a significant predictor of economic development in the Czech Republic and Slovakia. The results showed that internet penetration is significantly related to the HDI and GNI in the Czech Republic. Not only thus these results affirm our hypothesis two, but the significant effect also corroborates previous findings by Qiang and Rossotto (2009) whose study found a positive relationship between internet penetration and economic growth in developing countries. They argued that the internet has the potential to increase productivity and facilitate trade, all of which can contribute to economic development. Likewise, Salahuddin & Gow (2016) examined the impact of the internet on economic growth and development. The study found that internet penetration has a positive and significant effect on GNI per capita. The study argued that the internet provides access to information and enhances communication, which leads to increased productivity and competitiveness. In the case of the Czech Republic, the high coefficient for both trade openness and internet penetration indicates that these variables have a strong positive impact on economic development in the country.

In the case of Slovakia, the results are somewhat mixed. While the coefficient for trade openness is significant and relatively high, the coefficient for internet penetration is only significant with the HDI and not the GNI. This suggests that while internet access is important for promoting human development in Slovakia, it may not have as much of an impact on gross national income per capita. Even though this is not consistent with our expectations, it supports the position of Amaluddin (2020) whose research found a mixed relationship between internet penetration and economic growth. The study argued that while the internet has the potential to increase productivity and facilitate access to markets, it can also lead to increased inequality, which can negatively affect economic growth and development.

The findings of this research recommend some practical implications for policymakers and business owners in Czech and Slovakia. Governments in both the Czech Republic and Slovakia could focus on increasing trade openness through measures such as reducing trade barriers and tariffs, increasing international trade agreements, and encouraging foreign investment (Abrego, et al., 2019). This could potentially lead to higher levels of economic development as measured by HDI and GNI per capita. Both countries could focus on investing in internet infrastructure, such as expanding broadband coverage and improving internet speeds (Hambly & Rajabiun, 2021). This could help to improve internet penetration rates, which were found to be a significant predictor of economic development in the Czech Republic and to some extent in Slovakia. These practical implications could help policymakers and governments in both the Czech Republic and Slovakia to promote economic development and improve the well-being of their citizens.

This study however has some limitation, the variables and number of countries studied are limited. Hence, results cannot be generalized.

6. Conclusion

In conclusion, the results of this study highlight the importance of both trade openness and internet penetration in promoting economic development in the Czech Republic and Slovakia. The findings suggest that policies that promote trade and internet access are likely to be effective in promoting economic growth and development in these countries. However, the study also indicates that the impact of these variables may vary depending on the specific indicator used to measure economic development. While trade openness appears to have a strong impact on both the HDI and GNI in both countries, the impact of internet penetration is more closely related to the HDI in Slovakia.

Future research can expand on this study by examining the impact of other variables such as political stability, investment in education, and the effects of regional disparities on economic development in Czech and Slovakia. Additionally, studies that compare the effects of trade openness and internet penetration on economic development across multiple countries can provide insights on how to improve economic development in different regions.

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Green Knowledge Management and Innovation for Sustainable Development: A Comprehensive Framework

Maryam Ghorbani
Isfahan University of Technology, Iran

ghorbanimaryam091@gmail.com

Abstract: This paper explores the concept of Green Knowledge Management (GKM) and its relationship with sustainable development and green innovation. A comprehensive review of relevant literature was conducted to gain a better understanding of the components of GKM. Based on this review, a conceptual framework was proposed to outline the intricate interrelationships between GKM, green innovation, sustainable development, organizational green culture, consumer resistance, pro-environmental behaviour, and environmental knowledge. The proposed framework stresses the significance of managing green knowledge effectively to attain sustainable development goals through green innovation. It also highlights the importance of promoting an environmentally friendly culture within the organization to strengthen the link between green knowledge management, green innovation, and sustainable development. Furthermore, the framework acknowledges the potential resistance of consumers towards adopting green innovation products. To overcome this challenge, companies must provide adequate environmental knowledge and encourage pro-environmental behaviour among consumers. This will enable companies to manage their green knowledge effectively and promote sustainable development through green innovation. In conclusion, GKM is a crucial factor in developing green innovation and achieving sustainable development. Organizational green culture plays a significant role in strengthening the bond between GKM and sustainable development. The proposed conceptual framework provides a clear understanding of the complex relationships between green knowledge management, green culture, sustainable development, consumer resistance, pro-environmental behaviour, and environmental knowledge. It underscores the importance of managing green knowledge and fostering an environmentally friendly culture within organizations to achieve sustainable development goals through green innovation. This paper's findings have significant implications for companies that seek to promote sustainable development through green innovation. By effectively managing their green knowledge, companies can develop innovative solutions that address environmental challenges while achieving sustainable growth. Furthermore, by promoting an environmentally friendly culture, companies can ensure that their employees and customers embrace sustainability as a core value, leading to a more sustainable future for all.

Keywords: Green knowledge management, Green innovation, Sustainable development, Consumer resistance, Environmental knowledge, Conceptual framework, Organizational green culture, Pro-environmental behaviour

1. Introduction

The topic of knowledge management (KM) has been a topic of considerable discourse in both academic and business circles for many years. Organizations have come to recognize the importance of effective knowledge management in improving performance and competitiveness. However, with the growing emphasis on sustainability, there is a pressing need to integrate sustainable development principles into KM practices.

This paper reviews the literature on topics related to KM and sustainability, such as green knowledge management and the environmental, economic, and social aspects of sustainable development. It also covers green innovation and provides a framework that integrates all these concepts.

1.1 Knowledge Management

According to Qinghua Fu et al (2022), knowledge is an intangible and abstract asset that plays a crucial role in the effective functioning of companies. In today's dynamic business environment, companies that can successfully manage the knowledge inherent in their operations are believed to have a competitive advantage over others. Kumari et al (2021), and Aamir et al (2021) suggest that failure to do so can lead to failure. “Additionally, knowledge has transformed the traditional approach to the competition, especially in industrialized economies where natural resources were once considered the primary asset and have been replaced by intellectual property” (Pan et al, 2022). Chamba-Rueda et al (2021) and Abbas et al (2022) claim that this is why many researchers identify the current period as the age of knowledge management (KM). To conclude, effective knowledge management is crucial for companies to succeed in today's business environment, where intellectual property is the primary asset in industrialized economies.

1.2 Green Knowledge Management

“Green Knowledge Management (GKM) is a novel approach to knowledge management that strives to incorporate environmental concerns into all aspects of knowledge management. A company's commitment to GKM is judged on how it influences the organization's green performance and the potential benefits that GKM

practices might bring to the natural environment. In the present globalized market, environmentally conscious strategies and information extend beyond individual organizations to all stakeholders as recommended by the United Nations. However, with a lack of GKM literature, the need for green knowledge has increased tremendously in response to environmental challenges. As green knowledge is an intangible asset, its management differs from other resources. Failing to consider the technical and cultural aspects of GKM may negatively impact companies striving to adopt GKM practices" (UNDP, 2021).

"GKM is also necessary for both individual and organizational creative performance, with people's green learning orientation enhancing the ecological awareness of companies and breeding new ideas and solutions. To reap maximum benefits from GKM, it must be inculcated as a systematic process that involves all stakeholders in decision-making. Literature research suggests that GKM can be categorized into a system of five components: green knowledge acquisition, green knowledge storage, green knowledge sharing, green knowledge application, and green knowledge creation. The acquisition and organization of knowledge related to environmental protection are key components of green knowledge acquisition, enabling ecological resources and technology to be enriched to safeguard the natural environment" (Aboelmaged et al, 2019; Alexandra Zbuchea et al, 2019).

"For instance, The GKM model can be employed as a checklist to ensure that organizations' green measurement models are comprehended by managers and professionals to implement an effective GKM system. Besides, Environmental protection-oriented businesses can utilize the GKM tool to evaluate their performance and identify areas for improvement" (Siming Yu et al, 2022). In a nutshell, implementing Green Knowledge Management (GKM) practices is crucial for organizations to enhance their green performance, address environmental challenges, foster creative solutions, and improve decision-making involving all stakeholders.

2. Sustainable Development

In recent years, environmental concerns have become a hot topic, thanks in part to ecologists who have raised awareness about the depletion of natural resources and the negative impact businesses have on the environment by consuming resources at an alarming rate. Kumar et al (2022) provide evidence of this. As Abbas et al (2020) point out, stakeholders are now putting pressure on businesses to protect the environment and incorporate environmental concerns into their operations and societies. "The United Nations' Brundtland Commission report has spurred businesses to shift their focus to sustainable development" (UN, 1987), leading to new concepts and theories that incorporate knowledge about nature and society, as discussed by Song et al (2020).

Green knowledge goes beyond information about natural conditions and encompasses a wide range of sustainable environmental, social, and economic development strategies. Creating new knowledge is crucial for green growth and sustainable development. Dynamic organizations promote a knowledge-creation culture by encouraging their employees to share their knowledge, as noted by Wang et al (2019), and by providing adequate infrastructure and facilities. Additionally, these organizations offer non-financial and financial incentives to employees who actively share their knowledge or provide unique ideas or solutions, as stated by Xie et al (2019). Ultimately, the growing concern for environmental issues has prompted stakeholders and organizations to prioritize sustainable development and incorporate green knowledge into their operations, as evidenced by recent studies and reports, ultimately highlighting the importance of creating a knowledge-sharing culture within dynamic organizations.

2.1 Social

"Early research in the field of business management suggests that knowledge is the primary resource necessary for companies to compete effectively and gain unique advantages" (Nonaka et al, 1994). "In order to achieve this, companies must create and utilize dispersed knowledge to enhance competition" (Alavi et al, 2001) and "capitalize on external opportunities" (Lichtenthaler et al, 2009). "Employees within companies play a vital role in identifying external knowledge and integrating it with internal knowledge to improve products and processes" (West et al, 2014). "Therefore, it is reasonable to assume that human resource management (HRM), which encompasses all the strategic actions taken by a company's management that influence its relationship with employees, can impact the company's ability to acquire and manage knowledge effectively" (Beer et al, 1994).

According to research conducted by Armando Papa et al (2018), this study's findings support the significance of HRM practices in improving organizational innovation performance. The research analysed 129 companies

using regression analysis to examine the correlation between knowledge acquisition and innovation performance, revealing that HRM moderates this relationship. The results indicate that implementing HRM practices and retaining employees can amplify the impact of knowledge acquisition on innovation performance, leading to sustainable growth and effective corporate knowledge management. Therefore, the important role of human resource management practices in improving organizational innovation performance by enhancing knowledge acquisition, retention, and integration, ultimately leading to sustainable growth and effective corporate knowledge management is highlighted.

2.2 Environmental

“The sharing of knowledge related to environmentally-friendly practices, or "green knowledge sharing," can involve the transfer of knowledge between colleagues, competitors, suppliers, or other stakeholders with the goal of developing effective techniques and technologies to reduce the negative impact of business activities on the natural environment” (Song et al, 2020). “This practice is influenced by several factors including human factors, organizational culture, infrastructure and technology, reward, and recognition” (Alexandra Zbuchea et al, 2019). “Integrating green knowledge into decision-making, product/service design, and operations can enable companies to minimize or eliminate negative environmental effects, thus providing a competitive advantage” (Aboelmaged et al, 2019). Additionally, environmental knowledge encompasses information about product production and its environmental impact.

2.3 Economic

“To optimize a company's knowledge economy, a strategic approach to knowledge management is crucial. This requires consideration of various factors, including information technology, organizational structures, human resource practices, and culture” (Alexandra Zbuchea et al, 2019). “Effective knowledge management frameworks suggest that a successful KM structure should incorporate both enabling factors and processes, with a clear understanding of operations” (Pilar Bernal et al, 2022). “Organizations that consistently assess their use of knowledge are referred to as KM enablers and previous studies have differentiated between exploitative and exploratory KM processes” (Gonzalez et al, 2018). “Knowledge discovery typically involves research and development and knowledge creation, with R&D initiatives serving as a significant component of knowledge creation within a company” (Chamba-Rueda et al, 2021). “This may include developing new content or replacing outdated material in the organization's knowledge repository” (Khan et al, 2022). “Research has linked knowledge creation and innovation” (Goyal et al, 2020), “while knowledge exploitation encompasses techniques such as knowledge application, storage, transfer, and application” (Abubakar Mohammed Abubakar et al, 2019).

The United Nations has stressed the importance of raising awareness and knowledge about the environment in order to achieve sustainable development. In line with this, Muhammad Aamir Shafique Khan et al (2022) have emphasized the need for SMEs to address consumer resistance towards green innovation products. The study has found a connection between green innovation practices, consumer resistance, environmental knowledge, and pro-environmental behaviour. It highlights the crucial role of green innovation practices in SME success, while also underscoring the importance of businesses adapting their policies and marketing strategies to overcome customer resistance. The study's key findings suggest that effectively managing consumer resistance is advantageous for product acceptance and serves as a solid basis for policy-making and handling resistance to green innovation products among consumers. Thus, the strategic approach to knowledge management, the significance of knowledge creation and exploitation, and the role of green innovation practices in SME success emphasize the necessity for businesses to adapt their policies and marketing strategies to address consumer resistance and achieve sustainable development.

3. Green Innovation

Research by Juan Piñeiro et al (2019) highlights knowledge, entrepreneurship, and innovation as key drivers of economic growth and competitiveness. “These factors have a significant impact on the economy, environment, and society, making them crucial components of the United Nations Sustainable Development Goals” (UNDP, 2021). “The interdependent relationship between knowledge, innovation, and entrepreneurship means that knowledge plays a vital role in the innovation capabilities of individuals and organizations” (Chamba-Rueda et al, 2021). “Improved innovation quality leads to enhanced firm performance” (Chaithanapat et al, 2022). According to Nonaka et al (1991), organizations that adopt the knowledge-based view (KBV) can better acquire and utilize knowledge, which is critical for creating resources. The KBV identifies knowledge as the most valuable strategic resource that an organization can possess.

"Additionally, green innovation can help mitigate environmental risks such as carbon emissions and other climate change-induced consequences while reducing product impact" (UNDP, 2021).

Shouwen Wang et al (2022) conducted a study that delves into the correlation between green knowledge management (GKM), corporate sustainable development (CSD), and green innovation. The study also explores the moderating effects of organizational green culture (OGC). It examines the impact of four GKM practices on the green innovation capabilities and sustainability activities of organizations. According to the study's findings, aligning GKM initiatives with overall business policies can enhance environmental and business performance. Moreover, the study emphasizes the relevance of green culture in organizational activities and its impact on the relationship between GKM and green innovation. Additionally, the study reveals that firm size and industry significantly affect organizational capabilities for green innovation and minimally relate to CSD. Accordingly, it underscores the crucial role of knowledge, entrepreneurship, and innovation in driving economic growth and competitiveness, emphasizing the significance of green knowledge management and organizational green culture in enhancing environmental and business performance through green innovation.

4. Conclusion

This article delves into the relationship between green knowledge management, green innovation, and sustainable development. Through careful analysis, the article proposes a conceptual framework that illustrates how green knowledge management can positively impact sustainable development through green innovation (Figure 1). The framework emphasizes the importance of a company's green culture in strengthening these connections. It is also important to consider the potential resistance of consumers towards adopting green innovation products. This can be addressed by increasing their environmental knowledge and promoting pro-environment behaviour. Overall, the article stresses the essential role of green knowledge management in achieving sustainable development through green innovation.

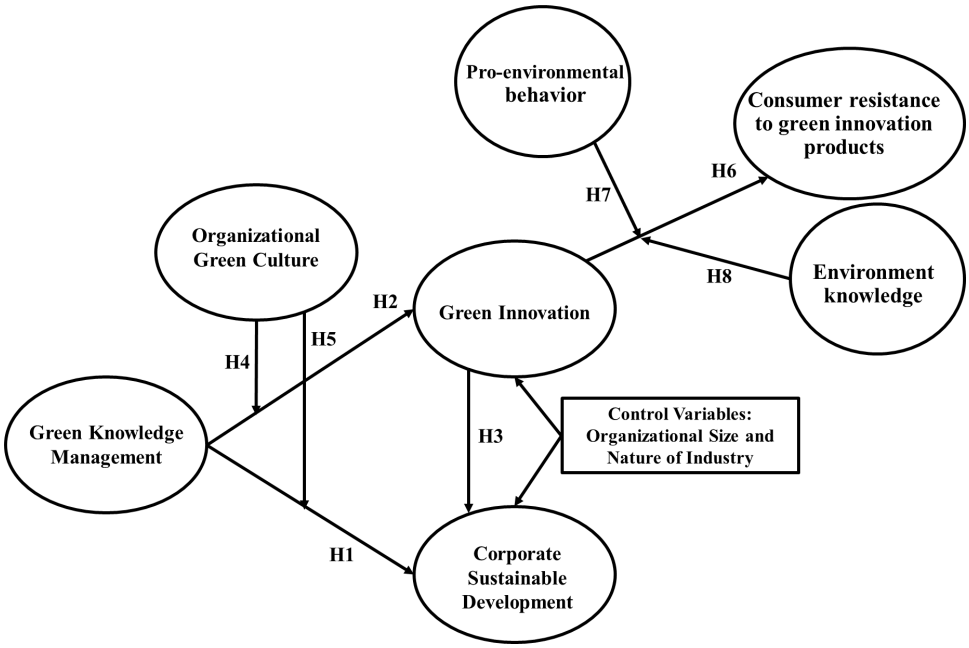


Figure 1: A Conceptual Framework

Therefore, the conclusion section proposes a conceptual framework that highlights the following relationships:

H1: Green knowledge management is a significant predictor of a company's sustainable development.

H2: Green knowledge management positively influences an organization's green innovation performance.

H3: Green innovation strengthens an organization's capabilities to achieve sustainable development goals.

H4: Organizational green culture strengthens the relationship between green knowledge management and green innovation, as well as sustainable development.

H5: Green innovation measures are negatively related to consumer resistance to green innovation products. As innovative measures increase, so does consumer resistance.

H6: Pro-environmental behaviour moderates the relationship between green innovation practices and consumer resistance.

H7: pro-environmental behaviour moderates the relationship between green innovation practices and consumer resistance. If environmental knowledge is high, the negative relationship is weak.

H8: Environmental knowledge moderates the relationship between green innovation practices and consumer resistance. If environmental knowledge is high, the negative relationship is weak.

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A Transdisciplinary Research Model Through Knowledge Co-Production in Complex Sociotechnical Systems

Eduardo Giugliani, Maria Angélica Jung Marques and Priscila Susin
PUCRS, Porto Alegre, Brazil

giugliani@pucrs.br
angelicajmarques@gmail.com
pri.qsusin@gmail.com

Abstract: This paper presents the transdisciplinary research and conceptual model adopted by the projects developed within the research center HFACTORS – Human Factors and Resilience Research Center. Transdisciplinary research produces knowledge with workers, be they leaders or sharp-end professionals, and within the company, as it seeks to understand the daily demands without imposing pre-defined solutions. In this sense, a transdisciplinary research model aims to integrate and co-produce "actionable knowledge" to face challenges and complex problems where disciplines alone are no longer enough. This paper shows how the HFACTORS Center seeks to implement a multi-perspective approach to its interventions, transcending disciplinary boundaries, co-producing knowledge, and connecting scientific knowledge with everyday practice. Such an approach requires multiple ways of working, developing strategies, and creating tools and spaces for co-production where different teams can work and interact. Interaction can occur on various levels and allows both the co-creation and co-production of narratives, solutions, and negotiations, as well as the prototyping of ideas and learning from integrating knowledge (scientific and applied). Therefore, we present the HFACTORS research model, describing the strategies and mechanisms used to develop processes of transdisciplinary knowledge co-production aligned with a Human Factors perspective, its implementation challenges and future research opportunities.

Keywords: Transdisciplinary research, Knowledge co-production, Research model, Complex sociotechnical systems, Resilient systems

1. Introduction

The Human Factors area presents itself as a broad field of studies and research with transdisciplinary nature. It is centered on the interaction between organizational, group and individual factors with a view to improving people's performance in organizations and complex socio-technical environments. It is a comprehensive field of knowledge, with multiple domains and objects. Among the challenges in this field, transdisciplinary research stands out.

Transdisciplinary research aims to co-produce knowledge and integrate it into the daily practices of stakeholders, with the building of structures that make these practices more effective for corporate action and change. These arrangements point, in turn, to opportunities and challenges for governance and innovative processes in organizational environments: spaces for prototyping, experimentation and validation, among others (Engels, Wentland, Pfotenhauer 2019). Transdisciplinary research takes a comprehensive, multi-perspective approach, problem- and solution-oriented that transcends disciplinary boundaries and promotes the connection between science and practice (Pohl 2011). In addition, transdisciplinary research proposes a reflective approach of interdisciplinary collaboration between academic and non-academic stakeholders (Bammer et al. 2020; Hoffmann, Thompson, Pohl 2019).

When dealing with topics typical from the Human Factors research area such as safety in complex socio-technical systems, the association between human elements, complex structures, high technology, finite resources, knowledge (specialized and tacit), variability and uncertainties, transdisciplinary research is essential. In this sense, new tools, methods, and methodologies are needed to facilitate the processes of integration and co-production of knowledge. In this article, we offer the HFACTORS view on the co-production of transdisciplinary knowledge in the field of Human Factors, as well as the conceptual model adopted.

The HFactors is a Research Center formed by an interdisciplinary team of researchers, involving specialists from the Pontifical Catholic University of Rio Grande do Sul (PUCRS, Brazil) and partner universities, in areas such as Resilience Engineering, Sociology, Social Work, Psychology, Engineering, Media and Knowledge Management. The Center focuses on design and carries out R,D&I (research, development and innovation) projects with high added value and intensive technical-scientific knowledge, involving models and technologies aimed at strengthening the culture of safety, resilience and human factors. Concepts and definitions about transdisciplinary research are presented in this paper, as well as key notions on the co-production of knowledge, pointing out how the HFACTORS seeks to implement a broader, multiperspective approach to its projects,

oriented towards problems and solutions that transcend disciplinary boundaries, and proposing a connection between science and everyday practice (Pohl 2011).

2. Transdisciplinary Research and Knowledge Co-Production

Transdisciplinary research and knowledge co-production are terms coined to refer to processes of knowledge connection between academic and non-academic actors that lead to the creation, communication, and use of combined forms of knowledge (Bremer, Meisch 2017; Mauser et al. 2013). Knowledge co-production has been an effective means of producing usable knowledge in science through a collaborative process between scientists and decision makers (Djenontin, Meadow 2018). This has led researchers and professionals to turn to knowledge co-production as a promising approach for advancing studies in complex environments (Norström et al. 2020): co-production emerges as a response to complexity, oriented by context, problem-focused, demanding the participation of various disciplines and non-academic actors in the process - not just as informants, but as interested and active parties, which includes negotiation and agreement on research questions and activities (Jacobi et al. 2020).

Bammer (Bammer 2019; Bammer et al. 2020) highlights that specialization in the integration and implementation of research is an essential but often overlooked component in the context of addressing complex problems. It is through knowledge integration that "actionable" knowledge is co-produced. Actionable knowledge is that knowledge that can be worked on and applied to solve a real-world problem. The co-production of actionable knowledge requires researchers to adopt ways of working together that create time and space to build teams, networks, relationships, narratives, and prototype ideas, to fail, learn, and start over (Evans, Terhorst, Kang 2017)

Although transdisciplinary research is a recognized approach to dealing with complex real-world problems, some aspects can limit its success. Schmidt et al. (2020), for example, warn about the importance of stakeholder involvement, a central aspect of transdisciplinarity, which still lacks more broad reflection on its objectives in the literature. In this sense, with a view to integrating different perspectives and bodies of knowledge to develop scientifically valid and relevant results for companies, the transdisciplinary research approach allows reflecting and respecting the diversity of epistemologies, cultures, roles, and interests of all parties involved (Hoffmann, Thompson, Pohl 2019; Jahn, Bergmann, Keil 2012; Schmidt, Falk, Siegmund-Schultze 2020).

In this sense, a preponderantly influencing factor of the transdisciplinary research process is the ability to promote the integration of knowledge, either through tools, dynamics, and strategies. In this direction, there is a rich body of literature dedicated to this process, for example, Klein (2012), Hoffmann et al. (2017); Hoffmann (2016); Bammer (2013), Pohl et al. (2021), Pennington (2016), Defila and Di (2015), Marques, Giugliani e Santos (2022), to name a few. The HFACTORS Model seeks to add to this literature on the experience of co-production of transdisciplinary knowledge oriented to problems in complex socio-technical systems with a focus on the Human Factors field. The model's approaches and strategies developed by the HFACTORS team in recent years are presented below as well as the challenges to consolidate such model.

3. HFACTORS Model of Transdisciplinary Research and Knowledge Co-Production

Through transdisciplinary research, the HFACTORS seeks a comprehensive, multi-perspective, problem- and solution-oriented approach that transcends disciplinary boundaries, proposing a "bridge" between science and practice (Pohl 2011). The insights of Polk (2014) and the interaction model proposed by Hoffman et al. (2019), in which different forms of knowledge from science and practice combine and relate to each other to produce a "third" sphere of knowledge, served as inspiration for the HFACTORS model of transdisciplinary research in complex socio-technical systems. This model is illustrated in figure 1.

The HFACTORS model aims to establish cyclical processes of thematic synthesis and co-production of knowledge, in order to identify and overcome the challenges that arise at different stages of a transdisciplinary research project, seeking to co-produce solutions to a complex problem. The establishment of the central problem, object of a transdisciplinary research, is based on a cycle of interactions with the team of the contracting organization, where the main research questions are co-designed (co-design stage). This cycle is based on practices from real world experiences and demands a series of interactions between academic and non-academic teams. Once the research questions are co-designed, the strategies and macro activities to be developed are elaborated. These macro activities, in turn, are developed in iterative and interactive cycles of co-design, co-production and co-evaluation, where knowledge is gradually integrated.

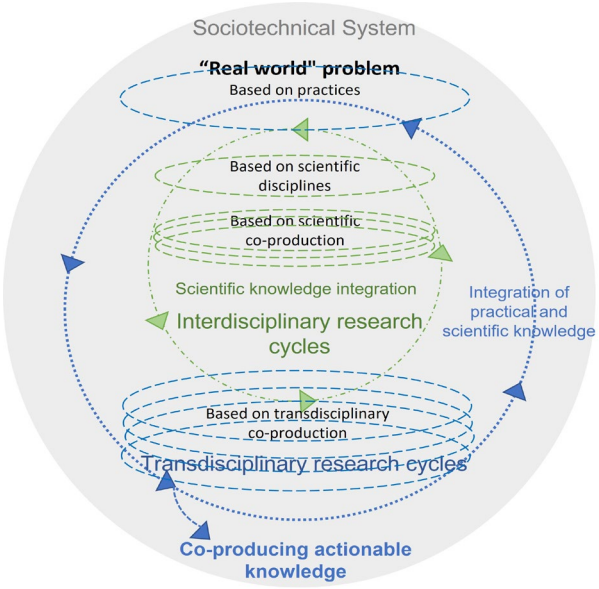


Figure 1: HFACTORS Model – Conceptual Model of the Transdisciplinary Research Process In Complex Sociotechnical Systems

In the HFACTORS, the proposition of knowledge co-production tools was based on a multilevel perspective, considering, at least, the following elements: a) the socialization of researchers around the reality and the language used in the socio-technical system that is object of the research ; b) the construction of a relatively common language in order to develop and share research results based on co-production; c) a relatively shared vision about the problem and object of research; and, d) the work in small interdisciplinary groups for the integration of knowledge, leaving the discipline-based production for the co-production of actionable knowledge. It is worth clarifying the strategies adopted by HFACTORS for each of these levels.

According to Thompson (2009), interdisciplinary research teams need to negotiate meanings and work continuously to establish and sustain what the author has termed "a sense of collective communication competence". The construction of linguistic 'bridges' within the HFACTORS, for example, occurred from two demands.

The first concerned the researchers' ability to dialogue and understand the realities presented by the workers of the socio-technical systems under analysis, considering the collection of data from very different methods. The construction of research instruments and the contextualized analysis of results requires, therefore, a massive approximation between researchers and the routines and dynamics of the systems. The proposition of formal spaces of exchange between researchers and professionals from different areas of the contracting organizations, especially through workshops, seminars, and lectures, is one of the first actions in terms of conceptual adjustment. This includes the recognition of technical terms and jargon, without which it would not be possible to interpret much of the data collected.

Another opportunity for language alignment, and perhaps the most important, was the possibility for the research teams to experience the routine of the sectors being investigated, in person whenever possible, such as, for example, in the oil industry, embarking on offshore oil and gas exploration and production platforms, or even in onshore environments. In addition to a better conceptual harmonization, these experiences also make it possible to experience and observe what, from the workers' reports, would still be a purely theoretical abstraction of the research teams.

The second demand in terms of language is the need to build a relatively common conceptual and epistemological field between the different disciplines involved in exploratory research, in order to develop and share increasingly integrated research results. This challenge is especially complex, as it requires not only the co-creation of opportunities for dialogue, but also the effort between researchers from disciplines historically and supposedly positioned in so-called antagonistic positions. The conduction of common readings, the establishment of dialogues, seminars to share theories, concepts, and approaches, are key strategies adopted with the creation of an interdisciplinary scientific committee, also responsible for creating these spaces of exchange and integration of knowledge.

Another strategy adopted by the HFACTORS is the incorporation of a systemic look at the establishment of the research object and problem. As Moraes (2001: 34) points out, systemic thinking allows "the understanding of the different connections, the interactions that express the set of relationships established between the whole and the parts, between actions and feedbacks, making explicit, including the organization that shapes the system". For the implementation of transdisciplinary projects, incorporating a systemic approach means considering different perspectives and problematizations about the same socio-technical system during the process of exploratory research and during the cycles of co-production, admitting that all the answers could be right or wrong, depending on the point of view of the analysis and the observer (O'Rourke et al. 2019).

Finally, working in small groups or subgroups for integration and co-production of knowledge is also essential for effective praxis within the HFACTORS. They can be considered both a tool and a space for co-production but require a set of skills of collective communication and shared language, the capacity for a systemic look and, crucially, the horizontalization of disciplinary relations towards transdisciplinary work. As pointed out by Thompson (2009), these work groups provide some fundamental practices for co-production processes, among them, the sharing of time among researchers, the exchange of information about tasks, and the continuous negotiation in relation to language differences.

In the HFACTORS, the working groups are constituted from a long learning process, which begins in a disciplinary manner, especially during its first phases. However, in this process, they become increasingly interdisciplinary, as the cycles of knowledge integration develop from the formation of subgroups composed of researchers from different areas. As these cycles are repeated, each group assumes different thematic fields. The segmentation by area, in this way, becomes more diffuse, especially due to the need for transdisciplinary articulation directed towards practical problems of the socio-technical systems investigated, which need to be contemplated in their final phase of action-research.

This integration of knowledge is increasingly and constantly challenged as transdisciplinary research cycles are developed, with the active participation of professionals from the contracted organization. To this end, one of the strategies adopted by HFACTORS was the creation of spaces of co-production of knowledge where issues related to work practices are problematized and negotiated from the foundations and principles of human factors. Finally, another important strategy developed by HFACTORS is the construction and availability of virtual spaces for knowledge sharing and dissemination, which aim to stimulate constant interaction and co-production among academic and non-academic members of the project, such as the digital platform HFACTORS.

4. Final Remarks

The authors developed this article with the main objective of presenting the HFACTORS research model. Based on its focus on action and on a Human Factors approach, we can list two basic constructs for its effective performance: transdisciplinary research and knowledge co-production. Since 2014 the HFACTORS Center's team has engaged with applied transdisciplinary research. Based on these experiences, the model aims to advance in a propositional way toward solving problems in complex sociotechnical systems. It is also worth mentioning the resilient capacity developed by HFACTORS throughout its trajectory (learn-respond-monitor-anticipate), offering answers and solutions to complex problems within the transdisciplinary context that surrounds us, as well as the requirements for transformation imposed by the 21st century.

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Smart Village Concept: What are the Crucial Categories of Elements?

Konrad Głębocki
Czestochowa University of Technology, Faculty of Management, Poland

konrad.glebocki@pcz.pl

Abstract: Over the past few decades, villages have faced significant challenges, such as depopulation, that have hindered their development. To address these issues, the concept of a Smart Village has emerged as a potential solution for rural development. The present article aims to investigate the essential categories of elements that comprise this concept by conducting an international literature review in multiple languages, including Polish, English, Spanish, Italian, French, and German. The article begins with an introduction that discusses the current challenges facing rural development, followed by a detailed analysis of various aspects of the Smart Village concept. Additionally, the article presents case studies from different countries to illustrate how the concept has been implemented in practice. Finally, the article employs inductive reasoning based on the previous literature review to identify four fundamental categories of elements that underpin the Smart Village concept.

Key words: Smart Village, New technologies, ICT, Public management, Strategic planning

1. Introduction

Today's village faces various challenges that are social, organisational, demographic, and economic in nature. However, the emerging concept of the Smart Village provides a new approach to addressing these challenges. The issue of Smart Village need to be reviewed to systematize and to expand the knowledge of the concept and its practical application - the article responds to this need. In this article, the author first examines the challenges facing villages, followed by a detailed analysis of various aspects of the Smart Village concept. Additionally, the article presents case studies from different countries to illustrate how the concept has been implemented in practice. Finally, the article employs inductive reasoning to classify the essential categories of elements that underlie the Smart Village concept into various categories. The conclusions drawn from this research provide valuable insights for policymakers and stakeholders in rural development.

In Western countries one of the main challenges of village development is the aging population and depopulation partly rooted in leaving villages by younger generations. Older people prefer to stay in village but the problem is how to engage them into village organization (Gammonley et. al 2019). Still issues of involving inhabitants of villages into not only consultations on village development but as well as into cooperation in governing are vital (Rumkel et al. 2019).

Also in Poland, for many villages the basic dilemma consists in whether depopulation is an inevitable trend that will continue in the following decades. This is particularly true of villages located in peripheral areas - they are not located in the immediate vicinity of large cities and urban agglomerations. Depopulation entails both social and economic negative consequences - the level of socio-economic development decreases which also results in a lower quality of life, which then contributes to the low attractiveness of such areas, in turn causing an increasing acceleration of rural depopulation (Wesołowska, 2016, p. 269).

The challenges that Polish countryside has to face include, for example:

- further increasing the standard of living for the rural population, improving the agrarian structure, and modernizing agriculture;
- creating new jobs in the countryside apart from agriculture;
- motivating rural communities to create new local development programmes - rebuilding social capital and civil society. Residents of rural areas should not look at others - waiting for someone else to solve their problems;
- active and efficient local governance - putting a dam on the passivity of local leaders and individual residents;
- developing rural infrastructure;
- creating opportunities for entrepreneurial people (Kłodziński, 2010, p. 24).

In the broader spectrum of elements relevant to future rural development, it is possible to point to the spreading of remote working, which was one of the consequences of the Covid-19 pandemic. Information concerning the dangerous health situation led to adopting remote working as a method of maintaining health

while staying active (Torres 2021, p. 13). Moreover, high-level strategic development planning is important for village development. The development strategies of rural municipalities should not only be a tool for promoting the municipality, but most importantly, within traditional village activities new methods should be found to improve breeding animals in village – e.g., poultry (Tuan Chu et al. 2018). Poor villages look for their chance in tourism which could be an opportunity for sustainable development (Sesotyaningtyas 2015).

2. Smart Village Concept – Chosen Aspects

The Smart Village concept has gained increasing attention in recent years. However, despite its growing popularity, it lacks a well-established theoretical framework and remains largely undefined. Furthermore, there has been little exploration of the relationship between the Smart Village and the better-defined Smart City concept. Clarifying this relationship is a necessary step in understanding how smartness can impact social and environmental aspects of rural realities. From a practical perspective, designing and implementing the Smart Village concept in European countries, drawing on experiences from Africa and Asia, could contribute to the EU's green and digital transformation agenda by emphasizing sustainability and environmental protection (Gerli, Marco, Whalley 2022, p. 15).

The Smart Village concept rests on several fundamental assumptions, including food security, democratic engagement (achieved through effective local governance and social development), health and well-being (supported by environmental and personal development), education (which provides basic knowledge to raise awareness), and local businesses (which promote economic development). For the Smart Village concept to effectively contribute to sustainable development, there is a need to redirect the focus of education. Education plays a critical role in promoting sustainable development, and basic education forms the foundation for environmental and development-related education, which should be prioritized in educational curricula. Developing ethical awareness, values, attitudes, skills, and behaviors in line with sustainable development is essential for effective public decision-making, including public participation. Moreover, education should be accessible to people of all ages (Somwanshi et al. 2016, p. 397). In order to promote rural development, it is necessary to tap into the knowledge held by leaders and members of a given community. Today, knowledge acquisition is not limited to formal education, such as earning a bachelor's or master's degree. Knowledge can be acquired through a variety of means, such as listening to TEDx speeches, where experts who have dedicated decades of work to a particular field share the most important conclusions from their experiences in concise 20-minute talks.

The implementation of the Smart Village concept faces significant challenges. One such challenge in many countries is the lack of adequate digital services in rural areas. Additionally, there is often a lack of networking between residents, communities, and local administrations. The levels that comprise the digital ecosystem of a Smart Village include: digital services that require collaboration with the citizens who use them, a technical platform that integrates the main technical aspects relevant to the functioning of digital services in rural areas, the availability of digital infrastructure, which is a necessary but not sufficient condition for digital innovation. The latter can be fostered through initiatives such as Living Labs and Rural Digital Hubs (Gallardo-Cobos, Sanchez-Zamora, 2022, p. 409). Elements that may be duplicated and disseminated are developed in terms of the Smart Village concept. One such element is the concept of an information system for managing the infrastructure and activity of a rural municipality. The idea is to create a very useful but minimalist system, consisting of four main activities: collecting data (linking objects), storing data (NoSQL database), prediction (model composed of algorithms, learning automatically), and data visualization (Kibana) (Antoine-Santoni et al. 2019 p. 8).

Smart Village also encompasses the development of rural tourism, which has been greatly impacted by the Covid-19 pandemic. Villages that had previously succeeded in attracting tourists experienced a significant decrease in tourism activity. Therefore, it is essential to carefully examine the conditions under which this activity takes place, including the governance models at both the national and local levels. This requires a detailed analysis of the theoretical and practical foundations that impact the development of tourism in smaller village-type locations (Bravo et al. 2021, p. 269).

There are many investments that qualify under the Smart City concept, and many solutions implementing this concept appear. The case is different for the Smart Village - a concept that lacks a large number of village-focused, specific implementations (Park, Cha 2019, p. 177). However, more and more solutions are emerging that fit into the Smart Village concept and can contribute to developing villages, such as theme parks. These parks should take advantage of the assets of a given village or town and be specific enough to stand out and attract interested parties, including tourists. They should promote beauty and good taste, be accessible to all,

and be an attractive location in terms of composition and aesthetics (Poczobut 2013, p. 380). Theme parks have been successful worldwide, including small-scale parks. Creating a website and a special app for smartphones that lists theme parks would fit in with implementing the Smart Village concept. The app should be based on a clear and logical typology, with proper criteria for qualifying sites. Parks that meet the criteria should combine interactivity, fun, and education (Doroz-Tomasik, Jankowski 2016, p. 30). Historical parks can play a special role, referring to historical events in a particular place, such as a battle during the Invasion of Poland at the beginning of the Second World War. Such parks can be an interesting element of tourist development if they meet the criteria of interactivity, fun, and historical education.

Another example of Smart Village activities may be the neighbourhood help - transport sharing app. A resident travelling by car to a large city makes this information available on an app that other residents can view. A resident without available means of transport opens the app, enters a date and destination and then receives information about people who are going to the city on that day. When using such an app, the challenge will be to ensure the security of people and data.

3. Smart Village Concept - Experiences of Various Countries

In Germany, attempts are being made to break down the barrier in the form of poor digital services in the countryside. An example consists in the actions taken by the Fraunhof Institute, which has invested € 4.5 million until 2019 in cooperation with the Ministry of the Interior in a pilot digital villages project including digital services for residents of villages, a digitalized marketplace of local services, access to mobile digital services, an app with local news in typical areas, and a digital lead platform for two-way communication between local residents and the local administration (Park, Cha 2019, pp. 178-179). Furthermore, in Germany, a part of the "Smart Village" concept consists of creating a web-based platform that collects and links data, which is then available to interested parties in the form of well-visualized interfaces. Data from a large number of sensors is transferred to a 3D platform, allowing for efficient access to information on electricity production from photovoltaic panels in a given village or the entire municipality, as well as heat resources and energy obtained from the use of biomass. Thanks to these applications, it is much easier to plan the development of photovoltaic installations in a village, for example (Santhanavanich et. al 2020, pp. 56-57). Especially in Germany, data security issues, including personal data, are also being raised in the context of the Smart Village. In some advanced IT systems, there is a high risk of reducing a human to an object that will also follow the commands of artificial intelligence machines. Numerous examples from East Asian countries, shaped by Confucian philosophy, show that such systems can already be quickly introduced today. In Germany, it is indicated that systems reflecting historical experience, the rule of law, constitutionally protected rights, and data protection principles should be developed. In particular, a careful examination of solutions already proven in other cultural circles is called for (Von Lucke 2019, p. 59).

In Italy, the "Smart Village" concept is being analyzed in terms of its use in previously marginalized areas. An example of the analysis concerning potential applications in such areas can be found in Sardinia. It is indicated that using ICT instruments, big data, and the Internet by public authorities in cooperation with private entities can bring solutions to revitalize the rural space in terms of strategic sectors such as public transport, distance education, rural tourism, health, or renewable energy, working in favor of developing new forms of sharing economy as well as new relations with the outside world. In terms of the EU's programming of development for the years 2021-2027, the Smart Village may gain a real dimension not by replacing the instruments already in place but rather by integrating them in a way that serves sustainable development (Lampreu 2022, p. 77). The Smart Village concept in Italy was already known before 2012. There have been pilot projects integrating three spheres: the outdoor lighting system - smart lighting that adapts to conditions, smart building networks, and smart mobility. These projects, such as the one carried out by the state agency ENEA, were focused on developing such an integrated model for a specific locality (village) so that it has the potential to be extended not only to following villages, but also to small towns (Annunziato et al. 2012, p. 6).

In France, in the context of smart villages, a hybrid model is indicated. This model is a combination of a territorial approach, social innovation projects in conjunction with economic models, and the combination of public and private entities as well as resources in the form of public-private partnerships, along with a simultaneous presence in multi-entity local projects for public and private services. In this way, co-responsibility is shaped, as evidenced by the development of a cooperative society for implementing a collective goal. The multiplication of locations and levels constitutes an indicator of this hybridisation dynamic (Association ADRETS 2021, p. 11). Research carried out in France also attempts to build a more solid theoretical basis for the Smart City concept described as a multi-faceted and hitherto unspecified concept.

Appropriately, this research can also be applied to the Smart Village. It is proposed to base this concept on three immanent pillars: acquiring and using megadata, modernizing public services, and the political will to support greater citizen participation (Eveno 2018, p. 37).

The following points, among others, have been highlighted during research carried out in the Czech Republic in the context of implementing the Smart Village concept:

- there is no technological or cost barrier associated with using modern ICT technologies in rural areas, network coverage is not as intense as in urban areas, but the vast majority of rural residents have access to the Internet;
- a lower level of education results from less use of the web for more practical purposes, residents tend to use the Internet for entertainment, shopping, or participating in social media
- remote work may be more attractive for rural-to-urban migrants who can combine living in a rural environment with an attractive and well-paid remote job. However, it seems that fully remote work is rarer, most often it has to be combined with visiting an office in the city;
- improving the skill level of rural residents should include improving IT proficiency in relation to rural development instead of improving only formal education (Vaishar, Stastna 2019 pp. 657-658).

Also in developing countries like Algeria, it is pointed out that in peripheral regions, rural development (especially in the current era of globalization) can be the driving force of economic development by ensuring an improving the wealth with a sustainable character. Such development should be based on developing own resources (Agharmiou-Rahmoun 2021, p. 144). In Cuba, the concept of smart municipalities is advocated while pointing out that implementing this concept towards sustainable development constitutes a complex process involving social, economic, political, environmental, and cultural dimensions. In turn, this process must be based on education, which moves towards assigning individual actors their roles according to their knowledge, experience, attitudes, and values (Rodriguez, Perez 2020, pp. 33-34).

In poorer countries, the Smart Village concept appears as an opportunity to move towards a new level of development. The developed model of the integrated development of the Smart Ayllu (Bolivian village) points out the significance of, among others, the following elements: the revalorization of the Ayllu living system, recognizing the centrality of the family as an integral part of the community, where ancestral principles allow strengthening the sustainable drive of village development and community well-being; appreciating existing social ties crucial to the living system; recognizing the central role of citizens in the interaction with the community; and strengthening a new complementary relationship between space and inhabitants using different technological systems (Yujra, Medina 2021).

4. Crucial Categories of Elements of the Smart Village Concept

Based on the above literature review, including the experiences of individual countries, and taking advantage of inductive reasoning, the following categories of Smart Village elements can be distinguished: the digital elements category, the socio-organisational elements category, the domain elements category and the educational elements category. The elements of each group are listed below. Surely, the catalogue of individual categories can be developed further, as well as the number of categories themselves and their nature, which can also be refined in the course of further research.

Digital elements category:

- complete availability of digital services;
- web platforms and other digital applications;
- visual interface of clean energy production;
- data security;
- living labs.

Category of socio-organisational elements:

- participation of residents in the development of the village community;
- developing social ties (including traditional ones);
- public-private partnership.

Domain elements category:

- smart lighting (street lighting and other public infrastructure);

- smart mobility (transport sharing among others);
- smart buildings;
- tourism development (theme parks in this);
- economic development (remote work in it).

Educational elements category:

- adapting formal education curricula to the challenges of smart villages and sustainable development;
- education related to improving IT proficiency;
- education related to changing habits so that residents take advantage of the internet not only for shopping and entertainment, but also for life-long learning.

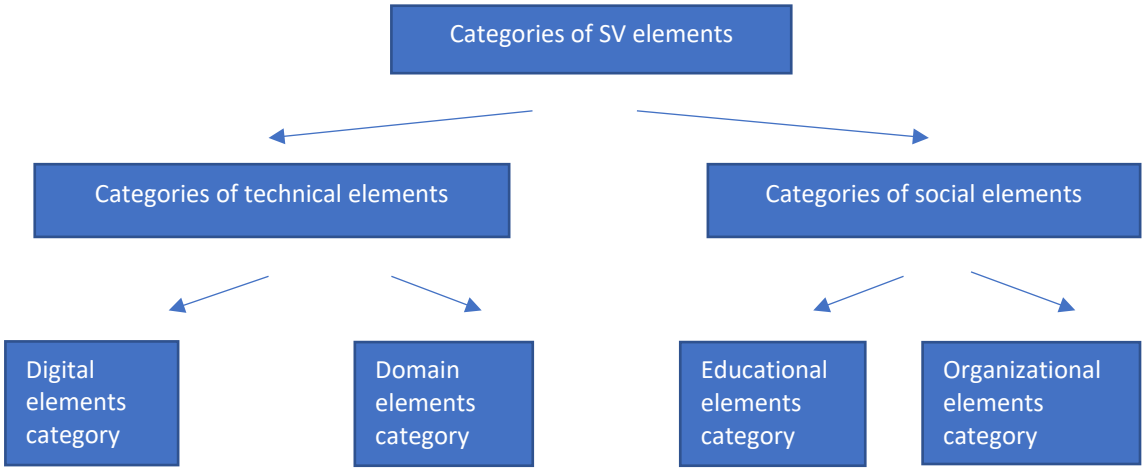


Figure 1: Categories of Smart Village Elements. Source: Author's own figure

Two of the above categories have more technical character (digital elements category and domain elements category) and the other two have more social character (category of socio-organizational elements and educational elements category). Categories of more technical character seem to be easier to introduce but need more financial resource and categories of social type maybe would cost less but are more difficult to introduce because the process takes more time to bring effects.

5. Conclusions

Today's village confronts a range of challenges, and depopulation represents a particularly pressing issue in many countries. The Smart Village is a new concept which is intimately linked to sustainable development. Attempts to categorise the various elements of the Smart Village have been explored in the literature. One such categorisation scheme is based on a set of key assumptions that prioritise food security, democratic engagement (through effective local governance and social development), health and well-being (through environmental and personal development), education (through basic knowledge to promote awareness), and local businesses (through economic development). By identifying and categorising these crucial elements, policymakers and other stakeholders can more effectively design and implement strategies to foster sustainable development and promote the vitality of villages.

Experiences of various countries show that stress within the Smart Village concept could be put on various elements. In the article, the author used especially the elements from Germany, France, Italy, the Czech Republic, Algeria, Cuba, and Bolivia. Basing on sixteen elements stemming from multilingual international literature review the found elements of smart village were grouped into following four categories: digital, socio-organizational, sectoral and educational. Two of the these categories have more technical character (digital elements category and domain elements category) and the other two have more social character (category of socio-organizational elements and educational elements category). Categories of more technical character seem to be easier to introduce but need more financial resource and categories of social type maybe would cost less but are more difficult to introduce because the process of their implementation takes more

time to bring effects. The catalogue of various categories can be developed, as well as the number of categories themselves and their nature can also be developed in the course of further research.

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Model for Developing the Creativity of Future Engineers

Marek Goliński, Małgorzata Spychała and Magdalena Graczyk-Kucharska
Poznan University of Technology, Faculty of Engineering Management, Poland

marek.golinski@put.poznan.pl
malgorzata.spychala@put.poznan.pl (corresponding author)
magdalena.graczyk@put.poznan.pl

Abstract: The article presents factors and their interrelations that influence the development of engineers' creativity. The subject of the article is in the field of human resources management and was in-spired by the results of research related to the analysis of the competency potential of future employees. The main goals of this paper are: - How can competencies of future engineers in the area of creativity be developed and what does creativity depend on – internal and external factors. - Can a model of enhancing creativity of future engineers be worked out? The research was carried out between 2014-2020, on a group of 861 students. The survey method was used, and the research tool was a self-evaluation questionnaire. The research used regression analyses, Spearman's rank correlation coefficients, the power of interrelation between chosen variables (social competencies and forms of education) was evaluated. Hierarchical multiple regression was carried out to verify the objective of the research. The analysis of correlations was verified and visualised with principal components analysis PCA, as well with cluster analysis using Ward's method. The main value of the article is the developed graphic model that reflects the stages of creative development as a competence that is a very important competence resource of the company. A mathematical model that includes the analysis, based on hierarchical multiple regression, revealed that social competencies and forms of learning examined are strongly correlated with 'creative thinking' competence, and this correlation is statistically significant.

Keywords: Management competencies, Creativity, Engineers' skills, Competencies of the future

1. Introduction

The question related to creativity and innovation is of key importance for modern organizations (Audretsch et al. 2020). Market requirements and customers' needs motivate companies to improve their products and intensify activities in the area of innovation. That, in turn, requires creativity in designing new solutions – in other words: to go beyond what is known, common and obvious (Pinker, 2009). Another reason why more attention is paid to creativity is the shift from economy based on tangible assets that is end-product oriented, to economy based on intangible assets, knowledge and services (Georgiev et al., 2016). Employees' creativity of a company gives the basis for a creative organization and is the source of competitive advantage (Al-Ajlouni, 2020). Creativity has become one of the production factors, a non-material resource, unique and of great value.

Why is creativity a competency of such demand? According to The Future of Jobs Report 2020, 'creativity and social intelligence will probably be indispensable skills in case of most new jobs created before 2030. Because these skills give people a distinct advantage over machines and software' (World Economic …, 2020). Employees who can combine mathematical, technological skills with creativity will be indispensable in organizations of the future. Hopkins (Hopkins & Keown, 2005) claims that a creative engineer is able to find various solutions regarding the design of a new product or improvement of a product already designed in order to be more sustainable. Creativity and innovation within a technoeconomic perspective are becoming the major driving forces behind the sustainability of economic growth and competitive achievements (Badran, 2007). Creative thinking is therefore a very essential part of earning and sustainable development (Sandri, 2013). Creativity is an essential engineering skill, therefore engineers have a lot of scope to support the development of creative skills (Carbonell-Carrera, 2019].

What is the level of engineers' creativity? How do they develop this skill? Does university education ensure a high level of creativity of future engineers?

Research shows that although students believe creative thinking is an important aspect of engineering, they do not have the impression of having enhanced their creative skills during the course of studies (Cropley, 2015).

There is a lot of research in the area of acquiring creativity among students (Szafrański et al., 2017). Such research was also done within the project called „The acceleration method of development of transversal competencies in the students' practical training process", realised in four countries: Poland, Finland, Slovakia and Slovenia. Literature of the subject also presents modern models directly referring to creativity regarding innovative organizations (Amabile & Pratt, 2016), new service development (Han-Kuang, et al., 2018), organizational creativity (Anderson et al., 2014) or collective creativity (Hargadon & Bechky, 2006). This

research rarely takes into account the process of enhancing creativity during formal, informal and non-formal education, therefore the authors included such an approach in this paper.

Competency enhancement approaches should be adapted to the student's needs. It is necessary to evaluate the level of creativity competency of individual students, and then to prepare a programme of business knowledge and skills development. The main research aspects of this paper are:

- How can competencies of future engineers in the area of creativity be developed and what does creativity depend on – internal and external factors (e.g. age, chosen elements of non-formal education, place of residence, forms of enhancing creativity).
- Can a model of enhancing creativity of future engineers be worked out?

In order to realise these goals, research on creativity competencies of students of two technical universities (A and B) was done between 2014-2020. In total, 861 future engineers of various technical faculties were examined. Using the method of a survey, the authors of this article recognized factors that influence enhancing students' creativity. Next, each of them was analysed statistically in order to isolate the dominant factors of developing creativity of future employees, and based on literature and empirical research, a model of developing future engineers' creativity was drawn up.

2. Enhancing Creativity Competency of Future Engineers

Enhancing the competency of creativity is the process of continuous learning and a key factor of the organization's success. A student develops and perfects their competencies in a formal, informal and non-formal way (Straka, 2002). Formal learning is institutionalised, formalised education, realised in accordance with syllabuses that result in qualifications accepted in a given legal system. Informal learning is intentional (self-learning) and unintentional learning, occurring accidentally in situations of everyday life, as well as when someone gains experience while working, not during formal or informal training. This form of education is usually of disorganized and non-systematic character, and covers any method of obtaining knowledge and experience (figure 1).

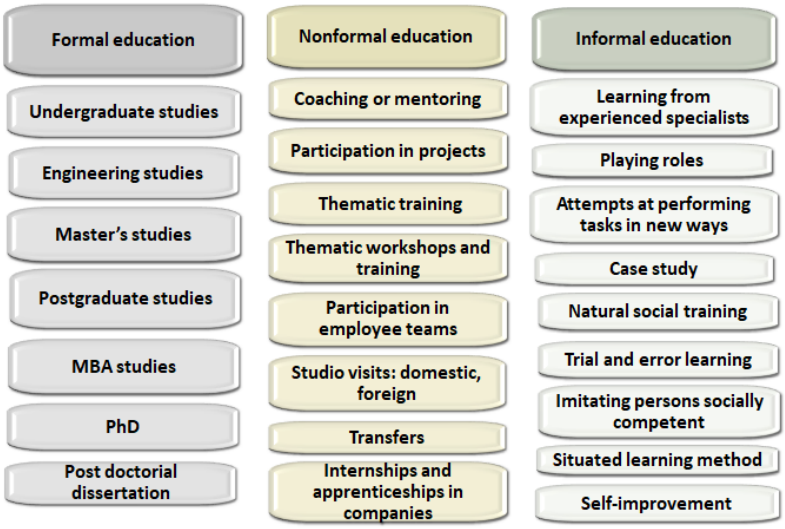


Figure 1: Formal, Non-Formal and Informal Learning of Creativity Competency of a Student - Examples (own Elaboration)

Figure 1 shows examples of a student's competencies development and improvement in a formal, informal and non-formal way (Spychała & Matejun, 2015).

The development and perfecting of a future engineer's creativity depend on many factors that, based on literature of the subject, were grouped into four categories and presented in the model drawn up:

- social and technical competencies that influence the development of creative thinking (Abrantes, 2020);
- characteristics of an employee and their environment (Sadłowska-Wrzesińska et al., 2017);

- forms of education realised throughout the professional career (2017; European Commission…2020);
- influence of the economic environment, including supply and demand for competencies of creativity, therein learning, knowledge and innovation (Hermawati, 2020).

3. Results

3.1 Research Assumptions

Statistical analyses for the research were carried out using TIBCO Software Inc. (2017). Statistica (data analysis software system), version 13. The research used regression analyses, Spearman's rank correlation coefficients, the power of interrelation between chosen variables (social competencies and forms of education) was evaluated. Only those factors that were correlated and whose correlation was statistically significant were used to build the statistical model. The analysis of correlations was verified and visualised with principal components analysis PCA, as well with cluster analysis using Ward's method.

The objective of the research was to create a hierarchy of chosen forms of formal, informal and non-formal education, which are evaluated by students and young employees who enter the job market as key forms in enhancing creativity, and to combine them with social competencies.

The research was carried out between 2014-2020, on a group of 861 students of day studies and extramural studies of two technical universities (A and B). The survey method was used, and the research tool was a self-evaluation questionnaire, where the creativity competency was expressed as synthetic measures based on three coefficients that allow evaluation of knowledge, skills and attitudes related to a given competence.

- K1 – knowledge regarding techniques of creative thinking
- K2 – ability to use techniques of creative thinking
- K3 – ability to think in a way that leads to original solutions, create new concepts or new connections with existing ideas.

These coefficients were described in detail and were evaluated by students on a scale 1-8, according to rules presented in Table 1.

The level of creative competency was set as the arithmetic mean of the battery of coefficients.

Cronbach's alpha was used to evaluate the reliability of the measurement. This coefficient allows to evaluate the conformity between various components (coefficients) of defined synthetic measures (Hair et al., 2006).

This coefficient defines with its value to what extent a set of coefficients describes the same theoretical constructs, represented by a given measure. According to the rules of methodology, it was accepted for this paper that the battery of coefficients represents acceptably reliable measure with Cr. > 0,7 (Sarstedt & Mooi, 2014).

Further in the paper, we presented the results of research on creativity level of students depending on various factors of one of the university A (594 respondents), where the arithmetic mean of results was analysed. Next, a model was drawn up, based on the correlation coefficient for all students surveyed of universities A and B.

Table 1: Description of Competency Levels

Level	Description
1	Competency is not acquired. No behaviour shows its acquisition and use in actions undertaken.
2	Basic acquisition of competence. It is used irregularly. Supervision and support from more experienced persons are required.
3	Sufficient acquisition of competence, hence it may be used in practice, independently. At times supervision of experienced persons is required.
4	Satisfactory acquisition of competence, hence it may be used indepentenly when performing professional tasks.
5	Good acquisition of competence, which enables adequate fulfilment of tasks in a given area.
6	Very good acquisition of competence, which enables very good fulfilment of tasks in a given area, and to pass own experience to others.
7	Excellent acquisition of competence. Ability to creatively use and develop knowledge and attitudes in a given area of tasks.
8	Expert level, ability to creatively share knowledge and skills with other managers and employees.

Source: own elaboration based on the research result

3.2 Questionnaire Research Analysis

The results of the research combine data from questionnaires that facilitated presentation of:

- students' age compared to self-assessment of creativity,
- internships and work used as a chosen element of non-formal education compared to creativity,
- work position during internship (manual, technical, administrative, managerial) compared to creativity,
- place of residence compared to creativity,
- forms of creativity development (formal: classes at university; non-formal: professional work, internships and apprenticeships, workshops and training, social organizations; informal: social life, family life).

Regarding the research results calculated with the arithmetic mean, it may be stated that:

- students (48 persons) who gave highest scores (7 and 8 out of 8) to three elements: presence in formal classes at university, initiative in class and results in education – average of competencies regarding creativity of these students is 4.49 (scale 1 – 8 see…);
- slightly lower – at 4.3, were placed students (55 persons) who gave high scores (7 and 8) only regarding their initiative in class;
- students (70 persons) who were placed at 4.01 gave high scores (7 and 8) regarding their average grade at university;
- the lowest self-assessment of creativity (3.48) was among students (306 persons) who gave high scores (7 and 8) only regarding one area, i.e. presence in clas-ses.

The arithmetic mean of self-assessment of all students surveyed at university A (total of 594) is 3.48 (on an eight-point scale).

The older the students, the higher the score of creativity self-assessment. Creativity self-assessment among 19-year-olds was 3 (38 students), 20-year-old – 3.18 (63 students), 21-year-olds – 3.24 (115 students), 22-year-olds – 3.47 (108 students), 23-year-olds – 3.59 (111 students) 24-year-olds – 3.69 (87 students), 25-year-olds – 4.01 (28 students), for students aged 26 and older – 4.1 (33 students).

Another factor analysed that enhanced creativity is internship. Average creativity self-assessment score (3.65) of students who did an internship (372 persons) was high-er by 0.17 compared to the arithmetic mean of creativity self-assessment score of all students. This difference was even bigger for students doing an internship or working for up to 4 years (by 0.59 – average creativity self-assessment score of 15 students was 4.07), up to 5 years (by 1.06 – average creativity self-assessment score of 8 students was 4.54) and above 5 years (by 0.93 – average creativity self-assessment score of 23 stu-dents was 4.41). The difference decreased as the length of internship or work de-creased. For 35 students doing an internship or working for up to 3 years, creativity self-assessment score was 3.93 – 0.45 higher than the arithmetic mean of creativity self-assessment score of all students surveyed. For 63 students doing and internship or working for up to 2 years, creativity self-assessment score was 3.47 – 0.01 lower than the average; for 228 students doing an internship or working less than a year creativity self-assessment score was 3.65 – 0.17 higher than the average.

The third factor analysed was the work position of internship or work. The highest scores of self-assessment of the surveyed group were among 42 persons who did an internship or worked in managerial positions (arithmetic mean of creativity self-assessment score – 4.24, 0.76 higher than the average of all surveyed students). Creativity self-assessment score of students doing an internship or working in technical positions was below the arithmetic mean of all students surveyed (arithmetic mean for a group of 107 students was 3.33, 0.15 lower than the average), and in manual positions (arithmetic mean for a group of 84 students was 3.3, 0.18 lower than the average of all persons surveyed).

The data analysed suggests that place of residence has an influence on creativity self-assessment done by students. 271 persons with above-average score of creativity self-assessment live in a big city of population >500 thousand inhabitants (arithmetic mean of creativity was 3.62 – 0.14 higher than the arithmetic mean of all persons surveyed). Students from small towns – 151 persons – were below the arithmetic mean of creativity self-assessment (arithmetic mean of the score – 3.46, 0.02 lower than arithmetic mean of all persons surveyed). The same applies to inhabitants of villages (167 persons, arithmetic mean of score – 3.29, 0.19 lower than the average of all scores).

Formal education, which includes classes at university (lectures, practical and laboratory classes and projects) is the most common source of developing creativity of the students surveyed (87% of indications). On the other hand, the lowest number of the surveyed (14%) evaluated this form as most useful in development of creativity competencies. The biggest influence on developing knowledge, skills and creativity attitudes is professional work, included in the category of non-formal education. This form is of key importance for the development of creativity competencies, as was indicated in 35% of cases, but also by a high assessment score of 5.28. Charities were evaluated by students as a poor form of developing competencies (average score 3.82). The fewest respondents (15%) indicated its key role in the process of improving creativity skills. Internships and apprenticeships, as well as workshops and training were given a higher score for their role in developing creativity competencies.

The last form of learning is informal learning: family and social life. Situations in social life were deemed by 23% of students as those that develop creativity competencies to the largest extent, with a high average score of 4.92. Importance of this form of learning is thus high and in the hierarchy it takes the second place, following professional work. Situations in family life were evaluated on a similar level to workshops and training – average score was 4.49, with a slightly higher percentage of respondents attributing those situations with a key role in the process of developing creativity.

3.3 Drawing up the Model Based on the Correlation Coefficient

In view of the above conclusions and aiming at realisation of the research objective, a path of developing creativity may be drawn (fig. 2). Individual stages of developing creativity result from both literature analysis and the analysis of survey research among students. 861 students took part in the research, but due to the completeness of data for calculating the correlation coefficient, surveys of 841 respondents were used.

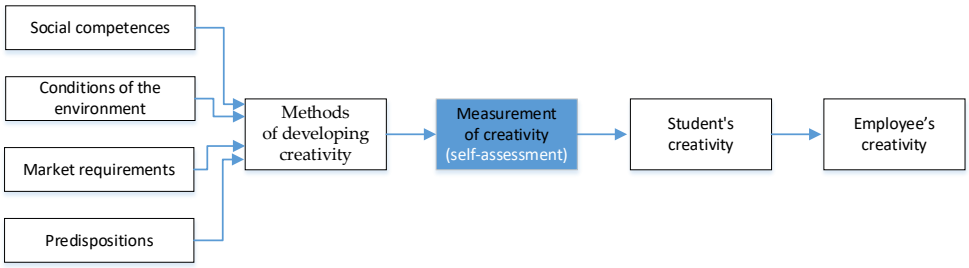


Figure 2: Chosen Factors That Influence the Path of Competency Development With an Impact on Employee's Creativity

Stages of developing creativity presented in fig. 2 were examined in detail through questionnaires, and results thus obtained were subjected to statistical research. The analysis, based on hierarchical multiple regression, revealed that social competencies and forms of learning examined are strongly correlated with 'creative thinking' competence, and this correlation is statistically significant.

Table 2. shows correlation coefficients between chosen independent variables self-assessing the level of social competencies and the used forms of learning, and the most significant competency related with creativity – 'creative thinking'. The strongest correlation was shown by the group of social competencies (SC - 02 Managing a team, SC – 03 Conflict resolution, SC - 04 Organizational skills, SC - 05 Negotiation skills, SC - 06 Internal communication skills, SC - 07 Communicating with the environment, SC - 08 Strategic thinking, SC - 09 Managing information). Weaker correlation was shown by FE - 01 Professional work, FE - 02 Internship/ apprenticeship, FE - 03 Workshops/ training (simulations), FE – 04 University classes (e.g. practical classes), FE – 05 Out-side work (e.g. organizing events), FE – 06 Family life (e.g. parents), FE – 07 Social activity (voluntary work)).

Table 2: Spearman's R Correlation Coefficient Between 'Creative Thinking' and Other Social Competencies and Forms of Learning. Basic Statistics

No.	Variable	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14	15.	16.
1.	SC - 01 Creative thinking	-															
	SC - 02 Managing a team	0.59*	-														
3.	SC - 03 Conflict resolution	0.55*	0.69*	-													
4.	SC - 04 Organizational skills	0.35*	0.50*	0.50*	-												
5.	SC - 05 Negotiation skills	0.52*	0.60*	0.68*	0.45*												
6.	SC - 06 Internal communication skills	0.46*	0.59*	0.65*	0.45*	0.64*	-										
7.	SC - 07 Communicating with the environment	0.44*	0.59*	0.61*	0.47*	0.57*	0.77*	-									
8.	SC - 08 Strategic thinking	0.46*	0.59*	0.56*	0.55*	0.53*	0.56*	0.60*	-								
9.	SC - 09 Managing information	0.42*	0.45*	0.49*	0.30*	0.4*	0.41*	0.39*	0.38*	-							
10.	FE - 01 Professional work	0.24*	0.25*	0.21*	0.19*	0.23*	0.17*	0.24*	0.22*	0.29*	-						
11.	FE - 02 Internship/ apprenticeship	0.19*	0.18*	0.16*	0.11*	0.21*	0.14*	0.16*	0.11*	0.18*	0.37*	-					
12.	FE - 03 Workshops/ training (simulations)	0.26*	0.27*	0.25*	0.19*	0.24*	0.24*	0.23*	0.21*	0.19*	0.34*	0.41*	-				
13.	FE – 04 University classes (e.g. practical classes)	0.11*	0.17*	0.14*	0.08*	0.17*	0.15*	0.15*	0.09*	0.10*	0.08*	0.15*	0.30*	-			
14.	FE – 05 Outside work (e.g. organizing events)	0.16*	0.20*	0.20*	0.14*	0.24*	0.18*	0.18*	0.13*	0.15*	0.16*	0.20*	0.33*	0.33*	-		
15.	FE – 06 Family life (e.g. parents)	0.13*	0.17*	0.18*	0.12*	0.20*	0.16*	0.17*	0.15*	0.12*	0.24*	0.21*	0.26*	0.28*	0.46*	-	
16.	FE – 07 Social activity (voluntary work)	0.10*	0.17*	0.14*	0.17*	0.15*	0.15*	0.15*	0.11*	0.10*	0.20*	0.30*	0.44*	0.19*	0.33*	0.30*	
	Median	3.7	4.0	4.3	3.0	4.0	4.4	4.3	4.0	3.5	0.5	0.4	0.4	0.4	0.5	0.4	0.2
	Q1-Q3	2.7-4.3	3.0-4.8	3.3-5.0	2.5-4.5	3.0-5.0	3.6-5.2	3.7-5.3	3.0-5.0	0-5.0	1-7	1-6	1-5	3-6	2-6	1-6	0-5
	SE	0.04	0.04	0.04	0.05	0.05	0.04	0.04	0.05	0.08	0.10	0.09	0.09	0.07	0.09	0.09	0.09

* $p<0.05$ statistically significant value, $p\geq0.05$ statistically insignificant value. Source: own elaboration based on the research result

In order to describe the dependency model based on hierarchical multiple regression, all independent variables that showed a significant correlation with creative thinking were analysed (tab. 3). The model drawn up covered six steps, but since in the last step the variable did not enhance the description, it was not included in the description of the model. In the first step, the variable (SC – 02 Managing a team) described the model largely and was statistically significant ($R2 = 0.35$, $p \leq 0.001$), where-as further variables improved the correlations of the model. Finally, the description of the model was based on four variables from the area of social competencies (SC – 02 Managing a team, SC – 05 Negotiation skills, SC – 03 Conflict resolution, SC – 08 – Strategic thinking) and one variable regarding the form of education (FE – 03 Work-shops/ training (simulations)). This model described significantly – in 43% - the phenomenon of correlating creative thinking with qualities examined in the survey ($R2 = 0.43$, $p \leq 0.001$, $F = 13,27$).

Figure 3 shows graphic correlations between qualities analysed that have an influence on creative thinking. Factors appearing in the model describing the phenomenon statistically analysed were also marked in the chart (social competencies SC – 02, SC – 05, SC – 03, SC – 08 and the form of education FE – 03). The chart presented is also the idea reflection of factors related with competencies significant in the job market, as well as the reflection of the model for developing creativity of future engineers.

Additionally, while looking for the correlations between the examined qualities, an analysis of variance was used to estimate the distance between clusters as well as Ward's method. (fig. 4.) The choice of this method was justified with the analysis of variance relating to the data set while obtaining a high effectiveness with examining small clusters.

Internal similarities and external differences may be observed based on the tree diagram, an example of which may be a separate accumulation of social competencies from SC – 01 to SC – 08 and a separate accumulation of forms of education from FE 01 to FE 07. A very distinct similarity of social competencies SC – 01 and SC – 08, while simultaneously discarding SC – 08 should be noted. It shows a lack of group connection with a very distinct individual similarity.

Table 3: Analysis of Backwards Stepwise Regression – Establishing the Model Of Dependencies

Variable	R^2	β	F	p value
Step 1	**0.35**		**461.32**	**<0.001**
SC - 02 Managing a team		0.59		<0.001
Step 2	**0.39**		**278.51**	**<0.001**
SC - 02 Managing a team		0.43		<0.001
SC - 05 Negotiation skills		0.27		<0.001
Step 3	**0.41**		**196.86**	**<0.001**
SC - 02 Managing a team		0.35		<0.001
SC - 05 Negotiation skills		0.18		<0.001
SC – 03 Conflict resolution		0.19		<0.001
Step 4	**0.42**		**152.99**	**<0.001**
SC - 02 Managing a team		0.31		<0.001
SC - 05 Negotiation skills		0.16		0.0001
SC - 03 Conflict resolution		0.16		0.0001
SC - 08 Strategic thinking		0.12		0.0003
Step 5	**0.43**		**125.5**	**<0.001**
SC - 02 Managing a team		0.29		<0.001
SC - 05 Negotiation skills		0.15		0.0001
SC - 03 Conflict resolution		0.16		0.0002
SC - 08 Strategic thinking		0.12		0.0004
FE - 03 Workshops/ trainig (simulations)		0.09		0.0015
Step 6	**0.43**		**107.13**	**<0.001**
SC - 02 Managing a team		0.29		<0.001
SC - 05 Negotiation skills		0.12		0.0026
SC - 03 Conflict resolution		0.15		0.0005
SC - 08 Strategic thinking		0.12		0.0005
FE - 03 Workshops/ trainig (simulations)		0.08		0.0025
SC - 09 Managing information		0.09		0.0038

* p<0.05 statistically significant value, p≥0.05 statistically insignificant value. Source: own elaboration based on the research result

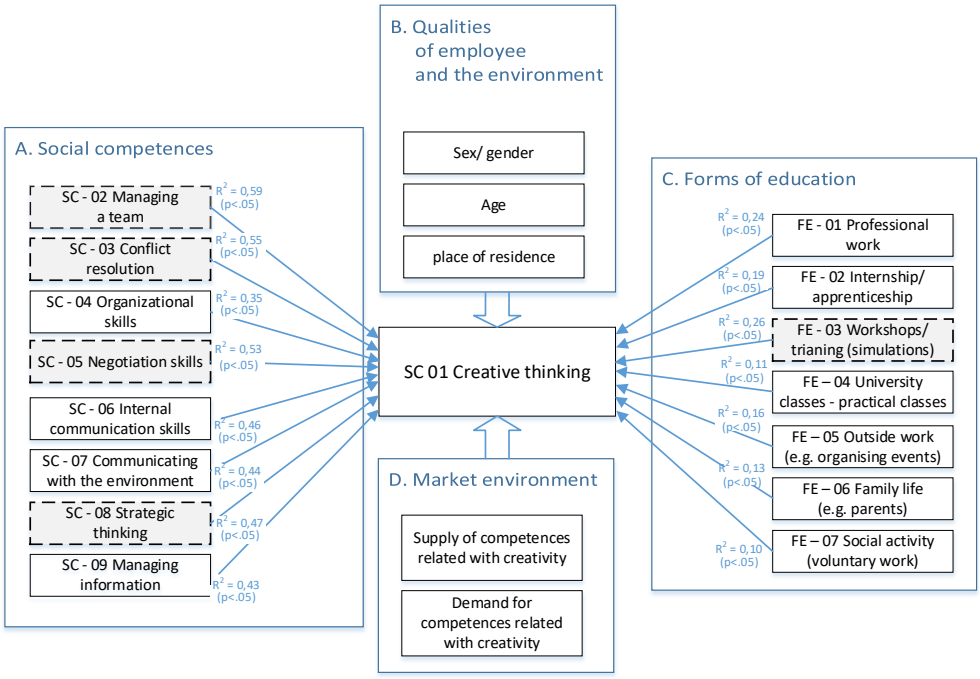


Figure 3: Graphic and Statistical Model for Developing Creativity of Future Engineers

Within the scope of expanding search for correlations indicating general regularities in relationships between variables taken into account in the examination of social qualities that influence creativity, principal component analysis (PCA) was done – figure 5. The component, corresponding to the first (biggest) eigenvalue, explains as much as 61.9% of total variability, the second one – 9.7%, which explains 71.6% of random variable. Vectors representing the analysed variables reach almost the edges of the unit circle, thus they are well represented by the first two components. Five components show a positive flow direction and confirm, previously proved in other research and literature analysis, a stronger correlation between social qualities

connected with communication (managing a team, internal communication skills, communication with the environment) and coordinating managerial competencies (organizational skills, strategic thinking). Managing in-formation is also characterised by a bigger angle inclination, which proves a weaker correlation among other variables. The distribution of other variables indicates a significant correlation of primary variables – their angle inclination from the second principal component does not exceed 900 (α < 450).

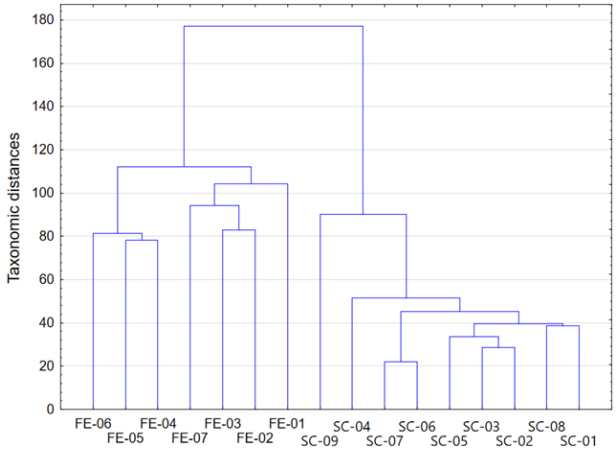


Figure 4: Tree Diagram - Ward's Method – Accumulation of Qualities Related with Creative Thinking

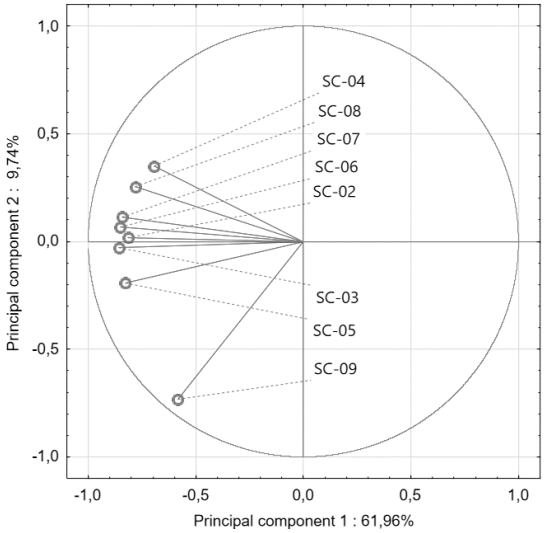


Figure 5: Principle Component Analysis of Social Competencies Related With Creative Thinking

The choice of analyses presented and the results was an attempt at showing opportunities of managing employees' competencies in effective business management. The use of activities described in the presented model should result in improving the quality of developing key competencies during the learning process, and their agile use and development at work.

4. Discussion

The objectives stated at the beginning of this paper referred to two areas: a) factors that influence the development and perfecting competencies of future engineers regarding creativity, and b) a proposal of a model for developing creativity of future engineers, that would encompass factors showing the higher influence on social competencies. Looking for the appropriate method of developing students' competencies, first their level should be recognised and adapted to their needs. It is necessary then to first examine the level of creativity competency of individual students, and next to create a programme of developing knowledge and business skills. Main research aspects of this paper, related with the opportunity for development and perfecting competencies of future engineers regarding creativity were included in the model. A large number of future engineers who provided information for the construction of the model is the reliable premise for implementation of the model obtained.

Having analysed our results, we may state that limiting development of factors most closely correlated with creative thinking (Managing a team, Negotiation skills, Conflict resolution, Strategic thinking or the form of education based on Workshops and training) may be the effective approach to the development of necessary competencies. In the research two areas were confronted – practical and theoretical – students' self-assessment of their own competencies in connection with factors included in the questionnaire, which were resulting from the literature analysis. The results obtained also confirmed the thesis that the university plays an important role in developing students' creativity, which is in line with research of other authors, e.g. (Tawil, & Dahlan, 2017; Tawil & Dahlan, 2017).

Factors present in examined models of creativity published by other authors were included in the model drawn up, e.g. (Awan et al., 2019). Taking into consideration the results of other authors and in order to increase the usefulness of the model used, further re-search could extend it by factors connected with internal motivation of the surveyed and conditions enabling implementation of innovation in the environment.

5. Conclusions

The importance of creativity among employees in the job market is emphasised (Abrantes, 2020). Human capital is currently the most valuable resource of modern businesses. Due to the great variability of the surroundings and the necessity to continuously increase competitive advantage and to be distinguished in the market, creativity may be the key competency in many work positions. It seems to be one of the key factors that influence the success of a business.

This paper emphasises the necessity of extensive description of competencies, which reflect knowledge and skills of employees and their connections with interrelations on managing human capital. Research results are based on data obtained from a large group of students, i.e. the group most involved in the development of managerial skills. Conclusions presented regarding the importance of creative thinking and including this social competency in the group of various forms of education are coincident with the perception of an employee as the most important 'resource' expressed as human capital (Bortolotti et al., 2015]. Such a view of social competencies and their development is also an important aspect of preventive management. Research shows that future engineers, while still at university, must develop their potential, investing in various forms of education for their future jobs. The significance of the influence of various forms of education on creative thinking is also presented in scientific papers discussing the ways of increasing the effectiveness of the educational process (Carayannis et al., 2017). Justification and practical use of the model presented in this paper is also shown in other research carried out by the authors (Goliński & Miądowicz, 2019; Goliński & Szafrański, 2019; Graczyk-Kucharska, 2019).

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Undesirable Knowledge Behaviours and Task Conflict in Hospitals: Effects on Quality of Care

Tiago Gonçalves and Carla Curado
ADVANCE/CSG - ISEG, Universidade de Lisboa, Portugal

tiago.goncalves@aln.iseg.ulisboa.pt
ccurado@iseg.ulisboa.pt

Abstract: Knowledge management systems in the healthcare context are designed to facilitate knowledge flows and to integrate ways of capturing, leveraging, and sharing knowledge effectively. However, knowledge management implementation is often challenging and driven by the complex and multifaceted nature of healthcare knowledge, albeit related to high performance healthcare outcomes. The social nature of knowledge brings forth additional complexities and managerial challenges that can be related to individual undesirable knowledge behaviours - such as knowledge hiding and knowledge hoarding. Undesirable knowledge behaviours reflect human-based activities that jeopardize decision-making and performance by consciously and unconsciously hindering knowledge flows inside organizations. Such loss of important information can promote disagreements surrounding allocation of resources, contributing to dissonant goals and perspectives that shape task conflict. To that end, the purpose of our work is to understand the influencing role of knowledge management systems, knowledge hoarding, knowledge hiding and task conflict as contributors shaping quality of care in hospitals. We follow a quantitative approach, using partial least-squares structural equation modelling (PLS-SEM) to test the relationships between variables from our original empirical model. Research data comes after a survey conducted to 318 healthcare professionals working in Portuguese hospitals. Main findings show that knowledge management systems positively contribute to knowledge hoarding behaviour, while also presenting a positive influence on the quality of care provided by the hospital. Additionally, knowledge management systems are negatively related to the existence of task conflict between healthcare professionals. Conversely, results show that knowledge hiding is positively related to task conflict–being the latter a negative predictor of quality of care. Moreover, results show that knowledge hoarding positively affects quality of care. Our research offers an original contribution to healthcare management by providing insight on the influence of knowledge related systems and behaviours and their influence on the quality of care provided by healthcare professionals. Theoretical and practical contributions driving future action and research are presented.

Keywords: Knowledge management systems, Knowledge hiding, knowledge hoarding, Task conflict, Quality of care, Mixed-methods, Healthcare

1. Introduction

Quality of care reflects dimensions of responsiveness, access, and patient trust, making it a core concern of healthcare practice (Anufriyeva et al., 2020). As such, quality of care results of a combination of factors that drive the core concern of healthcare services (Aiken et al., 2002). As healthcare development becomes increasingly complex, so do the conventional forms of measurement representing quality of care are being challenged (Hannawa et al., 2021). Structural aspects such as clinical practice knowledge, efficiency procedures, and techniques are important factors that influence quality of care (Karamitri et al., 2017; Kosklin et al., 2022). By extension, job and task related complexities are also drivers shaping quality of care (Anufryeva et al., 2020; Hannawa et al., 2021).

Despite the recognized importance of knowledge management practices and systems in the development of healthcare performance, knowledge management systems (KMS) remain underused in healthcare organizations (Hammoda et al., 2022). The implementation of knowledge management in healthcare faces many challenges and obstacles, as discussed by previous research (Karamitri et al., 2017)

Expanding on the knowledge difficulties (Hammoda et al., 2022) evidence suggests that the poor implementation of knowledge management systems and practices can act as a driver to power shift differences, marginalization of professionals and stratification through social isolation (Pandey et al., 2021). Such risks draw parallels from emergent literature in knowledge management literature focused on counterproductive forms of knowledge (Connelly et al., 2012). Knowledge hiding and hoarding are both motivated by power and psychological ownership of knowledge, and both are negatively related to knowledge sharing (Connelly et al., 2012; Oliveira et al., 2021). While research on the damaging effects of knowledge hiding in healthcare is limited, recent evidence suggests negative consequences at the individual level (Alam et al., 2021; Pandey et al., 2021). However, performance-based outcomes and consequences shaping the nature of healthcare work remain scarce in the healthcare literature. Expanding on such gap, this work aims to explore the role of knowledge management systems and counterproductive forms of knowledge behaviour

(knowledge hiding and knowledge hoarding), assessing their impact on the task conflict experienced by healthcare professionals and in the quality of care provided to patients.

2. Literature Review

2.1 Quality of Care

Quality of care is influenced by both structural aspects, such as clinical knowledge and procedures, and intrapersonal/individual characteristics, such as skill, learning, and teamwork (Anufryeva et al., 2020; Hannawa et al., 2021).

Therefore, it is necessary to explore the integration of both individual and organizational factors in promoting quality of care (Moen et al., 2021). Recent literature emphasizes the importance of self-assessment and individual input from healthcare professionals in measuring quality of care (Hannawa et al., 2022; Moen et al., 2021). By extension, it is of importance to consider the perspectives of healthcare professionals and patients to better understand the contribution of individual input to organizational preparedness in healthcare environments (Ayatollahi and Zeraatkar, 2019).

Achieving quality of care requires a focus on knowledge management at multiple levels, including infrastructural related sources (information technologies and systems), task oriented related sources (job complexity, task characteristics), and individual factors such as motivations and attitudes towards knowledge seeking and sharing (Anh et al., 2021; Savic et al., 2020). The healthcare industry can benefit from a transposition of such requirements to achieve innovative and competitive performance, mirroring in healthcare performance outcomes driven by knowledge related phenomena similar positive performance outcomes found in other knowledge intensive environments (Karamitri et al., 2017).

The integration of individual and organizational factors related to knowledge as an asset is essential in promoting quality of care in healthcare delivery (Hammoda et al., 2022; Karamitri et al., 2017; Pandey et al., 2021).

2.2 Knowledge Management Systems in Healthcare Organizations

KMS describe fundamental managerial process to improve individual and organizational outcomes in healthcare organizations (Karamitri et al., 2017; Kosklin et al. 2022). KMS rely on combinations of information infrastructures, technologies, as well as policies, processes and practices that can support the management of knowledge (Avali and Leidner, 2001).

The growing complexities in healthcare knowledge further justify the development of KMS in recent years, supported by the developments of new forms of technologies to support knowledge's potential in achieving proper forms of diagnostics and treatment to patients (Phan et al. 2022). As such, the role of KMS in healthcare should consider a two-folded approach to knowledge mobilization and knowledge use. The first, considering their potential to organize work, tasks and gain access to knowledge (Ayatollahi & Zeraatkar, 2019; Plaice & Kitch, 2003). The second, to ensure KMS design concerns on promoting social contact to attain higher levels of tacit knowledge only available at the individual level (Ayatollahi & Zeraatkar, 2019).

The implementation of KMS and practices can enhance interaction and reduce conflicts and professional tensions, therefore reducing uncertainty (Kosklin et al., 2022) – a proposition that mirrors the positive role of KMS in hindering task conflicts that arise from unclear visibility of the nature of work in other knowledge intensive environments (Semerci, 2019) or among working teams (Mu et al., 2021). Considering the advantages of KMS in the promotion of clearer venues of communication and knowledge flows in healthcare organizations (Alam et al., 2021; Karamitri et al., 20217; Kosklin et al., 2022), we propose that:

H1: KMS have a positive influence on the quality of care provided by healthcare professionals.

H2: KMS have a negative influence on the task conflict experienced by healthcare professionals.

Although deemed a knowledge intensive environment (Kosklin et al., 2022), healthcare organizations reliance on technology supporting knowledge management systems alone is insufficient if individuals fail to contribute or perceive these systems (Karamitri et al., 2017).

Of the risks related to mismanagement of knowledge management in healthcare settings, knowledge hiding and knowledge hoarding represent two counterproductive behaviours that can have life-threatening consequences, compromising the quality of care and the well-being of professionals (Pandey et al., 2021). These behaviours are driven by power dynamics and the perceived ownership of knowledge (Connelly et al.,

2012; Oliveira et al., 2021), acting more than an opposing force to knowledge sharing (Oliveira et al., 2021). Knowledge hiding reflects the intentional concealment of knowledge solicited by others, whereas knowledge hoarding reflects an unintentional accumulation of knowledge that is not shared with others for personal gain (Connelly et al., 2012; Gonçalves et al., 2023; Oliveira et al., 2021). Given the KMS focus on ensuring knowledge flows and knowledge availability in healthcare organizations (Alam et al., 2021; Kosklin et al., 2022), we argue that KMS hinders knowledge hiding behaviour. Nevertheless, we also propose that the availability of knowledge can promote accidental accumulations of knowledge and promote knowledge stickiness (Kim et al., 2012). Therefore, we hypothesize that:

H3: KMS have a negative influence on the knowledge hiding behaviour among healthcare professionals.

H4: KMS have a positive influence on the knowledge hoarding behaviour among healthcare professionals.

2.3 The Emergence of Counterproductive Knowledge Behaviours

Emerging as the more studied forms of counterproductive forms of knowledge behaviour, both knowledge hiding and knowledge hoarding represent two of the more conceptually developed and empirically studied phenomena in the literature discussing negative behaviours related to knowledge (Gonçalves et al., 2023; Oliveira et al., 2021; Silva de Garcia et al., 2021).

Literature suggests that knowledge hiding and knowledge hoarding research is focused simultaneously on both individual and organizational influences leading to such behaviours, and individual and organizational consequences stemming from them (Gonçalves et al., 2023). Nevertheless, empirical research is still scarce, with conceptual overlaps, still persisting in the operationalization of both knowledge hiding and knowledge hoarding (Gonçalves et al., 2023; Oliveira et al., 2021). Existing conceptual work proposes that knowledge hiding represents a deliberate intention to conceal information from others upon request (Conelly et al., 2012). On the other hand, knowledge hoarding represents an equal form of withholding of knowledge that is not shared to others after an accidental (and individual) accumulation of knowledge (Oliveira et al., 2021). Existing evidence in the literature suggests that job characteristics are related to knowledge hiding behaviours, with such forms of negative behaviours contributing to cycles of conflict grounded on psychological and power threats (Semerci et al., 2019). Nevertheless, there is little to no evidence on the role of knowledge hoarding as a form of behaviour that further leads to perceived conflicts in organizations. Given the complex nature of healthcare knowledge and the task related complexities representing knowledge assets in healthcare organizations (Hammoda et al., 2022), we propose that:

H5: Knowledge hiding behaviour has a positive influence on the task conflict experienced by healthcare professionals.

H6: Knowledge hoarding behaviour has a positive influence on the task conflict experienced by healthcare professionals.

Consequently, the difficulties surrounding the implementation of KMS in healthcare led to the development of healthcare management literature focused on the barriers, risks, and consequences of poor knowledge management inside healthcare organizations (Alam et al., 2021; Hammoda et al., 2022; Pandey et al., 2021). Expanding on the implementation of KMS and practices in healthcare organizations, knowledge management initiatives in healthcare are met with persistent and old-fashioned practices, as discussed in literature spawning more than a decade (Alam et al., 2021; Kim et al., 2012; Karamitri et al., 2017). Such evidence is of concern, in particular when considering both the life-threatening consequences from poor management of healthcare knowledge, and the potential for counterproductive behaviours stemming from erosion or knowledge devalue in healthcare organizations (Pandey et al., 2021). Pandey and colleagues (2021) argue that such lack of strategy or direction in the management of knowledge leads to power imbalances, stratification, and marginalization. This perspective aligns with current research on knowledge management, which has identified knowledge hiding and hoarding as negative or counterproductive forms of organizational behaviour related to knowledge as a resource (Connelly et al., 2012; Gonçalves, Curado and Oliveira, 2023). Adding to the identified risks of value destruction in healthcare through mismanagement of knowledge assets, counterproductive forms of knowledge behaviour are discussed in the literature as antecedents of both individual and team performance (Garg et al., 2022). Nevertheless, we argue that knowledge hoarding acts as a positive antecedent of quality of care, given the quasi-accidental nature of knowledge hoarding (Oliveira et

al., 2021) and its self-interest focus on individual development (Oliveira et al., 2021). Therefore, we propose that:

H7: Knowledge hiding behaviour has a negative influence on the quality of care provided by healthcare professionals.

H8: Knowledge hoarding behaviour has a positive influence on the quality of care provided by healthcare professionals.

2.4 Task Conflict in Healthcare Organizations

Task conflict describes a type of interpersonal conflict that arises from disagreements or conflicting views on how to approach and perform specific tasks or activities in the organizational context (Jehn et al., 1995). As such, task conflict differs from relationship conflict through the awareness of differences in interests and the incompatibility of interests pertaining the nature of work.

Research on task conflict represents a static nature of the phenomenon, often not acknowledging the cyclical pattern surrounding task conflict (Kuypers et al., 2018). Expanding on such view, literature suggests that the complex nature of task conflict presents a temporal pattern shifting from and to relationship conflicts (Guenter et al., 2016). Such evidence can draw a comparison with several propositions supporting the individual-centric nature of knowledge (Hammoda et al., 2022) by understanding individual behaviours and individual complexity. Expanding on this rationale, Kuypers and colleagues (2018) discuss that the role of task conflict should be viewed, not under its managerial complexities, but as a phenomenon related to human capital depletion (p. 1290).

Effective communication, open-mindedness, and willingness to compromise are key factors in managing task conflict in healthcare teams (Gittell et al., 2013; Mitchell et al., 2019). Additionally, clear role definitions, shared goals, and a focus on patient-centered care can help to minimize task conflict and facilitate the delivery of quality of care (Gittell et al., 2013). By extension, evidence also suggests that positive forms of commitment and communication between healthcare teams can also contribute to better quality of care when experienced task conflict is low (Mitchell et al., 2019). Therefore, we propose that:

H9: Task conflict experienced by healthcare professionals has a negative influence on the quality of care provided.

Figure 1 presents the research model.

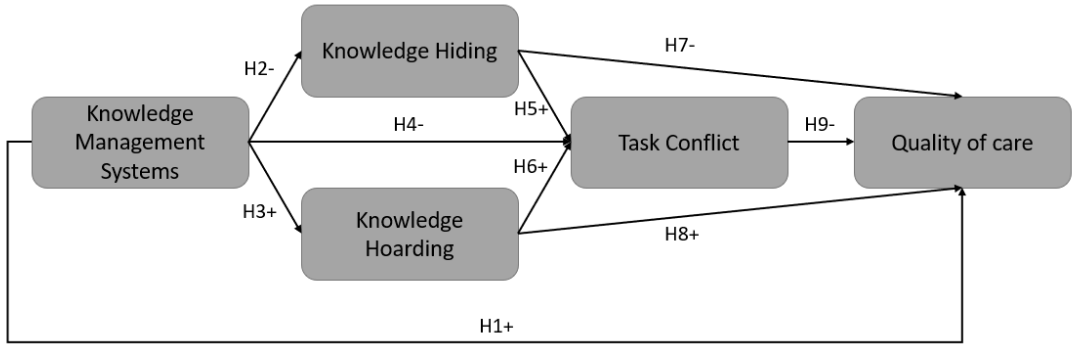


Figure 1: Research Model

3. Methods

3.1 Partial Least Squares Structural Equation Modelling

This study adopts a quantitative approach and utilizes a Partial Least Squares Structural Equation Model (PLS-SEM) to examine survey data collected from 318 healthcare professionals. The PLS-SEM is an estimation model that aims to evaluate and estimate the path models between latent variables and their connections. It is a suitable technique for smaller samples and can address limitations in researching complex variables (Hair et al., 2019).

3.2 Sample

The data comes from an online survey using QualtricsXM® sent to healthcare professionals working in hospital in Portugal. The research team contacted several hospitals (both private and public) who acted as a point of contact to ensure the internal distribution of the survey among healthcare professionals. The survey was internally validated by the Ethical Committees from the partnering organizations to ensure compliance. Measures come from different sources, previously validated in the literature. We conducted several ex-ante procedures to ensure data consistency and remove common-method and non-response bias. Participant anonymity and confidentiality was ensured. Items were randomized and counterbalanced. A team of six specialists representing several healthcare professionals provided insight on the survey to ensure further consistency and remove bias. The final sample comprises 318 responses. The demographic information of the sample is presented below (Table 1).

Table 1: Descriptive statistics

		f	%
Gender	Female	238	74.8
	Male	78	24.8
	Non-binary/Other	1	0.3
Age(years)	18-24	19	6
	25-34	74	23.3
	35-44	77	24.2
	45-54	72	22.6
	55-64	69	21.7
	65+	7	2.2
Profession	Certified therapists	27	8.5
	Hospital pharmacists	21	6.6
	Medical doctors	95	29.8
	Nurses	125	39.3
	Other allied health professionals (e.g. Technicians and technologists)	46	14.5
	Psychologists	4	1.3
Professional Experience(years)	0-1	23	7.2
	1-5	44	13.8
	6-10	41	12.9
	11-15	33	10.4
	16-20	55	17.3
	21+	122	38.4

3.3 Measures

We use previously validated measures coming from difference streams in the literature to ensure diversity and reduce common-method bias. KMS comes from Serenko and Bontis (2016). Knowledge hiding and knowledge hoarding comes from Connelly and colleagues (2012). Task conflict comes from Jehn (1995). Lastly, quality of care comes from Aiken and colleagues (2002). All measures were adapted following a seven-point Likert like scale system (1-Completely disagree/Very poor/Completely unconfident to 7-Totally agree/Excellent/Completely confident).

3.4 Measurement Model

The PLS-SEM approach requires a two-step analysis process (Hair et al., 2014; 2019). The first, centred in measures, relies on the calculation of the discriminant and convergent validity of the measures used in the

research. Following best practices, we calculate the convergent validity of the measures by inspecting the variance extracted (AVE), the Cronbach's alpha, and the resulting composite reliability (CR) (Hair et al., 2019) using the SmartPLS4® PLS-SEM algorithm. All measures remain above the recommended thresholds (AVE>0.5; CR>0.8). Regarding the discriminant validity, we follow three analyses (Hair et al., 2014; 2019). The analysis of outer-loadings, cross-loadings and the assessment of the heterotrait-monotrait (HTMT) matrix. All outer loadings for the items are above 0.5 (acceptable given the exploratory nature of the model (Hair et al., 2019)), ranging from 0.573 to 0.886. All outer loadings are higher than the cross-loadings, and the HTMT matrix presented values below the recommended threshold. The subsequent validation of the variance inflation factors (VIF) shows the presence of 2 items related to knowledge hiding (KH2 and KH10) with higher than recommended values (Hair et al., 2019), therefore being removed from the final model.

4. Results

The testing of the significance of the relationships in the structural model uses the SmartPLS4® bootstrapping algorithm. Results show that KMS has a positive impact on the quality of care provided by healthcare professionals (β=0.478;t=10.234;p<0.001) (H1). Conversely, KMS have a negative impact on the task conflict experienced by healthcare professionals (β=-0.275;t=4.782;p<0.001) (H2). KMS also have a positive impact on the knowledge hoarding behaviour (β=0.204;t=3.745;p<0.001), therefore confirmed hypothesis 3. However, no significative relationship was found between KMS and knowledge hiding behaviour (H4). Regarding counterproductive knowledge behaviours, results show that only knowledge hoarding has a significative and positive impact on quality of care (β=0.108;t=2.105;p<0.05)(H8), with knowledge hiding showing no effect on the outcome (H7). Conversely, while knowledge hoarding shows no significative impact on the task conflict experienced by healthcare professionals (H6), knowledge hiding has a positive and significative impact for the same outcome (H5)(β=0.223;t=4.531;p<0.001). Lastly, results show that task conflict experienced by healthcare professionals as a negative impact on the quality of care delivered to patients (β=-0.121;t=2.257;p<0.05). Figure 2 shows the main results.

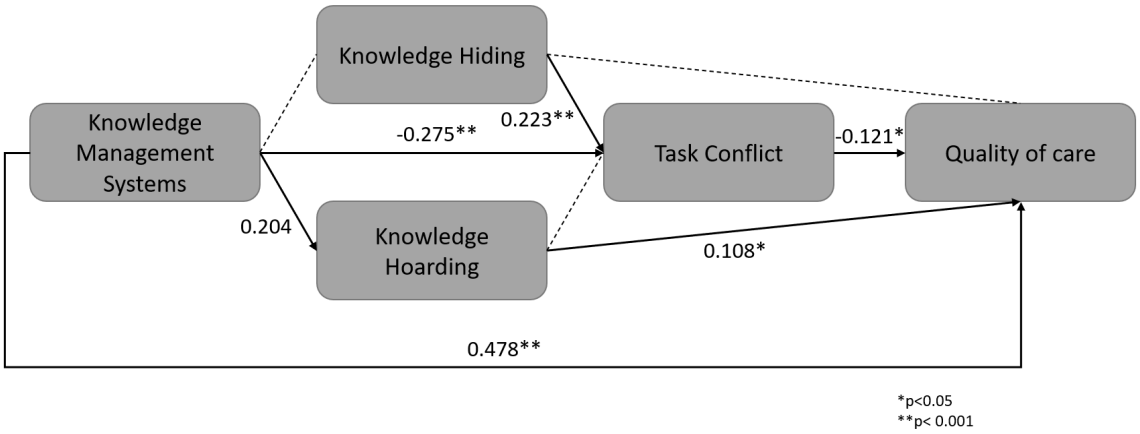


Figure 2: Quantitative Results

According to the structural model analysis, the results explain approximately 31% of the variance of data found for quality of care (R^2= 0.312), suggesting a medium explaining power of the model to the outcome (Hair et al., 2014). All significant relationships have effect sizes (f^2) above the recommended threshold (>0.05) (Hair et al., 2019).

5. Discussion and Conclusion

Our research expands on the importance of knowledge management in healthcare by exploring aspects related to the organizational capability to manage knowledge (KMS) and by expanding on a gap pertaining the consequences of counterproductive forms of knowledge in an understudied setting: that of healthcare organizations. Therefore, the work provides insight on current streams of research revisiting knowledge risks in healthcare (Hammoda et al., 2022), raising awareness to their consequences.

Regarding our hypotheses, results show that KMS have a positive influence on the quality of care delivered to patients (H1). Such findings reflect the importance of knowledge management implementation previously

discussed in the literature, relying on its vital role as a strategical tool to handle knowledge complexity and value creation through knowledge leverage in healthcare (Hammoda et al., 2022; Karamitri et al., 2017; Pandey et al., 2021). By extension, results also show that KMS have a negative influence in task conflict (H4), acting as an organizational structure that can reduce uncertainty and dissonances in healthcare tasks through the raised awareness on communication and cooperation (Karamat et al., 2019; Ayatollahi & Zeraatkar, 2019). Although KMS show no relationship with knowledge hiding in healthcare (H2), findings suggest a positive relationship between KMS and knowledge hoarding behaviour (H3). We argue that, by facilitating knowledge flows among healthcare professionals, KMS presents a quasi-paradoxical risk to knowledge stickiness (Kim et al., 2012) by nurturing behaviours of accumulation. Such novel findings advise caution and managerial implications. In the context of our findings, knowledge hoarding promotes quality of care – suggesting that the centralization and accumulation of knowledge in individuals can be beneficial to the development of healthcare performance (H8) (Karamitri et al., 2017). However, literature suggests that knowledge hoarding can lead to knowledge devalue and negative organizational consequences fostered not on task conflicts, but on relational forms of conflict that bypass the nature of the job (Connelly et al., 2012; Gonçalves et al., 2023; Oliveira et al., 2021).

Findings also suggest a positive relationship between knowledge hiding and task conflict (H5), and no relationship between knowledge hiding and quality of care (H7). Knowledge hiding has no direct effect on the quality of care provided to patients, however it does contribute to task conflicts experienced by healthcare professionals (H5), which in turn impact negatively on quality of care (H9). Similarly to the findings pertaining to knowledge hoarding, such evidence raises managerial concerns. We argue that knowledge hiding behaviours do not present a face value threat to quality of care given the growing concerns on team complexity design and vertical integrations in the healthcare process found in recent literature (Short & Ho, 2020). Expanding on the relationship between knowledge hiding and task conflict, although previous literature explores task conflict as an antecedent of knowledge hiding (Garg et al., 2021), we challenge that conceptualization by following a rational grounded on cyclical forms of conflict as discussed by Jehn (1995). Our findings suggests that task conflict is a consequence of knowledge hiding, relying on the promotion of knowledge mobilization strategies to support the current managerial challenges and difficulties in handling task conflict and its consequences (de Wit et al., 2012; Guenter et al., 2016; Kuypers et al., 2018). Lastly, findings corroborate previous evidence on the role of task conflict in healthcare organizations, suggesting that the lack of shared views in the nature of tasks has a negative impact on healthcare outcomes (Gittell et al., 2013; Mitchell et al., 2019) – here represented under quality of care.

Our work provides important theoretical and practical contributions. From a theoretical standpoint, this paper expands on the still limited empirical knowledge on counterproductive forms of knowledge behaviour in healthcare organizations. By extension, it provides an empirical effort to clarify the differences between different forms of negative behaviour, by addressing the effects of both knowledge hiding and knowledge hoarding – accommodating a theoretical approach suggested in recent literature (Gonçalves et al., 2023; Oliveira et al., 2021). Finally, it explores the effects of knowledge related phenomena in healthcare performance by responding to current challenges on the nature of quality of care (Hannawa et al., 2022) – centring its assessment on the individual input of healthcare professionals.

Regarding practical implications, the focus on both KMS and individual knowledge behaviours allows for managerial flexibility to nurture quality of care and to identify and act on knowledge risks, as proposed in recent literature (Hammoda et al., 2022). Managers and healthcare policymakers should understand and encourage the individual awareness behaviours aimed at the use of KMS in healthcare organizations to promote knowledge flows (Karamitri et al., 2017). However, we recommend that a focus should be given to ensure that the optimization of knowledge mobilization should rely on a cyclical and continuous activity, to deny behavioural tendencies focused on the individual accumulation and stagnation of knowledge. The promotion of reward systems and training should be deployed to raise awareness of the importance of KMS, but also to alert managers of the risks of knowledge concealment (Hammoda et al., 2022). We advise a managerial strategy with engaging leadership that entices cooperation and encourages self-learning of team members, focused on flexibility and team communication. Only through the individual engagement and focus on knowledge related phenomena can knowledge management truly thrive in healthcare organizations (Agrifoglio et al., 2021; Hammoda et al., 2022; Pandey et al, 2021).

6. Limitations and Future Work

This work is not exempt from limitation. We use a PLS-SEM approach to provide an innovative empirical insight on KMS and counterproductive forms of knowledge behaviour in healthcare. However, the research design follows a cross-sectional strategy, which limits causality. The limit geographical scope is also another limitation (Portuguese hospitals), presents risks of cultural influences as non-accounted effects shaping our findings. We recommend future research to contrast our research considering an increased geographical scope and assessing contrasting between professional groups. Lastly, we recommend the inclusion of knowledge complexity and knowledge fragmentation, as well as specific types of knowledge in future research. Namely behaviours pertaining to explicit knowledge and to tacit knowledge.

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Employee Well-Being and its Potential Link With Human Knowledge Risks

Martyna Gonsiorowska[1] and Malgorzata Zieba[2]
[1]Doctoral School, Gdansk University of Technology, Poland
[2]Division of Management, Gdansk University of Technology, Poland

martynagon@gmail.com
mz@zie.pg.gda.pl (Corresponding author)

Abstract: Employee well-being is an essential component of any organisation organisation. Conscious companies make every effort to create a healthy work environment. The well-being of employees and their overall emotional, physical and economic health is affected by various internal and external factors. When employees feel well, they tend to perform better. Therefore, the impact of employee well-being on the organisation is a fact and has been proven in many studies. People with a high level of well-being have greater self-confidence and self-esteem, which means that they are not afraid to look for new solutions and innovations. They are also generally more committed to their work and more dedicated to the organisationorganizational goals (Kim, 2021). Finally, they are more productive, which affects the whole performance of the company. Despite the high importance of employee well-being for the success of organisations organisations, little is known about how this well-being might influence human knowledge risks appearing in organisations. The article aims to present the potential link between employee well-being and human knowledge risks. The paper presents theoretical insights related to employee well-being, as well as human knowledge risks. organisations and organisations.This study has allowed us to identify the potential link between employee well-being and human knowledge risks, which brings several implications for organisations and organisations. showsThe ability to create conditions by managers to increase the well-being of their employees might be useful, in the trial of minimising human knowledge risks in organisations. The study is of theoretical character, and thus its findings should be further examined in practise research studies. The study provides useful information for managers and owners of organisations in need of dealing with various human knowledge risks threatening their organizations. The paper is enriched with a number of sample solutions that they may apply to increase the well-being of their employees and, therefore, mitigate those risks. The paper lays the ground for a better understanding of human knowledge risks and its relationship with employee well-being. As such, the paper offers food for thought for researchers dealing with the topic of human knowledge risks and human resource management, in general.

Keywords: Human knowledge risks, Employee well-being, Knowledge management

1. Introduction

Anxiety, depression, fatigue, aches, aches, and pains are among the many symptoms of deteriorated mental and physical health and poor employee well-being – both possible causes of lower productivity and poorer organisational organisational performance (Rasool *et al.*, 2021). To reduce the severity of such phenomena, employers are fond of declaring that they support and care about the well-being of their employees. In reality, many organisations simply do not have a dedicated well-being strategy. Providing a medical package or a low-cost membership to a fitness club is not enough; these are only partial short-term measures. Companies must focus on a holistic strategy so that workplace well-being becomes part of their organisational culture (Nicholson, 2022). The Chartered Institute of Personnel and Development (2022) in their study identified that focussing on employee well-being brings a number of benefits. It is a healthy organisational culture that fosters inclusion, better employee morale and participation, and a better work-life balance. According to Grawitch, Gottschalk, and Munz (2006), 'fostering a work culture that is mindful of the importance of work-life balance, employee growth and development, health and safety, and employee participation can be the key to achieving sustainable employee well-being and organisational performance". Therefore, caring for employee well-being should not be an "add-on," it should be a part of the company's core operation and the centre of the business model. Healthy and happy employees cope better with their workload, build positive relationships with co-workers, are more creative, and achieve better results (Nicholson, 2022). People with a high level of well-being have greater self-confidence and self-esteem, which means that they are not afraid to look for new solutions and innovations. They are also usually more committed to their work and more dedicated to the organisation's goals (Kim, 2021).

Despite the high importance of employee well-being for the success of organisations, little is known about how this well-being might influence human knowledge risks appearing in organizations. Knowledge risks are a term used to describe a measure of the likelihood and severity of the negative impact of any knowledge-related activity that may negatively affect the functioning of an organisation (Durst and Zieba, 2019). Human knowledge risks originate from human behaviors and therefore are influenced by various personal, social, cultural, and psychological factors (Durst and Zieba, 2019). Knowledge risks are associated with negative consequences for

organisations; therefore, it is fundamental to effectively identify and reduce or eliminate all reasons causing them. There is a clear need for rigorous research on the topic of employee well-being and its influence on human knowledge risks. To fill this knowledge gap, this paper aims to present the potential link between employee well-being and human knowledge risks.

The paper develops in the following way. The second part presents the concept of employee well-being. In the third section, human knowledge risks are described. In the fourth section, potential links between employee well-being and human knowledge risks are presented together with potential ways of overcoming them described. The last section concludes the paper.

2. Employee Well-Being

Over the years, scientists have offered many definitions of employee well-being. The debate and divergence of opinion regarding the key factors that contribute to employee well-being indicate its multifaceted character. Page and Vella-Brodrick (2009) describe three elements that make up employee well-being: subjective well-being, defined as overall satisfaction with life; workplace well-being and; psychological well-being, which includes autonomy, self-acceptance, or purpose in life. In this sense, employee well-being is largely dependent on factors beyond the work space. Similarly, the Gallup Institute (2022) - the oldest polling institute in the world - has singled out five elements that affect employee well-being, i.e., social, financial, physical, and community well-being. We enjoy physical well-being when we feel strong, have the energy to do things, and do not feel pain or discomfort. Financial well-being means that we are satisfied with our earnings, we feel good and security, and it allows us to plan for the future. Professional well-being is achieved when we are satisfied with what we do and with the relationships, we have at work. Social well-being is about relationships with society and acting for the benefit of others.

On the other hand, Guest and Conway (2004) argue that six aspects construct employee well-being. All of them encompass the employee's working sphere and are manageable within the organisation. These are adequate workload, employee control over work, good working relationships, team inclusion, a clearly defined role, and a sense of involvement in change decisions. Similarly, the PERMA model of well-being identifies five building blocks to consider: positive emotions, Engagement, Relationships, Meaning, and achievement (Seligman, 2011). However, Donaldson, Heshmati, Lee, and Donaldson (2021) expanded this framework by adding relevant components - building blocks for work-related well-being. The PERMA + 4 framework also includes elements of physical health, mindset, work environment, and Economic Security elements, which makes the model fit better into the organisational context.

Juniper (2011) defines employee well-being as “that part of the overall wellbeing that they perceive to be primarily determined by work and can be influenced by workplace interventions”. This definition eliminates external factors and thus distinguishes between overall employee well-being and simply employee well-being. This definition has its opponents, because life situations and personal issues affect employees. On the other hand, employers do not have control over what happens after hours. The most important thing is to take responsibility for what they can do for their employees (Waida, 2021). When discussing employee well-being, one needs to remember that apart from some universal factors influencing this well-being, like access to sports facilities or green areas, helping to take care of the physical health of employees, there could also be some factors that might be specific for each individual, for example, the possibility to discuss topics on the forum might for some be a positive factor influencing well-being, while for some others it might be the factor decreasing this well-being due to stress generation. This makes the discussion of the well-being of employees even more complex.

Moreover, many factors have influenced the working conditions and therefore the well-being of employees, over the last several decades. Among those factors, there is the process of globalisation, developments in technology, high competition, work intensification, diversity of the workforce, increased share of women in the workforce, and blurring of boundaries between work and family (Kalliath and Kalliath, 2012). All these factors have posed some challenges related to working conditions and the well-being of employees. For example, blurred boundaries between work and family have contributed to burnout among employees. Similarly, advances in technology have changed the work environment, forcing many employees to work remotely and be available 24/7. Taking into account the fact that people spend a considerable part of their lives at work (between a quarter to a third of waking life) (Grawitch, Gottschalk, and Munz, 2006), it is not surprising that changes in their work environment might have a significant influence on their health and well-being, as well as on job and organisational performance (Kalliath and Kalliath, 2012). At the same time, more and more employees seek a good working environment, paying attention not only to their salaries but also to the atmosphere at work or the

possibility of maintaining a work-life balance. 'The new generation of office workers has been shaped by a hybrid and remote culture, and values the balance far more than generations that preceded it' (Pandey, 202).

There are several healthy workplace practises, namely: work-life balance, employee growth & development, health & safety recognition, and employee participation.participation. Employee well-being can be constituted by general physical health, general mental health, job satisfaction, employee morale, stress, motivation, organisational organisational commitment, and climate (Grawitch, Gottschalk, and Munz, 2006). Even if employers do not have the power to influence all these areas to the most extent, they can still influence some of these factors, for example by creating a supportive culture to reduce the stress at work and increase organisational commitment or by offering alternative work arrangements to reduce work-family conflicts.

3. Risks of Human Knowledge

Knowledge risks are still a new topic in the literature. According to the definition provided above, 'Knowledge risk is a measure of the probability and severity of adverse effects of any activity that engages or is related somehow to knowledge that can affect the functioning of an organisation at any level" (Durst and Zieba, 2019,p.2). Knowledge risks can be of different types and categories, and there are various consequences and ways of handling them. One of the categories is a category of human knowledge risks, which can be defined as 'connected with an individual´s personal, social, cultural, and psychological factors and thus the management of human resources' (Durst and Zieba, 2019). Among the risks of human knowledge, one can list knowledge hiding, knowledge hoarding, unlearning, the forgetting or missing/inadequate competencies of the organizational members.

Knowledge hiding can be defined as 'an intentional attempt to withhold or conceal knowledge that has been requested by another person' (Connelly *et al.*, 2012). In such a situation, an employee is asked about something or for something (e.g. help with the tool/software, etc.), but he or she decides to keep the knowledge or skill to himself or herself. Knowledge hoarding takes place in a situation when knowledge is not shared, but it has not been asked for by anyone; therefore, the effect is the same as in the case of knowledge hiding, but knowledge hoarding does not have to be intentional, even if its consequences can also be serious (lack of available knowledge needed for the functioning of the organisations). Another human knowledge risk, unlearning, can be defined as deliberate forgetting of knowledge, activities, routines, etc. Unlearning can be to some extent useful and necessary, for example, when new knowledge is needed to be introduced in an organisation, but in some cases, it can lead to negative consequences, when something potentially needed is unlearned. Another related risk is forgetting. It takes place when accidentally or intentionally employees forget certain knowledge and this knowledge is no longer available for their or organisational purpose. It can potentially have severe negative consequences when important knowledge is forgotten and an organisation in the future will need to gain it again, for example, by purchasing it from the outside. The last type of human knowledge risk is missing/inadequate competencies of organisational members. It can happen that employees do not have adequate competencies to handle the tasks or analyse and interpret available knowledge and, as a consequence, make an improper decision. Another example of a risky situation is when an organisation loses a business opportunity because its members are not able to notice it or properly use it for organizational benefit.

The authors of this paper believe that those risks of human knowledge risks might be related to the well-being of employees, and this link between those two concepts will be described in the following section.

4. The Potential Link Between Employee Well-Being and Human Knowledge Risks

Taking into account the characteristics of human knowledge risks and well-being of employees, one can expect a link between these concepts for several reasons. For example, human knowledge risks are related to the human behaviour and this behaviour can be influenced by the well-being of employees. For example, if an employee feels down, stressed, or overworked, he or she might not be willing to share their knowledge, and they can manifest knowledge hiding behaviour (which is one of human knowledge risk). Another example: if an employee is in a bad financial situation, he or she might not be devoted fully to working in an organisation, contributing with their full potential. They may, for example, unlearn some knowledge to make place for the practises helping them to improve their financial situation and not necessarily to help in organisational performance.

To provide a clearer understanding of the potential relationship between employee well-being and human knowledge risks, the following table has been prepared. It outlines the various elements and aspects of employee well-being based on the PERMA+4 (Donaldson, van Zyl and Donaldson, 2022). The PERMA+4

framework has been the subject of empirical investigation and its usefulness has been evidenced (Donaldson *et al.*, 2021). The table also presents human knowledge risks as a consequence when these 9 elements of employee well-being are lacking. Finally, possible strategies to overcome these risks are presented.

Elements/aspects of employee well-being (PERMA+4)	**Human knowledge risks as a consequence of the lack of the element of employee well-being**	**Potential ways of overcoming human knowledge risks**
Positive emotions	Knowledge hiding & hoarding	Appreciating an employee through all financial and non-financial incentives is essential, this shows employees how much the organisation values them. In addition, providing a path for advancement, supporting, and listening to the employee's needs is a fantastic approach to maintaining good vibes and sustaining positive emotions. Such solutions increase the chances that an employee will be happy on the workplace. Positive emotions in the workplace will reduce motivations for negative knowledge-related activities. It may even increase the desire to share knowledge and participate in additional initiatives or projects.
Engagement	Knowledge hiding & hoarding	Employees should participate in a variety of events, such as training sessions, learning days, team building exercises, office parties, and many more. An employee who feels required and involved in his work is more dedicated to the company and its objectives. Additionally, one is probably less inclined to hoard or hide knowledge.
Relationship	Knowledge hiding & hoarding	An organisational culture that does not create fierce competition between team members is essential. Employers must make every effort to integrate employees in order to format relationships between them. The mutual benefit relationship with others is characterised by sharing knowledge and support in daily life.
Meaning	Knowledge hiding & hoarding	The experience of being connected to something greater than yourself or serving a greater purpose is crucial. Employers need to show employees that their work is significant, that it matters, and serves a larger purpose. An employee's sense that he or she is fulfilling a mission, and its success depends partly on him or her, will reduce the risk of selfish behaviours like hiding or hoarding knowledge.

Elements/aspects of employee well-being (PERMA+4)	Human knowledge risks as a consequence of the lack of the element of employee well-being	Potential ways of overcoming human knowledge risks
Accomplishment	Knowledge hiding & hoarding	Providing employees with a sense of competence in a given area of interest and setting achievable goals that are later met by them is an excellent method to overcome human knowledge risks. Employees with a sense of accomplishment will not fear for their position in the company, thus they will not treat knowledge as their only advantage over their colleagues. It will certainly reduce the motives for negative knowledge-related actions.
Physical Health	Forgetting	Providing access to sports facilities and green areas can support employees' physical health. Providing medical packages and regular testing packages is another way of overcoming the knowledge risk which is forgetting.
Mindset	Knowledge hiding & hoarding, missing/inadequate competences	Having a growth mindset and a belief in one's skills and abilities can potentially reduce knowledge risks. Any initiatives taken by the company to support employees' growth mindsets like learning and development opportunities can have a significant impact on positive individual and organisational outcomes.
Work Environment	Knowledge hiding & hoarding	It is worthwhile to provide a comfortable, safe, and stimulating physical workplace. It directly affects with whom and how people connect and interact at work, since knowledge sharing involves social exchange; the physical workplace matters a lot.
Economic Security	Knowledge hiding & hoarding	Ensuring financial/economic security, and providing training for employees in financial literacy and financial planning can make unhealthy competition, including motives to retain knowledge, lessened.

Source: Own elaboration.

As can be seen in the table above, the most common human knowledge risk associated with various aspects of employee well-being is knowledge hiding and hoarding. These risks to knowledge can appear in case of a lack of positive emotions, engagement, lack of relationship, or meaning. It can also result from lack of economic security. In the event of lack of physical health, employees might forget important organizational practises and things. Last but not least, a lack of a growth mindset may result in employees not only lacking the necessary abilities or competencies but also being unable to absorb them. These considerations expand on the current theory with additional potential factors that may cause knowledge hiding or hoarding. Anand and Hassan (2019) identified person-related factors that lead to knowledge hiding behaviour. These include personality, emotional intelligence, bad intentions, revenge, seeking power, and expecting something in return. However, impaired

well-being or the absence of some elements of employee well-being, for example, negative emotions, lack of growth mindset, relationships, and no meaning, were not considered as potential factors leading to knowledge concealment.

Employees with overall low levels of well-being are potentially more vulnerable to human-knowledge risks. Deteriorated well-being or self-esteem can make employees less engaged at work, less motivated, and manifest certain negative knowledge-related phenomena, such as knowledge hiding or hoarding, forgetting, or missing competencies. Employees with negative emotions, no relationships, and no meaning of accomplishment are more likely to hide or hoard knowledge. Furthermore, a poor work environment, economic insecurity, or poor mindset can also exacerbate human knowledge risks.

As a consequence of impaired employee well-being, organisations may be more vulnerable to knowledge loss. Employees who are stressed, overloaded with work and in a depressed mood are more likely to leave their jobs. Increased turnover can cause a company not only to lose talent but also key knowledge.

Although this paper discusses only the aspect of human knowledge risks, it is also worth mentioning the potential link between employee well-being and other types of knowledge risks. For example, some technical knowledge risks can be more probable due to the reduced well-being of the employees. Deteriorated employee well-being can also contribute to greater vulnerability to cybercrime, which brings many negative consequences, including those related to knowledge such as spillover. People are still the weakest link when it comes to cybersecurity. That is why your well-being matters; when their mood is worse and their concentration drops, it is easier to make simple mistakes, such as opening a suspicious link.

5. Conclusions

To conclude, employee well-being is an important factor in the analysis of human-knowledge risks that can face. Until now, there have been no studies in the literature that present the potential impact of employee well-being on human knowledge risks and knowledge risks in general. This paper offers a significant step in understanding the link between well-being and knowledge risks such as hoarding, hiding, unlearning, and others. Furthermore, human knowledge risks as a consequence of the lack of the element of employee well-being and the potential ways of overcoming them have been presented. The contribution made in this paper can be best appreciated by practitioners who are dealing with human resources management and knowledge threats to their organisation. Furthermore, the paper offers insights that are worth pondering by researchers who deal with the topic of knowledge management, knowledge risks, and human resources management in general.

As this area is still in its infancy, this study has only laid theoretical grounds for future analysis. Being of a theoretical character, this paper has limitations. First of all, it is not based on a systematic literature review; to the best knowledge of the authors, there are no studies so far examining employee well-being and its relation with knowledge risks. Therefore, a systematic review of the literature would not deliver any outcomes. Second, as a theoretical study, it cannot deliver ready solutions to organisations; however, it can serve as food for thought for managers and owners of organisations. To overcome the limitations of the theoretical character of the study, a pilot study will be conducted in the near future, dealing with the examination of employee well-being and its influence on knowledge risks in organisations. Future research could also investigate whether employees who experience higher levels of well-being are more likely to participate in knowledge-sharing and collaboration.

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Analysis of Tools Supporting the Formation of Relations in an Educational-and-Economic Network

Magdalena Graczyk-Kucharska, Kamil Mousselli, Maciej Szafrański, Marek Goliński and Małgorzata Spychała
Faculty of Engineering Management, Poznan University of Technology, Poland

magdalena.graczyk-kucharska@put.poznan.pl
kamil.mousselli@gmail.com
maciej.szafranski@put.poznan.pl
marek.golinski@put.poznan.pl
malgorzata.spychala@put.poznan.pl

Abstract: The analysis of the literature shows that cooperation, in particular the maintenance long-term, enhanced and stable relations between education and business is very difficult. Supported by scientific research, source literature presents a beneficial effect of the transfer of knowledge on the improvement of innovation, competitiveness and organizational conditions in enterprises, public institutions as well as other organizations. The activities developed in the educational-and-economic network analyzed herein include e.g. engaging in particular medium-sized and big enterprises in the exchange and updating of knowledge about competencies on the labour market which are necessary on job positions at which graduates of technical schools are employed. The main objective of the paper is to develop a process of cooperation between education and business institutions, in particular with respect to strengthening relations in an education-and-business network in which the activity can improve knowledge sharing. An indirect objective in its development is the analysis of the effectiveness of the application of tools stimulating companies to cooperate and exchange knowledge within the network. The studied were based on data from 2017-2020 collected from a sample of 352 companies. The analysis was also carried out in the context of the frequency of e-mail and telephone contacts as well as direct contacts understood as individual meetings most often held at a given employer's facility. Kaiser-Mayer-Olkin criterion and Bartlett sphericity test were used for analysis of relationships between individual variables. Factor analysis (KMO and Cattell's criterion) and Pearson's correlation were used to study the effectiveness of the application of tools supporting the companies' activity in the network. The analyses show that the biggest impact on forming relations is linked to participation in discussion panels. It is worth pointing out that the activity is organized for the purposes of exchanging knowledge and experience of experts who usually represent medium-sized and big employers, especially in the area of HR. As a result of the studies, a process path was proposed for the purposes of establishing, developing and maintaining long-term relations with big and medium-sized enterprises in the network of entities cooperating in the field of education and business.

Keywords: Customer relationship, Knowledge sharing, Network, Competence management

1. Introduction

Knowledge management functions within organization management, but is focused on intangible resources which differ from tangible ones due to their abstraction, metaphorical semantics and non-linearity. Supported by scientific research, source literature presents a beneficial effect of the transfer of knowledge on the improvement of innovation, competitiveness and organizational conditions in enterprises, public institutions as well as other organizations. Knowledge management in an organization is a great challenge and in the network of entities, e.g. between entrepreneurs and entities related to education, it becomes even more complicated.

In the scientific scope, cooperation is analyzed mainly from the level of selected skills, e.g. entrepreneurship and the impact of the development of these competences on young people's career (Vodă & Florea, 2019). Many of the articles are based either on the analysis of competences acquired during education (Chan & Luck, 2022) or on a literature review (Flores et al, 2020). Therefore, the current knowledge of competences necessary in the job market and the way of their acquisition for management purposes, especially in the regional context, is still a major challenge (Szafrański, 2019). The needs of business and education (Bratianu et al, 2021) are often analyzed through the prism of students (Mahamood et al, 2021) and not through real needs of the job market and cooperation with business based on a relationship in the network. The process of defining competences required in the job market can be supported by reference models that indicate the most sought-after skills in the labour market. Such reference models may additionally contain a description of the required level of skills (Spychała et al, 2017). However, they are based on real requirements in the job market. The list of skills and their level in a reference model can become a tool in the education system to update knowledge of the requirements of the labour market and adapt the education system to their needs. Therefore, an exchange of knowledge related to competence needs between education and business is essential for better learning outcomes and

continuous improvement of skills compatible with the needs of the labour market, especially among the youngest generation of employees.

Previous studies show that knowledge management affects business education through the curriculum and the impact of the business environment (Bratianau, 2021), which means that finding effective methods of building relationships between business and education, will contribute to better knowledge management, e.g. in the area of competence needs in the labour market.

The main objective of the paper is to develop a process of cooperation between education and business institutions, in particular with respect to strengthening relations in an education-and-business network in which the activity of enterprises with a focus on education. An indirect objective in its development is the analysis of the effectiveness of the application of tools stimulating companies to cooperate and exchange knowledge within the network.

The activities developed in the educational-and-economic network analyzed herein include e.g. engaging in particular medium-sized and big enterprises in the exchange and updating of knowledge about competencies on the labour market which are necessary on job positions at which graduates of technical schools are employed.

The studied were based on data from 2017-2020 collected from a sample of 352 companies. The analysis of relationships between individual variables has been done with Kaiser-Mayer-Olkin criterion and Bartlett sphericity test. Then data analysis with Factor analysis (KMO and Cattell's criterion). Pearson's correlation was used to study the effectiveness of the application of tools supporting the companies' activity in the network. The analyses show that the biggest impact on forming relations is linked to participation in discussion panels. It is worth pointing out that the activity is organized for the purposes of exchanging knowledge and experience of experts who usually represent medium-sized and big employers, especially in the area of HR.

2. Literature Review

Knowledge is the sole meaningful economic resource as stated by Drucker (1995). Moreover, research by Quintas et al (1997) has established the role of knowledge as a key source of potential advantage and thus become a widely discussed topic in the field of economics. Mårtensson (2000) also Asrar-ul-Haq and Anwar (2016) view knowledge management (KM) as an integral component of the broader concept of intellectual capital. Frow and Payne (2009) show at their research how managing, sharing, and transferring knowledge should be one of the organization's business strategies. In addition, how it is determined by situational analysis that identifies changes in the industry and competitive environments, and growth opportunities. Indeed Marimuthu et al (2009) posit that human resource input undoubtedly plays a significant role in enhancing firms' competitiveness.

In the context of the knowledge economy, it is widely recognized that connections and collaboration between individuals and organizations can significantly enhance value creation (Du Plessis et al, 2007). One form of such partnership is knowledge networks, which are specifically designed to facilitate knowledge sharing and creation. Du Preez et al (2008) define knowledge networks as a set of people, resources, and relationships that enable the capture, transfer, and development of knowledge, thereby creating value. The concept of knowledge networks can be variously understood as information networks, expert networks, practice-oriented communities, or strategic alliances, depending on the interests of members and the nature of the network itself (Creech & Willard, 2001). Our research focuses on a case study investigating the strategic relationship between an economic organization and educational entity to develop a competitive advantage and increase innovation in education. We argue that knowledge sharing is not solely an internal process but rather involves a dynamic and long-term process of knowledge transfer among organizations (Lakpetch & Lorsuwannarat, 2012). Recent research by Ziegler (2022) reinforces the importance of knowledge sharing for maintaining competitiveness and effectiveness in the current economy. Past studies have used knowledge sharing as a mediating variable, highlighting its significance in facilitating the continuous exchange and development of individual and organizational knowledge (Zhao et al, 2021).

Knowledge sharing involves combining knowledge with a sharing mechanism, and the characteristics of the knowledge and channels used for sharing can affect outcomes (Ahmad & Karim, 2019). Personal and organizational factors also impact knowledge-sharing behaviors (Asrar-ul-Haq & Anwar, 2016). According to Frow and Payne (2009), focusing solely on the technological aspects of network sharing is not enough, and organizations should adopt a strategic approach towards networking and relationships. In their analysis, Marquez-Ramos and Mourelle (2019) examined the relationship between education and economic growth in Spain, highlighting education as a crucial determinant of economic well-being and human capital development

in the labor force. Modern universities strive to produce individuals who can lead social and economic development, as noted by Shi et al (2020). Goliński and Szafrański (2020) conducted a case study on "The Wielkopolska Educational-and-Economic Network (WEEN)." This network, which has been functioning and improving since 2010, was established by the Poznań University of Technology, the Wielkopolska Province Government, businesses, secondary technical schools from the region, and other mainly educational institutions. The purpose of WEEN is to develop and enhance knowledge management of competencies in the region. Continual improvement of the partners' knowledge about the existing relations between them and the value stemming from strengthening those relations is essential within WEEN. A higher level of knowledge about the interdependencies among stakeholders has a positive influence on building and consolidating intellectual capital. The cooperation with enterprises within WEEN has resulted in good practices in human resource management by these companies. In summary, Marquez-Ramos and Mourelle (2019) analysis emphasizes the importance of education in promoting economic growth, while the case study of WEEN showcases the benefits of knowledge-sharing networks in enhancing intellectual capital and improving human resource management practices.

Universities play a crucial role in knowledge transfer as key agents. According to Seibert et al (2017), universities, as producers of ideas and knowledge, and firms, as users of knowledge, are the two essential elements of the innovation system. Collaboration between these two agents, as emphasized by Chen and Lin (2017), Rubin et al (2015), and Miller et al (2016), is essential for achieving innovation and regional economic growth. Mikalauskienė and Atkočiūnienė (2019) emphasize that knowledge management goes beyond its direct meaning and involves the creation of an environment conducive to knowledge processes, as well as purposeful, continuous, and systemic management and development of the educational, economic, ecology and societal well-being. Our research paper focuses on the production of ideas and knowledge by economic entities that are needed in the labour market, which educational institutions then use. Based on the educational reform proposed by Sahlberg (2006), this process involves three steps: first, investigating the required competencies that increase the competitive value of enterprises; second, sharing the knowledge gained from this investigation with educational institutions; and finally, researching new methodologies and educational materials to achieve these competencies while considering change management.

Higher education is viewed as an engine for development in the new global economy, as it involves investing in human capital development and contributes to the economic growth of countries. However, some of the challenges faced by higher education institutions (HEIs), including the need to re-affirm the value of sustainability, management dilemmas, the lack of academic involvement, and the absence of an external evaluation (Hadam et al, 2020).

Our study indicates that there is no one best way to achieve high network performance, and multiple paths are possible to form the relations in an educational-and-economic network. Prior studies have examined this issue in relation to certain structural and functional network characteristics, such as governance forms and size, network management, and managerial mechanisms (Cristofoli et al, 2019). Our research paper discusses the effectiveness of knowledge network management tools between economics and educational entities based on collected data.

3. Methodology

3.1 Data Collection and Measures

The studied were based on data from 2017-2020 collected from a sample of 352 companies. The data used for the analyses come from CRM, an IT system which supports network management. The analysis of the effectiveness of the application of tools stimulating the activity of companies was carried out taking into account all identified activities of each company in the network in each calendar year. Then, all the activities treated as variables were summed up to examine the correlations between them. In addition, the authors took account of data such as the date of entering the facility into the CRM which illustrates the duration of relations in the network, the distance between the company's headquarters and the network coordinator, as well as the size of the employer determined by the number of employees. The analysis was also carried out in the context of the frequency of e-mail and telephone contacts as well as direct contacts understood as individual meetings most often held at a given employer’s facility. The analysis of relationships between individual variables has been done with Kaiser-Mayer-Olkin criterion and Bartlett sphericity test. Then data analysis with Factor analysis (KMO and Cattell's criterion) and Pearson's correlation coefficient.

The list of analysed Variables is as followed: 1. Date when the facility was entered in the CRM, 2. The distance between the entity and the network coordinator, 3. Size of the entity in the network, 4. Participant in the panel, 5. Long-term activity, 6. Provision of a job description, 7. Involvement in the development of a competency profile, 8. Sending job /apprenticeship /internship offers, 9. Conclusion of a cooperation agreement, 10. Activity in logging into the IT System, 11. Adding the offer to the IT System, 12. E-mailing activity, 13. Phone call activity, 14. Activity in direct meetings.

3.2 Data Analysis

In order to further explore relationships between entities and their activities in the framework of the Wielkopolska Education and Economic Network, factor analysis was carried out. It is a statistical method that allows to reduce the redundancy of the original data set as well as to detect directly unobserved common factors explaining the variability of the analyzed phenomena.

The condition for the applicability of factor analysis is the existence of relationships between individual variables. The Kaiser-Mayer-Olkin (KMO) criterion and Bartlett's test of sphericity were used to check it. In our case, the value of KMO=0.846 was obtained, which indicates that the use of factor analysis for the exploration of this data set is justified (in practice, factor analysis can be used if KMO > 0.7).

The Bartlett test of sphericity is used to verify a hypothesis which states that a correlation matrix between input variables is an identity matrix, which means the lack of mutual correlation of variables. In our test, $p < 0.001$ was obtained, which indicates a need to reject the null hypothesis and allows to claim that the variables used in the analysis are mutually correlated.

The following variables were excluded from further analyses: the date when the facility was entered in the CRM and the distance between the entity and the network coordinator, for which the resources of joint variability were the smallest (<0.2). The second stage of factor analysis is the determination of the number of distinguished factors. For this purpose, the Kaiser criterion (Table 1) was used, i.e. factors for which eigenvalues are greater than unity were distinguished.

Table 1: Kaiser Criterion - Factors for Which Eigenvalues are Greater Than Unity

Total Variance Explained									
Factor	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cum %	Total	% of Variance	Cum %	Total	% of Variance	Cum %
1	4.863	40.527	40.527	4.401	36.674	36.674	2.511	20.924	20.924
2	1.449	12.078	52.605	.997	8.306	44.980	2.096	17.465	38.390
3	1.153	9.608	62.212	.634	5.287	50.266	1.425	11.876	50.266
4	0.921	7.677	69.890						
5	0.747	6.227	76.117						
6	0.656	5.465	81.582						
7	0.558	4.653	86.235						
8	0.417	3.475	89.710						
9	0.402	3.347	93.057						
10	0.346	2.881	95.939						
11	0.268	2.235	98.174						
12	0.219	1.826	100.00						

Also, the Cattell criterion based on the screen plot indicates the choice of 3 factors as the best (Figure 1).

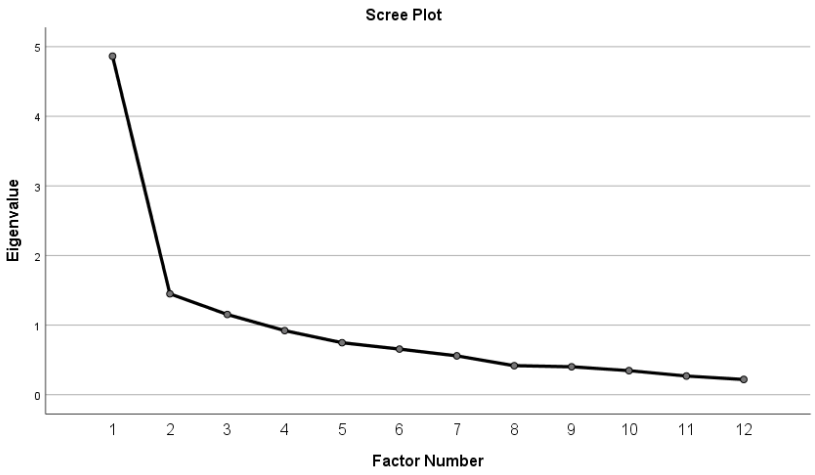


Figure 1: This is how a Figure Should Appear

For 3 distinguished factors, the maximum likelihood method with a VARIMAX rotation was used and, as a result, the following matrix of factor loadings of joint factors was obtained (Table 2).

Table 2: Rotated Factor Matrix for 3 Distingueshed Factors

Rotated Factor Matrix[a]			
	Factor		
	1	2	3
Size of the entity in the network	0.197	0.409	-0.022
Participant in the panel	0.611	0.474	0.171
Long-term activity	0.305	0.047	0.124
Provision of a job description	0.832	0.252	0.164
Involvement in the development of a competency profile	0.696	0.369	0.127
Sending job /apprenticeship /internship offers	0.579	0.200	0.392
Conclusion of a cooperation agreement	0.541	0.351	0.281
Activity in logging into the IT System	0.192	0.180	0.570
Adding the offer to the IT System	0.255	0.000	0.854
E-mailing activity	0.233	0.788	0.156
Phone call activity	0.176	0.528	0.060
Activity in direct meetings	0.112	0.638	0.148

The formation of the first factor defined as: "involvement in creating job reference descriptions/models" is most influenced by the following variables: participant in the panel, provision of a job description, involvement in the development of a competence profile, sending job /apprenticeship /internship offers, sending job /apprenticeship /internship offers, conclusion of a cooperation agreement, long-term activity. The second factor called “frequency of contacts” is most influenced by variables such as: e-mailing activity, phone call activity, activity in direct meetings, size of the entity in the network. The creation of the third factor referred to as "independent use of the system" is most influenced by variables such as: activity in logging into the IT System, adding the offer to the IT System. Figure 2 presents the Factor Plot in Rotated Factor Space for 3 distinguished factors.

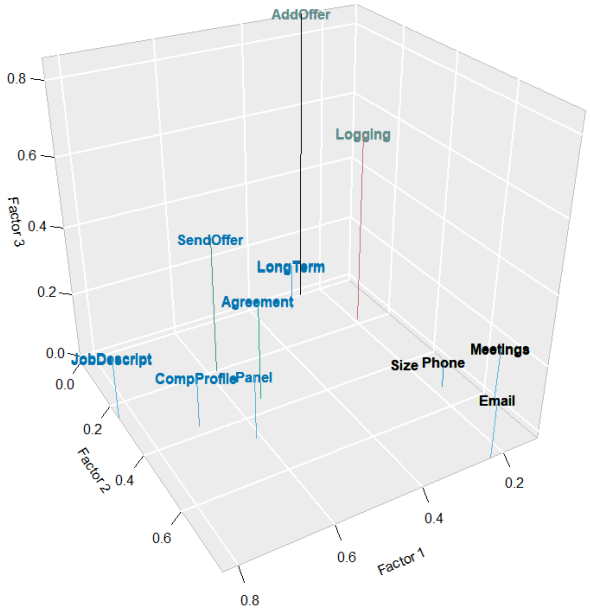


Figure 2: Factor Plot in Rotated Factor Space for 3 Distinguished Factors

In the next step, the Pearson correlation coefficient was analyzed to indicate key relationships between the studied variables. This approach is meant to help in the analysis of key and significant variables in determining the direction and key activities in maintaining relationships with entities in the network for the purpose of acquiring knowledge of competences.

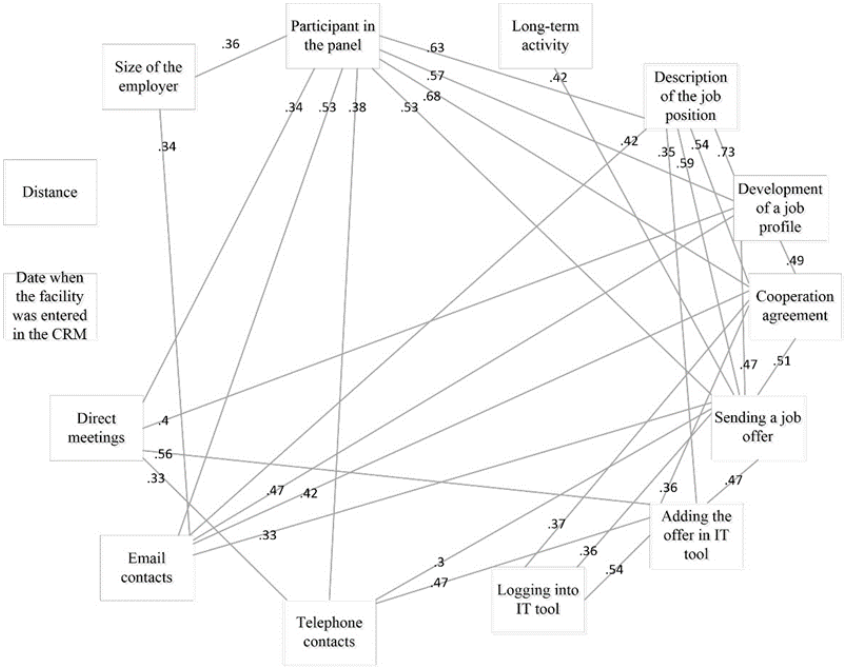


Table 3: Correlations Between Data Describing Entities in the Network and Activities in the Wielkopolska Educational-and-Economic Network

	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.
1. Date when the facility was entered in the CRM	1.00*													
2. The distance between the entity and the network coordinator	0.22*	1.00*												

	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.
3. Size of the entity in the network	-0.21*	-0.14*	1.00*											
4. Participant in the panel	-0.21*	-0.10	0.37*	1.00*										
5. Long-term activity	-0.05	-0.04	-0.02	0.27*	1.00*									
6. Provision of a job description	-0.23*	-0.09	0.26*	0.63*	0.25*	1.00*								
7. Involvement in the development of a competency profile	-0.23*	-0.09	0.29*	0.58*	0.21*	0.74*	1.00*							
8. Sending job /apprenticeship /internship offers	-0.18*	-0.06	0.14*	0.54*	0.43*	0.59*	0.48*	1.00*						
9. Conclusion of a cooperation agreement	-0.21*	-0.07	0.26*	0.69*	0.20*	0.55*	0.50*	0.52*	1.00*					
10. Activity in logging into the IT System	-0.05	-0.04	0.23*	0.27*	0.01	0.29*	0.30*	0.36*	0.37*	1.00*				
11. Adding the offer to the IT System	0.06	-0.02	0.01	0.30*	0.18*	0.36*	0.29*	0.48*	0.37*	0.54*	1.00*			
12. E-mailing activity	-0.26*	-0.15*	0.35*	0.54*	0.14*	0.43*	0.47*	0.34*	0.43*	0.26*	0.20*	1.00*		
13. Phone call activity	-0.18*	-0.09	0.24*	0.38*	0.14*	0.29*	0.27*	0.30*	0.28*	0.12*	0.09	0.48*	1.00*	
14. Activity in direct meetings	-0.16*	-0.11*	0.24*	0.35*	0.06	0.27*	0.41*	0.27*	0.27*	0.22*	0.16*	0.57*	0.37*	1.00*

The correlations considered significant in the inference were those for which $p < 0.05$ which was marked with an asterisk in Table 3. Figure 1 in Attachment 1 only shows only those correlations which present correlation strength higher than or equal to 0.3. In the case of participation in the panels, correlations above 0.3 occur with as many as 7 other activities (from 0.34 to 0.68), with 5 of them showing a correlation higher than 0.5. The lowest correlations linked to the activity participation in the discussion panel occur between direct meetings (0.34) and telephone contacts (0.38). A much higher correlation (0.53) occurs in the context of email contacts. The highest correlation in the context of participation in the panels can be seen in relation to a signed cooperation contract (0.68) and tools supporting defining the demand for competencies such as job description (0.63), development of a job profile (0.68) or sending the job offer (0.53). A similar correlation value between the studied activities can be seen in the item cooperation contract (7 correlations), however, these remain at a slightly lower level. Only 2 correlations of out 7 reached a value above 0.5. Other tools for building relations within the network show fewer connections among one another.

4. Research Findings and Discussion

From the analysis of Total Variance Explained we can conclude that from the point of view of building relationships in the network for the exchange of knowledge of competences, other factors are crucial: involvement in creating job reference descriptions/models, frequency of contacts and independent use of the system allowing for the free addition of job offers, traineeships, internships and the exchange of knowledge of competence needs using an IT system. Sharing knowledge of competence needs in the labour market happens in this case on the side, because the value for employers is to acquire a candidate for a job and not directly transfer knowledge of competence needs in an enterprise in a specific job position. On the basis of Figure 2, it can therefore be concluded that there are 3 islands of significant variables important for strengthening relationships in the network and the exchange of knowledge of competences. The description of key requirements at job positions (Spychała, 2017) can be strengthened by signing a formal agreement between entities and conducting meetings, panels, long-term cooperation and support in the use of an IT system allowing

for the publication of job offers, traineeships and internships. Another important variable in building relationships and contacts may be the size of an entity one cooperates with. Large companies have a more complex structure, but from the level of competence requirements at job positions, their structure is more specialized and not cross-sectional. This makes it possible to precisely describe competence requirements and acquire indispensable knowledge to create a reference model of a job position. This, in turn, may allow young people to see what competences are most often required.

As a result of the studies including Pearson's correlation, a process path was proposed for the purposes of establishing, developing and maintaining long-term relations with big and medium-sized enterprises in the network of entities cooperating in the field of education and business. The path is based on 4 key steps: (1) face-to-face meeting supported by email or phone contact. It is meant to extend an invitation to a discussion panel (2) to strengthen relations in order to (3) sign a cooperation agreement and (4) deepen the cooperation further for the purposes of defining the demand for competencies in enterprises by providing a job description, participating in the development of a competency profile or flow of information on job, apprenticeship or internship offers published on a free IT portal.

Our findings align with the view that the value of external sources and collaborative relationships are critical components of open innovation theory (Stachová et al, 2019). Also Universities play also a strategic role as drivers of regional economic growth (Fluster et al, 2019). We specifically focus on the knowledge network of the strategic relationship between economic organizations and educational entities, recognizing that the creation of such networks can lead to significant benefits for both parties.

Although the results are limited to some extent, e.g. with respect to the regional range of impact of the studied network, it should be noted that the research method can be implemented in any social networks, including educational-and-economic ones. The results of many studies can be compared, providing room for improving methods of shaping and strengthening relations between enterprises and other entities within social structures. In the future, the studies can be extended by the aspect of variability in time of the demand for tools activating entities which cooperate in a network.

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Developing Intellectual Capital Through Knowledge Management in International Assignments: A Conceptual Model

Adriana Gradim[1], José Vale[2] and Vera Vale[1]
[1]Research Unit on Governance, Competitiveness and Public Policies (GOVCOPP), Department of Economics, Management, Industrial Engineering and Tourism, University of Aveiro, Portugal
[2]CEOS.PP, Porto Accounting and Business School, Polytechnic of Porto, Portugal

adrianacoutinho@ua.pt
josevale@iscap.ipp.pt
v.c.vale@ua.pt

Abstract: Currently, organisations must view their intangible assets from a strategic perspective and ensure they can develop intellectual capital to integrate knowledge into their day-to-day management as part of their intangible assets. This strategic perspective leads to using international assignees as knowledge facilitators who can help develop intellectual capital. However, managing knowledge from international assignments to create intellectual capital is often complicated, and the literature pleads for more research on the topic. Therefore, through a systematic literature review, this study aims to overview the state of the art regarding knowledge and intellectual capital management in the context of international assignments to develop a new conceptual model in the field. This study answers the gap in the literature regarding a model that analyses how international assignments influence knowledge management and the creation of intellectual capital in organisations. The main findings suggest that research needs to focus on developing a system to manage knowledge and intellectual capital in the context of international assignments to ensure competitive advantage. The main limitation of this study is the use of only two databases. Further studies should implement the same research procedure using other databases to achieve a broader understanding. In addition, future research needs to focus on developing measurement models of knowledge and IC management for organisations.

Keywords: Knowledge, Knowledge management, Intellectual capital, International assignments, Systematic literature review

1. Introduction

In the current era, intangible resources such as knowledge and intellectual capital (IC) are crucial to creating competitive advantages that secure the success of organisations (Azamat et al., 2023). The increasing attention given to the management of intangible resources such as knowledge and IC is then significant for organisations for different reasons, such as increasing innovation, achieving higher performance and accessing global knowledge, which leads organisations to view knowledge and IC from a strategic perspective (van Criekingen, Bloch and Eklund, 2022; Azamat et al., 2023). IAs are crucial in accessing and acquiring knowledge from different locations (Phil St John Renshaw, Parry and Dickmann, 2020). They are seen as knowledge facilitators despite the need for more research to help identify their organisational value (Reiche, 2011; Renshaw et al., 2020b). However, management practices often do not consider the value of IAs for knowledge and IC management (Crowne, 2009; Awang, Hussain and Malek, 2013).

In the literature, there are few studies establishing a connection between some IC components and some KM processes, namely suggesting that different IC dimensions can impact KM processes differently. Therefore, there needs to be more literature considering the relationship between IC and KM in the context of international assignments, with most studies focusing on just IC or KM. This paper aims to analyse how the literature on knowledge and IC management evolved in the context of international assignments to develop a needed conceptual model in the field. Namely, it aims to answer the following research question: how is knowledge managed in the context of international assignments to help create intellectual capital?

2. Theoretical Background

In this study, IAs can be defined as people who go to work abroad, and different types can be identified in the literature (Fenwick, 2004; Bozkurt and Mohr, 2011). The two main groups of IAs analysed in the literature are expatriates and self-initiated expatriates (SIEs). Expatriates, also denominated as organisational expatriates, are employees sent by their home companies to international posts, following the organisation's path and depending on it (Makkonen, 2015; Farcas and Gonçalves, 2019). SIEs decide to live and work abroad by themselves, being hired as a local in a host country (Cerdin and Selmer, 2014; Andresen, Biemann and Pattie, 2015). Recently, a new type of IAs has been gaining attention, namely inpatriates. These are host or third-country managers transferred into the HQs on a semi-permanent to permanent basis to enhance the globalization of their business activities (Azar, 2012). In general, IAs are seen as knowledge brokers, facilitating knowledge

transfer. In doing so, they play a strategic role for organisations by connecting the home-country company to its subsidiaries (Bozkurt and Mohr, 2011; Azar, 2012). This happens since throughout the entire assignments (from pre-departure until they become repatriates), they can bring essential knowledge regarding the cultural context of potential international target markets they might have been involved (Knocke and Schuster, 2017).

Knowledge management (KM) is crucial from a strategic perspective to sustain competitive advantage for organisations and to help develop IC. In the KM literature, several processes can be identified (Kamoche, 1997; Choi and Johanson, 2012; Wu, Lee and Pham, 2020; Hsu et al., 2021). Since the knowledge involved in these processes can have two forms - tacit and explicit knowledge – it will differently influence how IC is developed (von Krogh, Nonaka and Aben, 2001; Thomas and Gupta, 2022).

In this study, IC is viewed as the knowledge that can be converted into value and englobes the four dimensions, namely human, social, structural and relational capital (Edvinsson and Sullivan, 1996). Human capital (HC) refers to the organisation's members' tacit knowledge, such as competencies and skills (Becker, 1993; Ramaswami, Carter and Dreher, 2016). Structural capital (SC) usually relates to tacit knowledge of the organisation, including mechanisms and structures that support employees in their quest for optimum intellectual performance and overall business performance (Bontis, 1998; Bakhsha, Afrazeh and Esfahanipour, 2018). Social capital refers to the ability of people and organisations involved in networks to secure mutual benefits (Portes, 1998; Ganguly, Talukdar and Chatterjee, 2020). Finally, relational capital (RC) is the relationships between the institution and internal and external entities, including its participation in national and international networks (Secundo et al., 2015; Abu-Rumman, 2018). So, considering the connection between KM and IC, as an example, by efficiently managing tacit knowledge, organisations can develop HC, which, in turn, can lead to SC creation in the form of explicit knowledge.

Since most knowledge derived from international assignments is tacit, it is difficult to codify and transfer it among individuals and throughout the organisation (Crocitto, Sullivan and Carraher, 2005; Glisby and Holden, 2005; Matherly and al Nahyan, 2015). Therefore, organisations must ensure that they have a proper mechanism to manage knowledge from IAs, namely, to transform tacit knowledge into explicit knowledge (Dahou, Hacini and Burgoyne, 2019). Furthermore, organisations must have strategies to manage different types of IAs to transfer the acquired knowledge and, consequently, create IC (Minbaeva and Michailova, 2004; Phil St J. Renshaw, Parry and Dickmann, 2020).

3. Materials and Methods

A literature review helps to gain knowledge on a specific topic of what has been done, the methods used, the key issues and future research needs (Hart, 1998; Denney and Tewksbury, 2013). A systematic literature review was conducted using the PRISMA method, followed by an in-depth literature analysis (Liberati et al., 2009; Page et al., 2021). On February 14, 2022, papers published to date on the Scopus and Web of Science databases were considered for analysis. The search in the databases only includes a limitation to document type, namely articles. No further limitations were included in this phase to achieve a better representative sample.

A first search was conducted using ("knowledge manag*" OR "knowledge shar*" OR "knowledge diff*" OR "knowledge transf*" OR "knowledge creat*" OR "knowledge dissem*" OR "knowledge absor*" OR "knowledge acqui*" OR "tacit knowledge" OR "explicit knowledge") AND ("mobility" OR "job mobility" OR "human mobility" OR "labour mobility" OR "labor mobility" OR "employee mobility" OR "expat*" OR "repat*" OR "assign*"). As a result, a total of 3558 articles were obtained: 1983 articles from the Scopus database and 1575 articles from the Web of Science. The second search was conducted using ("intellectual capital" OR "relational capital" OR "human capital" OR "structural capital" OR "social capital") AND ("mobility" OR "job mobility" OR "human mobility" OR "labour mobility" OR "labor mobility" OR "employee mobility" OR "expat*" OR "repat*" OR "assign*"). Finally, the term "assign*" was used instead of "international assign*" to achieve a broader number of articles that can use the first term to refer to international assignments. As a result, 2354 articles were obtained in Scopus and 2554 in ISI Web of Science (4908 articles in total). Hence, the initial sample was composed of 8466 articles.

After excluding duplicates, 5666 articles were included for the first screening. All abstracts were read. Those that were not aligned with the goal were excluded. Also, the articles with no access and those written in languages other than English, Portuguese, French or Spanish were excluded. Therefore, 105 articles were eligible to be fully read from the Intellectual Capital query and 115 from the Knowledge Management query.

The 220 articles, which comprised the final sample, were then thoroughly read and grouped according to their relevance (see Domingos et al., 2022). Hence, 37 articles were considered irrelevant and excluded. The remaining 183 articles were then analysed using an Excel sheet. This compilation of data made it possible to

create a comprehensive screening of all articles while comparing them to achieve a full systematic review. Figure 1 shows the PRISMA method applied in this paper to screen the articles.

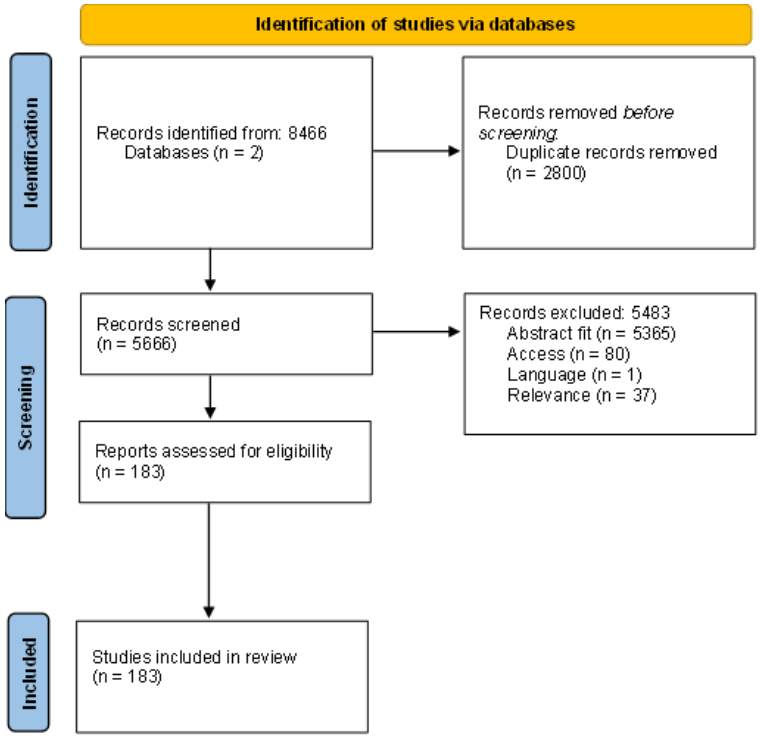


Figure 1: Knowledge, Intellectual Capital, and Mobility PRISMA. Source: Page et al. (2021)

4. Results and Discussion

The analysis of the articles shows a change in careers from people working in organisations that operate at a global level (Andresen et al., 2021). However, the management of IAs imposes several challenges to organisations, namely regarding how they manage their knowledge and IC.

4.1 KM in a Mobility Context

Traditionally, literature has focused on KM as a unidirectional process (from the headquarters (HQs) to the subsidiaries). However, in recent years, seeing it as a bidirectional process gained importance (Sanchez-Vidal, Sanz-Valle and Barba-Aragon, 2018). The sender is usually the IA and the receiver is the host-country national. However, the literature suggests that these parties should play both roles to create a bi-directional knowledge flow (Chang, 2012; Hsu et al., 2021).

The main KM processes referred to in the sample are knowledge (KT), knowledge sharing (KS) and knowledge hiding. Regarding KT, it was found that the process is way smoother when IAs and locals cooperate (Ado, Wanjiru and Su, 2021). Moreover, it was found that KT needs to be managed by considering whether it refers to explicit or tacit knowledge (Ado, Wanjiru and Su, 2021). While some authors suggest that IAs are better transferors of tacit knowledge due to their boundary spanner role, others see them as transferors of explicit knowledge, namely social capital. In the context of KT, increasing attention is given to the reverse knowledge transfer (RKT) process (knowledge from repatriates). However, there is still a lack of mechanisms in organisations to manage RKT (Ali et al., 2021; Amir et al., 2020)

Although KT and KS are commonly used as synonyms, KS is often more used in articles which analyse IAs from a social lens (Boyle, Nicholas and Mitchell, 2016; Heizmann, Fee and Gray, 2018). Concerning the KS process, it should be stressed the effect that cultural intelligence has on it. Cultural intelligence refers to a person's ability to work effectively in culturally diverse work environments (Ali et al., 2019). However, the role played by IAs in the KS process still needs to be clarified, as well as their impact on the type of shared knowledge (Boyle, Nicholas and Mitchell, 2012, 2016; Fan and Harzing, 2017). One crucial aspect to be assessed in the KS process is the direction of the sharing. Two directions are identified: the forward KS (from HQs to subsidiaries) is mainly conducted by expatriates, and repatriates conduct the reverse KS (from subsidiaries to HQs). As identified in the

KT process, less attention is given to the reverse KS (Huang, Chiu and Lu, 2013; Jayasingam, Chong and Abu Bakar, 2021).

Finally, a new process is emerging in the literature on IAs and KM: the one of knowledge hiding. This process refers to more than the absence of knowledge sharing. Instead, it is an intentional effort to conceal or deny knowledge another person requires. Three forms can be identified: (1) Rationalised knowledge hiding - knowledge holder provides a reason why knowledge is not being shared; (2) Evasive hiding - knowledge holder provides misleading, incorrect or partial information and (3) "Playing dumb" hiding - knowledge holder deliberately pretends ignorance or behaves as if unaware to avoid sharing knowledge (Ado et al., 2021; Ali et al., 2021).

4.2 IC in a Mobility Context

Regarding the relationship between IC and international assignments, the most analysed dimension is social capital (e.g., Andresen et al., 2018; Au & Fukuda, 2002; Furusawa & Brewster, 2018, 2019; Yildiz et al., 2019). First, it is mentioned that social capital positively influences IAs since it allows people to access resources embedded in a network (Au and Fukuda, 2002). Moreover, since IAs act as boundary spanners, it was found that social capital helps this role through its bridging and bonding perspectives. The bonding perspective views social capital as a means for establishing close and trustful relationships, while the bridging perspective views social capital as a resource that allows people to bridge ties in networks (Adler and Kwon, 2002; Andresen, Goldmann and Volodina, 2018; Egbe, Adegbite and Yekini, 2018).

The second most analysed dimension is HC (e.g., Andresen et al., 2021; Benson & Pattie, 2008; Breitenmoser et al., 2018; Ewers, 2013). In the analysed articles, HC tends to represent the human resources of an organisation that pursues an international assignment (Andresen et al., 2021). HC is developed through social interactions. Thus, social capital can maximise HC benefits since, i.e. through social networks, it can provide easier access to information and vital resources (Collings, 2014). However, the HC acquired abroad, although a source of competitive advantage, is only sometimes valued by organisations upon repatriation (Benson and Pattie, 2008; Breitenmoser, Bader and Berg, 2018). Such a fact imposes a problem for IC and knowledge management since the organisation's HC is the primary source of knowledge and facilitator of knowledge transfer and sharing (Azar, 2012). Moreover, if people feel that the organisation is not valuing their experience, they can leave it upon repatriation, taking their "new" knowledge with them. In such a case, HC will be lost for the organisation (Shieh, 2014).

The remaining IC dimensions – SC and RC –were less analysed over the years. As a result, most of the articles end up not specifying that they are analysing these dimensions. SC is indirectly referenced in the form of organisational routines and procedures. At the same time, in the assessed articles, RC is grounded on the relationships established between organisations, between the employees and between employees and organisations (e.g., Egbe et al., 2018; Ramaswami et al., 2016).

4.3 KM and IC in a Mobility Context

To answer the research question - how is knowledge managed in the context of international assignments to help create intellectual capital - the literature shows that KM processes boost the development of IC (Ali et al., 2021). However, in both IC and KM queries, there is no analysis of different processes/dimensions and how they can influence each other. With the increased globalisation, IAs act as boundary spanners by mediating the flow of knowledge. IAs are to increase their knowledge by acquiring new skills while abroad. To achieve common ground, it is necessary to consider that an international assignment cycle exists and that multiple aspects of this cycle must be managed according to its different phases. So, organisations should design a system by which IAs can transform tacit into explicit knowledge (e.g., through reports), thus reducing knowledge loss and creating intellectual capital.



Figure 2: Conceptual Base Model

This study aims to help future researchers by offering a base model portrayed in Figure 2 to be further developed as the research moves forward. The main idea behind it is that, in the context of mobility, how knowledge is managed can influence the creation or destruction of intellectual capital.

5. Conclusions

This study is relevant to the field since it aims to analyse KM on a broader way in the context of international assignments. Moreover, by identifying the main processes of KM mentioned in the literature, it helps to clearly define a research path to identify how the management of knowledge can impact the development of IC in the context of international assignments.

Research and practical implications

The main research implication of this study is the development of a base conceptual model. Second, is the identification of a need for studies to interconnect IC and knowledge management in the context of international assignments. Also, this study identified the need for research to differentiate the management of knowledge and IC in this context from traditional human resource management practices.

In terms of practical implications, it was found that it is important for organisations to create a knowledge and IC management team inside the human resource management department, which can develop a proper governance mechanism to retain this knowledge. Moreover, human resource managers must look at IAs as individuals who are different from the rest of the employees due to their knowledge, which can influence the development of IC.

Limitations and future research

This study's main limitation is using only two databases, namely Scopus and ISI Web of Science. Further studies should implement the same research procedure using other databases to achieve a broader understanding. In addition, future research needs to focus on developing measurement models of knowledge and IC management for organisations.

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The Dynamics of the Development of a Knowledge Ecosystem

Kristina Grumadaitė and Giedrius Jucevičius
Vytautas Magnus University, Kaunas, Lithuania

kristina.grumadaite@vdu.lt
giedrius.jucevicius@vdu.lt

Abstract: This paper presents and analyses the dynamics of the development of knowledge ecosystem, putting more emphasis on interorganisational context, such as industrial clusters or "geographical concentrations of interconnected companies, specialised suppliers, service providers, companies in related industries and associated institutions (trade / industry associations, universities, educational institutions) that compete but also cooperate" (Porter 2000). This paper contributes to scientific efforts to minimise the gap of research on organisational entities whose development reflects the essence of an ecosystem – a network of interacting actors, which compete and cooperate in order to create and apply new knowledge on the grounds of self-organisation. This paper, following a dynamic approach to the development of knowledge ecosystems, analyses four development stages, the preconditions behind the viability of knowledge ecosystems and their interconnections.

Keywords: Knowledge ecosystem, Development, Dynamics, Viability preconditions

1. Introduction

A knowledge ecosystem in its nature is a self-organising dynamic and adaptive system, in which all the processes of knowledge creation, sharing, using, managing take place on purpose to enhance knowledge (Öberg & Lundberg 2022). Its development accordingly goes through different stages while applying different dynamics modes – for example, Chiles, Meyers and Hench (2004) defined fluctuation dynamics, positive feedback dynamics, recombination dynamics, and stabilisation dynamics. Thus, the research of knowledge ecosystem requires a dynamic and complex approach, while revealing the emerging phenomena during each stage of the system's development. However, the static approach based on the analysis of statistical data about the development of such systems or application of the outsider's view into the development processes still prevail in the scientific literature. Accordingly, it results in the formulation of the following research questions – what are the stages of different dynamics of knowledge ecosystem development? What are the main features and preconditions of the development of knowledge ecosystem?

Thus, this paper adapts the dynamic approach into the development of knowledge ecosystems and *aims* to define and analyse both the dynamics and their preconditions of the development of knowledge ecosystem. It follows the approach that an ecosystem moves through different stages of its development while applying new manifestations with a need to implement particular decisions to make this process as smooth as possible (Grumadaite, Ceicyte, Bernotaite & Brazinskas 2022; Lichtenstein & Plowman 2009; Uhl-Bien & Arena 2018).

The first part of the paper reveals the concept of knowledge ecosystem through the lenses of interactions. The following parts of the paper present the dynamical nuances of different development stages and preconditions to make particular dynamics to happen. These preconditions are based on the empirical research results of industrial clusters in Lithuania those develop their clusters as knowledge ecosystems.

2. Knowledge Ecosystem as a Network of Interactions

Following complexity theory, which analyses how relationships impact the emergence of collective behaviour (Sammut-Bonnici 2015) knowledge ecosystem is a network of various actors implementing different types of interactions based on defined simple rules, values and behavioural standards in order to adapt to the environment, to learn continuously, and to develop trust, identity and responsible behaviour (Anderson 1999; Obolensky 2014). The actors of knowledge ecosystem manage various knowledge processes – they generate and share knowledge by effectively using knowledge generation and sharing tools, they storage knowledge and apply it into decision making processes and professional job-related activities (Zaim, Muhammed & Tarim 2018).

According to Aarikka-Stenroos and Ritala (2017), the ecosystem approach includes competition and evolution, emergence and disruption, stable business exchange and value co-creation. It means that in the case of knowledge ecosystem the main value is knowledge, and multiple actors participate in knowledge co-creation. One should note that knowledge co-creation is impossible without interactions. The types of social interactions by Nisbet (1970) consist of cooperation; conflict; social exchange, related to mutual benefits; coercion and conformity. Conflicts can be seen as a consequence of competition, and social exchange can be manifested in the process of cooperation. Conformity as a form of social interaction, according to Nisbet (1970), is not obedient

behaviour due to authoritarian actions, but behaviour to meet group expectations, for example, to follow certain values and standards of behaviour. Thus, one could conclude that an ecosystem is a network of actors interacting with each other and with the external environment, where because of the absence of control through communication, coordination, obedience to common values and norms of behaviour, competition, cooperation the ecosystem is able to be viable, co-evolving and adapting to external environment.

3. Dynamics Variations of Ecosystem During its Development

Scientific literature emphasises different stages of development of ecosystems, starting from the first initiating event to boost tension to the emergence of a new order based on self-organisation and self-regulation, when the ecosystem returns to stability following defined rules and behavioural norms (Anderson & Russell 2011).

Emergence of non-equilibrium

In general, scientific literature that analyses systems that are based on self-organisation, emphasises the importance of tensions at a starting stage of its development. They state that the greatest changes occur when the system is close to the *edge of chaos* or at the very point of edge of chaos (Boal & Schultz 2004). The first stage is called fluctuation dynamics (Chiles, Meyer & Hench 2004), initiating conditions (Plowman et al. 2007), dis-equilibrium state (Plowman et. al. 2007; Lichtenstein & Plowman 2009), emergence of non-equilibrium state (Jucevičius, Grumadaitė, Jucevičienė & Čeičytė 2019).

Non equilibrium is caused by various factors, that could be defined as *triggers* (Uhl-Bien et al., 2007), which can be planned or unplanned. Often the unplanned changes can be related to the development of external environment, and this development causes the need to acquire, accumulate and apply knowledge while attracting new actors and new resources. For example, the tension may occur because of emergence of a big competitor or many more competitors in a particular sector, merging of other enterprises, or in the opposite- a bankruptcy of an anchor enterprise as it happened in cinema industry in Lithuania. Losing a source of knowledge or seeing someone with a significant amount of knowledge may encourage to develop a new ecosystem with unique accumulated knowledge. In order to make it happen, a response as an initiative for further development of an ecosystem should occur.

Scientific literature reveals different strategic approaches, applied in the stage of non-equilibrium. Grumadaitė and Jucevičius (2022) define strategic approach of experimentation, strategic approach of external agent and strategic approach of ad hoc fellow professionals. Strategic approach of experimentation is based on taking advantage of opportunities without a clear expected outcome; thus, knowledge ecosystem is developing while using mistake-trial method. Strategic approach of the external agent, in the opposite, sees the initiators of development of the ecosystem having a clear expected outcome regarding the ecosystem and accordingly a clear plan regarding the further development of the ecosystem. Finally, the strategic approach of ad hoc fellow professionals emphasises the timely natural gathering of like-minded people and achieving common goals without thinking about formalised forms of cooperation (Ibid.).

One should state that in this stage the communication and cooperation happen only among a group of the main initiators, which communicate and cooperate together. In order to develop the knowledge ecosystem and invite new participants, additional tools are needed because the outsiders and initiators of the ecosystem may have no trust towards each other. Quite often the outsiders may even don't feel any urge to get united because they don't see any danger to come and/or expect to maintain the same direction as nothing happened. Thus, scientific literature emphasises the importance of strengthening non-equilibrium or amplifying actions (Plowman et. al. 2007; Lichtenstein & Plowman 2009).

Strengthening non-equilibrium

Naturally, strengthening non-equilibrium is related to various uncertainties, that are increasing. In the case, when the state of non-equilibrium is created deliberately in order to initiate particular changes, the reactions of all the involved may vary, from intensive discussions and sharing thoughts even with conflictual notes, until a tensed silence. In order to avoid being moved to a higher-level chaos or to return to a previous state with no changes, the following preconditions should be met:

- *Setting simple rules* (Plowman et al. 2007; Uhl-Bien et al. 2007; Palmberg 2009). In the ecosystem there is a variety of interacting actors that mostly are dependent only on local information (Anderson 1999). Thus, simple rules help them to maintain freedom in the actions but to follow common system's rules at the same time (Lichtenstein 2016). These rules reflect the vision, strategy, the best

practices of the system. Authority in the system or system's identity also works as simple rules (Obolensky 2014).

- *Setting main values and principles.* The ecosystem mostly maintains natural-regulation and stabilisation based on self-referencing values and principles that aren't pushed from outside (Chiles et al. 2004). The values could be related to risk taking and tolerating uncertainty; learning; adaptation to new events; cooperation and sharing in order to emphasise the importance of unity and efforts to avoid individualism and competition (Grumadaitė, Jucevičius & Staniulienė 2022).
- *Existing conditions for experimenting and innovating regarding to knowledge processes.* Since non-equilibrium state is related to the highest level of innovation, the conditions for experimentation and fluctuation should be implemented (Lichtenstein & Plowman 2009; Palmberg 2009).
- *Promotion of interactions in the system.* This precondition is related to the statement that the ecosystem is impossible without interactions (Laihonen 2006), thus, interactions inside and with an external environment should be encouraged and promoted in order to share and create knowledge (Lichtenstein & Plowman 2009; Palmberg 2009).
- *Spreading sense of events and vision* (Plowman et al. 2007; Palmberg 2009). Organisational experience reveals that the most active ecosystem's members used to highlight the advantages of working together even in the face of various uncertainties, even bankruptcy. The highlighting of aims to be fulfilled in the ecosystem and clarification of the expectations of ecosystem's members are also applied.

Those preconditions should lead to emergence of community feeling and dependency to the ecosystem, and in other words – movement to the *continuous two-way emergence of a new order* (Jucevičius, Grumadaitė, Jucevičienė & Čeičytė 2019) that is directly related to self-organisation state (Plowman et. al. 2007; Lichtenstein & Plowman 2009).

Continuous two-way emergence of a new order

In this stage, various interactions without centralised control take place, such as:

- Participation in joint learning activities: it also helps to get acquainted and explore the possibilities for future joint activities.
- Communication: representing (knowledge) community in various representative events and creating new contacts, organising joint regular meetings, communicating in informal settings – all that helps to create teams.
- Competition: working on projects with separated research areas or on development of new projects that are not in the area of direct competition.
- Coordination: it is expected that coordination of ecosystem is depending on the ecosystem's members themselves since there are no control outside.
- Cooperation: the ecosystem's members are creating joint activities and projects in order to develop new knowledge and or find new ways of its sharing, storage, etc.
- Compliance: to define simple rules, values and behavioural norms.

The empirical research of nine industrial clusters in Lithuania that formed naturally on a purpose to cooperate and create innovative products, such Cinema cluster, Game industry cluster, Tourism cluster, Machinery cluster, ICT cluster, Wellness cluster, Cluster of medical innovations, Photo electronics cluster and Laser cluster was performed while adapting multiple case research strategy (Yin, 2014) and conducting interviews with industry cluster coordinators – the individuals who see the cluster as a whole. The research was dedicated to the analysis of various factors regarding industrial cluster development dynamics and its preconditions. Starting with the questions about the beginning of the development of knowledge ecosystem, further questions reflected the need to analyse *the cluster viability*, which can be measured by the quantity (increase in the number of members) and quality (activities) in the cluster.

The respondents were asked about admission of new members into an emerging ecosystem, such as How the admission of new members to the cluster looks like? What are the admission criteria (in some cases, clarifying questions are provided, for example, whether a member who is new to the market and unfamiliar to the cluster members can be accepted)?

Later, the focus in the interviews is moved to the area of interactions, such as communication, cooperation, competition. The respondents were asked the following questions: How the process of communication and cooperation is ensured in the cluster? Are there competing companies in the cluster? If so, how is the problem

of competition solved? Are the members of your cluster more likely to act individually? If so, how is this solved? Do cluster enterprises feel like a community of common destiny, where the actions of one person / enterprise affect the whole cluster? What values are dominant in the cluster? How is trust maintained in the cluster? How is the learning process ensured in the cluster?

Research results revealed that in some cases the local development of knowledge ecosystems is limited because of a limited number of actors in a particular sector: "barely few new enterprises over the next twenty years" (Laser cluster). Reasons of such a slow industrial growth, that is related to a creation of unique products could be defined as follows:

- limited number of users: the main users are universities to whom unique products are created;
- the uncertainty of the final result, which implies that industry enterprises are not attractive to venture capital providers;
- a high demand of highly skilled workers who can create start-ups, and it takes time for new professionals to gain knowledge to develop their activities.

However, an increase in the number of enterprises in the industry is not necessarily a prerequisite for ecosystem's growth. On the contrary, some interviews even claimed that the ecosystem had reached the limit of the number of their members. According to the coordinator of Game industry cluster, the industry has a limited number of companies that can enter the developing ecosystem: "We do not see promising members that we can accept. It is not interesting to have people in the list or companies in the list – you need to have them for the activities".

Human resources – a skilled workforce – have a strong influence on the development of both industries and ecosystems. A scarcity of skilled work force was mentioned by the coordinators of both creative industries clusters and Machinery cluster. The coordinator of Tourism cluster highlighted another problem - a problem of keeping trained employees in cluster enterprises, because sometimes these employees simply leave.

Thus, the research revealed the areas of viability of developing knowledge ecosystem those have influence on the dynamics of knowledge ecosystem: *Actions regarding the admission of new members*, *Criteria regarding selection of new members* and *Preconditions behind the active involvement in the ecosystem* (see Figure 1).

As it can be seen in Figure 1, *Using external funding* was of significant importance for the dynamics of development of the ecosystem especially by facilitating the development of R&D infrastructure, joint trainings, participation in public events. However, the main emphasis will be put on the admission of new members and their involvement into the activities of the developing knowledge ecosystem.

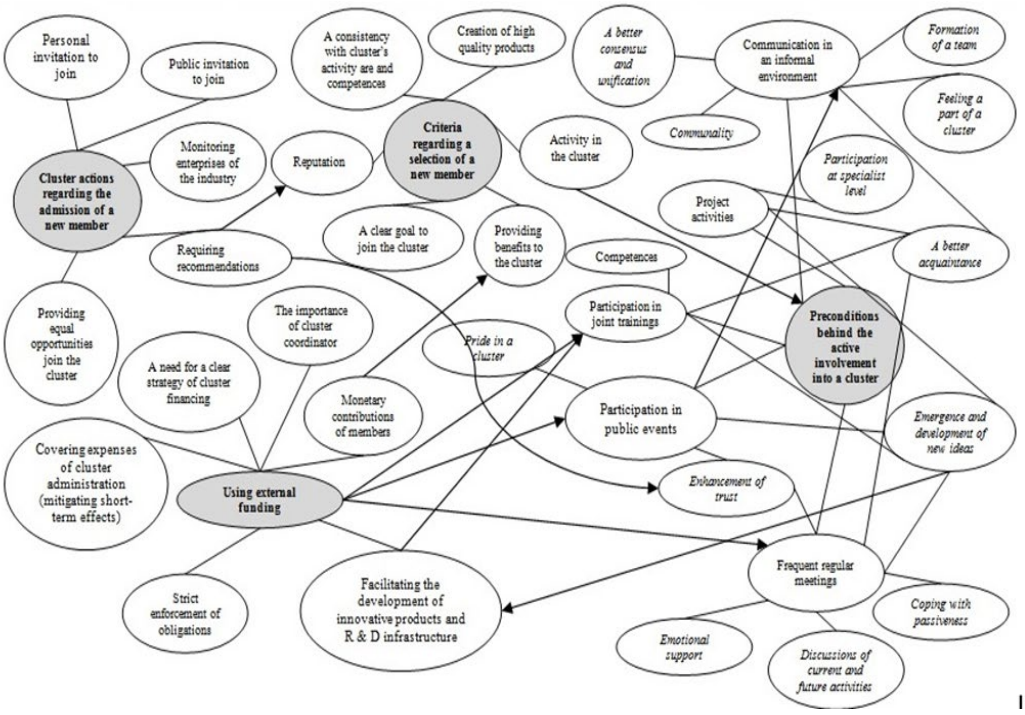


Figure 1: Dynamics and Viability Preconditions of the Knowledge Ecosystem (prepared by the Authors)

Purposeful admission of new members. New members are carefully selected because analysed clusters are oriented towards higher productivity, innovation and access to larger markets, and thus ecosystem's growth is based on quality rather than quantity. The purposeful acceptance of members is highlighted in every single interview. According to the interviews, a potential enterprise should meet the following criteria.

- *To be in accordance with ecosystem's - cluster's activity areas and competencies*. In the case of analysed clusters, a potential enterprise must seek to achieve more than the most of the same industry-based enterprises: "we position ourselves a little higher, that we can, we have bigger goals" (Cluster of medical innovations), especially if the cluster was created to develop innovative products: "Our cluster was created to develop health innovative products and services; if a new member just promotes a healthy lifestyle or is simply a SPA centre, he will be unfit for us" (Wellness Cluster).
- *To develop high-quality products which, for example, meet certain standards* (this is especially important to Machinery cluster, because cluster enterprises would not be allowed to enter international value chain without these standards.
- To have a good *reputation*.
- *To have a clear goal regarding joining the cluster*, in other words, to clearly understand its functions: as the coordinator of Cinema cluster told, "just to be here - there is no such goal".
- *To not limit themselves by getting benefits from a cluster but also provide benefits to the cluster* i.e. complement the cluster with resources and products – "knowledge, people, contacts, products, services", as well monetary investments.
- *To be active in cluster activities:* an enterprise should be focused on cooperation (Cinema cluster).

It is obvious that it is important to know about a particular enterprise as much as possible in order to choose a new member that meets the selection criteria (see Figure 1). As the amount of enterprises that belong to a particular industry is relatively small, enterprises in the industry know about each other quite well, thus one of the naturally occurring processes is a self-sustaining monitoring of the industry through performing activities and providing a personal offer to join the cluster, as in the case of the Cluster of medical innovations: "If we see that there is a company in Lithuania that does a little bit more than others do, or that company meets our ... our common goal ... then we just offer them, they hear our story who we are, what we are about". Similarly, in the case of the ICT cluster, when a cluster enterprise finds out that there is an enterprise that is beneficial to the cluster: "You go, talk to them, and then they get involved". Therefore, the recommendations of cluster enterprises are of great importance to the acceptance of new members, in particular due to the increased trust of that enterprise from the side of remaining members of the cluster. For example, a poorly provided service by a new member may be detrimental to the image of the whole cluster.

However, the most of clusters are open to all actors on the market; if it becomes clear during a conversation with the cluster coordinator that the candidate meets the criteria for the field of cluster's activity, product quality, reputation, providing benefit to cluster and other criteria, he may become a cluster member.

Active involvement in the knowledge ecosystem. In order to make a cluster active and viable, cluster members must engage in cooperation activities. A part of these activities are self-organised meetings between groups of enterprises in order to deal with various business issues. In some cases, an enterprise organises a meeting of all members of the cluster if this enterprise wants to report certain news, for example, to present new service, and the enterprise then "initiates a meeting, and then we all arrive, if we can". Sharing of functions and responsibilities is also being observed in analysed clusters: "some of them are more responsible for marketing, others may be more responsible for development, the third one is more responsible for science and business cooperation"; these functions can be appointed both by cluster members themselves or by a cluster coordinator in order to bring "benefits both to the cluster and to the environment".

Based on the analysis of the interviews, one could distinguish four types of activities that contribute not only to greater involvement in the cluster, but also to better acquaintance with each other, increasing trust and finding new ideas even with limited previous experience of cooperation, as follows:

- frequent regular meetings;
- communication in an informal environment;
- project activities;
- participation in public events;
- participation in joint trainings.

Frequent regular meetings according to cluster coordinators serve as means for a better acquaintance to each other, events, work results; discussions of current and future activities; coping with passiveness; emergence and development of new ideas; enhancement of trust; emotional support (also see Figure 1). In some cases, meetings happen quite naturally when enterprises share some common interests with each other, for example in the case of one of high-tech clusters, "there is constant communication between the labs, the people who work in the labs, and the companies." In Photo electronics cluster some enterprises meet "maybe once a week, and three or four - twice a week." In other clusters, frequent regular meetings are planned by cluster coordinators. Although such meetings can be held flexibly as needed ("we look roughly when we already have some knowledge, news, ideas, many meetings are organised and held regularly at least "six times a year", depending on the field of activity and the need to meet. Sometimes clusters simply follow the practice to organise regular meetings no matter the intensity of news: "even if there is a first impression that there is not much to talk, after meeting it becomes clear that there is something to talk about, new ideas and new thoughts are born, and then something new is born". Cluster coordinators reveal that "we gather and talk about our pains, our troubles, our joys". Such frequent conversations, if they are based on sincerity, also become a means of increasing trust: "we have many beautiful and diverse statistics, how trust is born depending on how many times a week you communicate with that person".

Communication in an informal environment serves as means for a better acquaintance, seeking consensus and unity; formation of a team; development of community feeling. Informal communication includes not only coffee-breaks but also various trips to spend time in an informal environment, for example, in the nature. High technology cluster and Cluster of medical innovations created a tradition to organise annual gatherings (including conferences) of all employees of cluster members-enterprises, even including their family members (see Figure 1). For example, in the case of the tourism cluster, in addition to the aforementioned weekly meetings to share joys and worries, the practice of visiting different companies of the cluster is applied: "we try to make that informal communication as well - we go to some specific companies of our cluster members". Visiting cluster companies by rotation is also a feature of the Wellness cluster - it helps to "feel each other" and "get other results".

Empirical research results revealed that *participating in projects* gives an opportunity to cluster members to get acquainted with each other at specialist level. Based on the interview with the coordinator of ICT cluster, projects help to learn about each other's opportunities and capabilities to take responsibilities, develop new ideas, and discover new markets and new areas for future activities. In addition, participation in public events (including conferences) enhances pride in a cluster and identification with it: "Yes, we are all here together, we did this, look here, this and that has been done". A trip to a particular destination also may become a tool for informal communication: "Through these trips, many different ideas are born, people are talking, gathering together, and there is already a stimulus: we will do something, there is a need to do something". Participation in public events may also act as a means of enhancing trust. A cluster member, who has successfully completed the tasks assigned to him to make new contacts, to bring and share the necessary information and knowledge with other cluster members, to represent the whole cluster, etc., deserves their trust.

Social capital is also developed through participation in joint training online and especially in a defined physical space, where participants of training not only develop their competences but also get acquainted with each other and discover new opportunities (see Figure 1).

Finally, at any time, the ecosystem returns to the state of **stabilisation** that is understood as a natural regulation process, which is understood as continuously following the rules or returning back to rules and values, when there is too much experimentation.

4. Concluding Remarks

This paper emphasises the variety of interactions that occur in the development of knowledge ecosystems – networks of actors that initiate and implement knowledge generation, sharing, storage and adaptation processes. In general, the development of knowledge ecosystems starts with the initiation and strengthening non-equilibrium which leads to a stage of the creation of a new order based on self-organisation and self-regulation.

Empirical research with nine industrial clusters revealed various interconnections between members that are worthy to enter the developing ecosystem and various aspects related to the involvement of the ecosystem's members. This empirical research revealed a context of the development that is emerging itself and still is not the most suitable for the smooth emergence of knowledge ecosystem. For example, there is a scarcity of skilled

work force that is emphasised as one of the most important preconditions for the emergence of an ecosystem. Enterprises that belong to analysed clusters create products, which require much knowledge and creative abilities.

Since gaining independence from Soviet Russia, many Lithuanian industries had created or recreated themselves from the scratch, thus sometimes the industries may be in the development stage. The scarcity of various resources creates a need to attract external funding. External funding contributes not only to softening short-term effects (compensation of administrative expenditures) but, even more - facilitating development of innovative products and R & D infrastructure. On the other hand, the scarcity of cooperation traditions and trust may result in issues of fierce competition, individualism and passiveness in mutual activities. However, the research results shouldn't be adapted only to post-Soviet context because the analysed context in general reflects any development of knowledge ecosystem that needs to start since beginning because of various circumstances. In such a case empirical research results provide practical insights for the active engagement into the development of knowledge ecosystem and what could be interconnections and consequences of various tools, including frequent regular meetings, communication in an informal environment, project activities, participation in public events and participation in joint trainings.

However, a deeper analysis is needed in order to develop a theoretical framework regarding the dynamics of development of knowledge ecosystem. This dynamic could be revealed through knowledge dimensions, such as Socialisation, Externalisation, Combination, and Internalisation, or Nonaka's SECI model (Bratianu 2010), including the mechanisms to overcome competition, individualism and passiveness regarding knowledge sharing. Although cluster coordinators can reveal many facts about the dynamics in the development of knowledge ecosystems, however, the empirical analysis from the perspective of the ecosystem's members is needed to reveal the process dynamics of the development of knowledge ecosystem.

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Knowledge Management Practices in Research and Development Strategic Projects Undertaken by Banks

Tadeusz Grzeszczyk and Tomasz Groszkowski
Warsaw University of Technology, Faculty of Management, Poland

tadeusz.grzeszczyk@pw.edu.pl
tomasz.groszkowski.dokt@pw.edu.pl

Abstract: The dynamic development of information technologies that can support the functioning of financial institutions also implies a rapid increase in the number of investments in projects, e.g., related to ICT and AI. In addition to projects concerning current operations in the banking sector, a growing number of research and development projects of strategic importance can be observed. Implementing such projects is an excellent way to improve the banks' competitive position on the market, provide a better response to customers' increasing expectations, improve the quality and increase the security of the financial services offered. The problem addressed in this study is of great significance in the context of seeking new directions to stimulate the development of R&D activities of strategic importance carried out by banks. However, such research has not been run thoroughly enough so far. Therefore, the theoretical, methodological, and practical gaps in this area are clearly visible against the background of the literature review. There is a need to improve knowledge management processes at the level of R&D strategic projects during their planning, implementation, completion, and post-project reviews. Project managers and business practitioners use more or less formalized activities and practices of knowledge management in strategic R&D projects, which are more or less adapted to the specifics of these financial institutions vital for the economy. The paper discusses the practices, procedures, and approaches used in selected big banks in Poland. This preliminary research used reviews of organizational documentation, direct observation, and interviews with people involved in R&D projects. Identification and analysis of these practices can contribute to improving the effectiveness of explicit and tacit knowledge management processes that are of strategic importance in the banking sector.

Keywords: Knowledge management practices, Research and development projects, Strategic bank projects, Knowledge management in projects

1. Introduction

Modern financial institutions and banks are required to effectively manage explicit knowledge in a formalized and documented form, as well as informal, subjective tacit knowledge, which results from personal experiences. The use of appropriate knowledge management practices helps to streamline decision-making processes, improve the quality of customer service and increase operational efficiency. The most important activities supported by these practices include, e.g.: capturing knowledge from various sources, organizing and storing knowledge in an orderly manner, sharing knowledge, ensuring access to knowledge and its transfer, managing the risk of losing critical expert knowledge, supporting knowledge-driven decisions and continuous improving banking organizations in order to ensure an appropriate competitive position in a dynamic banking environment. Knowledge management in banking supports the promotion of learning and innovation, building on the collective intelligence of the organization and gathering knowledge about customers. Apart from that, promotion of learning and innovation development in the banking sector is a subject of considerable interest, as visible thanks to the results of literature research devoted to new trends in knowledge in this sector, new technologies and digital media, as well as problems of adaptation to dynamic changes taking place in the banking sector (Borba *et al.*, 2022).

Constant changes taking place in a turbulent environment are conducive to the increasing use of a project approach in the development of financial software supporting the management of money and financial transactions. Appropriate selection of methodological approaches to project and risk management is one of the critical success factors for large financial software projects (Tae *et al.*, 2020). Among the most important success factors for IT projects in banking are also the right selection of subject matter experts of projects, development environment, project manager skills and good communication (Priambodo *et al.*, 2019). In addition, the literature points to the importance of knowledge as well as human and intellectual capital development, which is necessary for the successful implementation of IT projects and modern management models (Grzeszczyk, 2020). Changes taking place in the environment of financial institutions, therefore, force the use of appropriate approaches and practices to knowledge management in projects. In particular, account should be taken of the high intensity and diversity of knowledge fields, as well as the related need for knowledge and technology intensity (De Borba, 2022). These phenomena affect relations with bank customers, enforce digitization processes and the increasing use of IT supporting the functioning of financial institutions. Such investments take the form of IT projects, the implementation of which significantly modifies the current operations of banks.

In the past, the transfer of technologies developed by scientific and research institutions outside the banking sector was often observed. In recent years, an interesting trend has been noticed - a number of strategic research and development projects is implemented in the banking sector. The implementation of strategic projects is an appropriate way to improve the competitive position of banks, respond more efficiently to the growing expectations of customers, improve the quality and increase the security of the financial services offered. Against the background of the literature review, theoretical, methodological and practical gaps in the improvement of knowledge management processes at the level of R&D strategic projects during their planning, implementation, completion, and post-project reviews are clearly visible. Research related to this has not been carried out sufficiently thoroughly so far, and it is important in the context of searching for new directions to stimulate the development of strategic R&D activities conducted by banks.

Openness to the introduction of innovative solutions and knowledge management play a key role in the planning and implementation of strategic R&D projects undertaken by banks. Proper strategic alignment of information system and innovation can be achieved by implementing innovative solutions supported by organizational learning, knowledge management, developing good cooperation and understanding by the management of the need to introduce innovation initiatives (Yaw Obeng and Mkhize, 2019). Project managers should therefore improve knowledge management activities and practices that foster good communication at various levels of the organization, and the success of strategic IT projects. Thus, it is important to conduct theoretical analyzes and empirical research identifying applied and potentially available practices that may be of interest to project managers and business practitioners in the banking sector. Their identification can contribute to improving the efficiency of knowledge management processes in strategic IT projects and increase the probability of their success. The research results presented in this paper concern the practices, procedures and approaches used in selected large banks in Poland. The following research methods were used during the research: reviews of organizational documentation, direct observation, and interviews with people involved in R&D projects.

2. Knowledge Management in Strategic Banking Projects

Modern advanced economies are usually supported by knowledge management, human capital development and learning processes of financial and non-financial organizations (Clarke and Gholamshahi, 2018). Improving information and knowledge resources through intellectual and mental activity creates the basis for forging key economic resources of modern financial institutions (Ali and Yusof, 2009). Implementation of knowledge-based solutions, development of education and improvement of human capital management have a significant impact on creating favorable conditions for economic growth, as well as improvement of socio-economic well-being analyzed at the micro and macroeconomic levels (Garza-Rodriguez *et al.*, 2020).

Financial institutions are based not only on physical but also on intangible resources, and are knowledge and intellectually intensive (Yao *et al.*, 2019). Expanding knowledge resources, developing human capital and increasing the value of the intellectual capital of the organization provides it with a competitive advantage, and the accumulated resources of data, information, knowledge and experiences create the potential for shaping new values (Dumay, 2016). Projects that involve making temporary efforts and sharing significant amounts of knowledge between individuals and groups participating in these projects can also contribute to the increase in the number of useful knowledge resources, even if they do not have prescribed learning mechanisms, and are usually focused on immediate results (Holzmann, 2013). The importance of long-term and responsible knowledge collection and management is easier to understand when managing strategic projects or programs (sets of projects) that are focused on delivering long-term and strategic benefits.

Management of knowledge in projects is recognized as an increasingly important development factor in many industries. Research is being conducted on analyzing not only knowledge management within projects (temporary organizations), but also between them (Hanisch *et al.*, 2009). Identifying and acquiring knowledge, as well as learning from project experience is a problem increasingly recognized by banks. Previously, the importance of knowledge management was seen mainly in the context of repetitive processes carried out on the basis of traditional organizational structures. The growing importance of issues concerning knowledge management in projects results from the increasing involvement of banks in the implementation of projects. These organizations see more and more clearly turbulent changes in the environment, dynamic technological advances, the growing role of project-based activities and the need to introduce innovations in IT processes and systems supporting knowledge management. Therefore, bank managements clearly notice the growing challenges and competition in the banking sector, the increasing importance of knowledge, intellectual capital and the resulting challenges facing modern financial institutions (Joshi *et al.*, 2010).

Knowledge management is implemented in banks to support the identification, collection, protection, development, maintenance and application of knowledge in the learning processes of individual employees and the entire organization in order to ensure the maximization of knowledge-based sustainable growth of the organization (Mehrotra, 2019). This is done by systematically acquiring, organizing, storing and sharing knowledge, which most often results in streamlining decision-making processes, improving the quality of customer service and increasing operational efficiency. These systematic activities include the effective management of both explicit knowledge (regarding formalized and documented information) and tacit knowledge (related to experts, their subjective experiences, attitudes and observations).

The most important aspects of knowledge management in banking include: knowledge capture, knowledge organization and storage, knowledge sharing and communication in project teams, access to and retrieval of knowledge, knowledge transfer and training, knowledge-based decision-making, risk management and continuous improvement of knowledge resources. Banks strive to acquire valuable and useful knowledge from various sources, and capturing it is of great importance. Potential sources of knowledge include, e.g., contacts with customers, knowledge of field experts employed in banks, results of market research analyzes and expert opinions of consulting companies. Captured knowledge can also come from bank documentation, evaluation reports of projects implemented by banks, summaries of surveys and interviews with employees.

Knowledge capture should be organized and stored in an orderly manner. One way is to use knowledge repositories or databases adapted to storing categorized information that is relatively easy to find and share. Information and knowledge may relate to customers, banking products, regulations, research reports and best practices. In modern banks, systems of communication and knowledge sharing by employees are also being developed in order to facilitate the implementation of scientific knowledge diffusion processes and the introduction of useful innovations. Helpful communication tools include, e.g., employee team meetings, discussion forums, intranet portals, workshops and training programs. Great importance should be paid to improving the culture of knowledge sharing and the collective knowledge of bank employees.

Quick decision-making and efficient customer service are possible if adequate access to knowledge resources and its recovery are ensured. Therefore, mechanisms and tools for searching in often extensive repositories and knowledge bases are useful. The developed tools for accessing knowledge and searching for information include, e.g., systems based on natural language processing and machine learning. Among the important aspects of knowledge management in banks, the transfer of knowledge between key and experienced employees and their young successors should also be mentioned. Therefore, all kinds of courses and trainings are useful, as well as mentoring programs and documenting best practices, e.g. in the form of case studies. Appropriate knowledge transfer can contribute to minimizing the risk of losing critical expert knowledge. The key aspects of knowledge management also include knowledge-based decision-making by providing access to relevant and up-to-date knowledge to assess the risk of financial operations, develop effective strategies and make informed decisions conducive to the sustainable development of the organization. Banks should keep abreast of changes in regulations, industry guidelines and best practices for effective risk management. Implementing effective knowledge management practices help banks disseminate information on these topics and mitigate potential risks.

Continuous development of knowledge management practices enables the improvement of mechanisms for collecting and analyzing knowledge supporting the identification of areas requiring improvement in the implementation of changes. Knowledge of good practices and experience from previous contacts with clients creates a good basis for improving banking processes, products and services. Knowledge management in banking makes it possible to use the collective intelligence of the organization, promote learning and innovation, improve customer experience and create favorable conditions for sustainable growth in a turbulent banking environment, as well as the implementation of strategic knowledge and technological projects.

3. Methodology

The problem addressed in this research is of great significance in the context of seeking new directions to stimulate the development of R&D activities of strategic importance undertaken by banks. The purpose of the conducted study is the initial identification of knowledge management practices in R&D strategic projects in such financial institutions.

The main research was preceded by literature research. The following research methods were used in main study: reviews of organizational documentation, direct observation, and individual interviews with people involved in strategic R&D projects. The scope of considerations was limited to the largest organizations from the

Polish banking sector. This is justified by the fact that, above all, such financial institutions undertake to implement R&D projects on their own. This is a relatively new field of activity in this sector and smaller organizations do not have the appropriate experience and resources required.

The conducted study on knowledge management in R&D projects in organizations from the banking sector was aimed at collecting information on the methods, tools and practices of knowledge management, as well as the reported benefits related to it. The method of individual face-to-face interviews was chosen to collect such data due to the possibility of direct contact with bank employees involved in the processes of planning and implementing strategic R&D projects. The use of this qualitative research method was time-consuming and sometimes difficult to carry out due to the numerous professional duties of the respondents, but it made it possible to conduct in-depth research conducive to a good understanding of the researched problems.

Respondents were asked the following questions related to knowledge management practices in R&D strategic projects undertaken by banks:

- What practices of knowledge management in strategic R&D projects do you know?
- How does the specificity of bank's R&D projects affect knowledge management practices?
- Is there an interest in tacit expert knowledge?
- Are actions taken to record the knowledge of people who may change their place of employment?
- Do you have established procedures or good knowledge management practices (e.g. within the methodological approaches of project management)?
- What is the role of informal information and knowledge exchange?
- Is the state of knowledge constantly monitored or are there periodic evaluations?
- What software tools are used in your work to manage knowledge in R&D projects?
- Is building knowledge bases planned in your department?
- Do you use artificial intelligence methods and data mining to build knowledge bases in your R&D projects?
- Does your department use Electronic Document Management (EDM) solutions?
- Does your department use data warehouse solutions in the knowledge management in R&D projects?

20 potential respondents from several of the largest banks were approached with the proposal to participate in the study. Ultimately, 7 respondents took part in the research. The respondents were people from the management staff of R&D projects related to IT implemented in these banks. Most of the respondents had at least 10 years of experience in the banking sector and more than 5 years in project management. Their education was primarily: finance, management and IT. The study was conducted in March 2023.

The methodology of the research presented in this section has limitations due to the relatively small number of respondents who were available and agreed to participate in the interviews. These studies should therefore be treated as pilot studies carried out before the full-scale research project.

4. Results and Discussion

In general, the respondents were open to knowledge management issues, using appropriate tools and practices, as well as learning about new solutions in this area. Some of them emphasized insufficient knowledge of these issues, in particular of specific tools and technologies supporting knowledge management in projects. The interviewees noted that not everyone involved in the bank's strategic projects was aware of the importance of these issues. Among the main applied knowledge management practices in R&D strategic projects, the following were indicated:

- gathering experience after the completion of projects,
- using tools related to popular methodological approaches, e.g. Agile or Prince2,
- the key role of project managers and the appropriate selection of the scope of competence of individual members of project teams,
- gathering expert knowledge,
- using tools such as Confluence or Jira to manage and share knowledge,
- exchange of knowledge during regular meetings and training workshops,
- creating knowledge bases, documenting experiences from strategic projects, and cooperation between various organizational units of banks.

Respondents were aware of the importance of knowledge management in planning and managing strategic projects implemented by banks. Most of them declared that they used various knowledge management methods and tools in their work. They also pointed out the challenges concerning the application of knowledge management practices related to the constant improvement of the required competences, such as the ability to work in a team or the ability to identify and verify knowledge and good communication. They also pointed out that in knowledge management it is important to care for the quality of processed data, their security and proper use so that they properly support business processes.

Based on the analysis of the answers, three groups of respondents can be distinguished. The first group consists of people who use advanced knowledge management tools and methods in their activities. They are aware of the benefits of using these tools, such as faster and more accurate data analysis and better use of available knowledge. Their answers were more detailed and professional compared to other respondents. They were more focused on the practical application of tools supporting knowledge management and their particular impact on projects related to the implementation of the organization's strategy. They were also more aware of the benefits and opportunities of advanced knowledge management, and more engaged in using these tools in their strategic R&D projects. Respondents from this group also pointed to the use of various knowledge management tools, such as Jira, Confluence, Microsoft Teams or SharePoint. At work, they also took up challenges related to the use of advanced methods of AI and data mining to analyze large data sets and discover new relationships in data. In the knowledge management processes, they also used EDM systems, file sharing systems and a data warehouse. In their opinion, these technologies contributed to facilitating access to information, increasing work efficiency and better use of available knowledge.

The second (largest) group of respondents used less advanced methods of knowledge management. These were people less familiar with the procedures, tools and modern technologies supporting knowledge management. Respondents from this group stated that they had only used basic knowledge management tools so far, such as shared folders, e-mail or teleconferencing. In their work, they did not use AI methods or data mining, and only one of them used EDM or a data warehouse. Despite this, they were aware of the potential benefits of using modern technologies, the practical use of which in their banks was limited. One of the representatives of this group seemed to be aware of the benefits of using advanced methods such as AI and data mining, but had not had the opportunity to use them in his daily work. However, another respondent from this group was not aware of the existence of these methods. One more respondent used knowledge related to experience and training, and another used expert knowledge as part of solving technical problems.

It was also possible to distinguish a third group that answered the questions in a short and somewhat enigmatic way. While this group claimed to have used various tools, its members were unable to provide particular information. They pointed out that the transfer of knowledge is an individual matter and depends on specific people. At the same time, they were aware of factors influencing the quality of knowledge management, such as organizational culture, IT systems or business environment. The responses from this group indicated that knowledge management was, in their opinion, still in its early stages of development. They used tools such as SharePoint, but at the same time indicated that access to knowledge and information was still limited and depended on individual employees who had the necessary knowledge. Respondents from the third group pointed to the lack of formal knowledge exchange systems and the lack of dedicated tools that could facilitate knowledge management practices in projects. In their answers, the respondents also emphasized the importance of organizational culture and a good climate for cooperation and knowledge sharing. This group included answers indicating the lack of implemented solutions for knowledge management and data processing in their strategic R&D projects. In addition, their answers showed incomplete awareness of the benefits of implementing knowledge management tools, such as EDM and data warehouses.

The answers obtained as part of the study indicate the selective use of practices and opportunities resulting from the use of modern technologies in knowledge management in strategic R&D projects. In some cases, this may be due to a lack of awareness or lack of access to the right tools. In other banks, there are restrictions related to the policies of the organization and specifically understood legal regulations. In order to improve the efficiency of knowledge management in projects, it is worth investing in training for employees and the implementation of modern tools and technologies. Efforts should also be made to improve internal communication and develop modern forms of organizational culture based on sharing knowledge and improving cooperation.

The answers of the respondents suggest that in most cases actions were taken to support knowledge management in strategic R&D projects. All respondents used tools supporting team work, although not all of

them used EDM systems or data warehouses. The answers obtained show that the issues of AI and data mining are not yet well known, accepted and used in practice. This is despite the extensive literature on many applications of AI in knowledge management (Pai *et al.*, 2022).

The most frequently mentioned benefits of knowledge management in projects included better coordination and cooperation of teams, better communication, more effective use of knowledge resources, as well as faster decision-making related to project planning and implementation. Respondents also mentioned challenges that were important to them, such as too many documents, the problem with finding and organizing them, and difficulties in keeping knowledge up-to-date.

A group of respondents was identified as less advanced in the use of knowledge management methods, because the answers were 'I don't know' and 'I don't use'. Representatives of other groups were more advanced and aware of the benefits of using different knowledge management methods in strategic R&D projects.

One should also pay attention to some similarities among many respondents' answers. In general, they were aware of the benefits of using tools supporting knowledge management, such as EDM systems or data warehouses, but at the same time some did not use them in their work or used them only in some projects. The approach of the respondents to the exchange of knowledge between employees was also similar. All interlocutors were aware of its importance, but they did not always use dedicated tools to facilitate these exchanges. A common element was also the lack of formalization of processes related to knowledge management and the lack of designated persons or teams responsible for this field. Respondents were aware of the need for knowledge management in strategic R&D projects, but often did not take specific actions in this regard.

Interviews with respondents focused on the initial identification of knowledge management practices in R&D strategic projects undertaken by banks. The possibility of continuing further research on the impact of the use of advanced knowledge management methods and tools on such project outcomes should be considered.

5. Conclusions

Based on the performed study, the following conclusions can be drawn:

- knowledge management tools and methods are quite well known and mostly recognized by respondents, but their use in organizations varies,
- knowledge management tools and methods are considered useful and can bring benefits at work,
- tools and methods of AI and data mining are used only in individual cases,
- EDM systems are used in most organizations and are considered beneficial,
- the use of data warehouses is incidental,
- the main challenges in knowledge management in strategic R&D projects are large data sets and problems with their search and categorization,
- tools and methods of knowledge management in projects can contribute to improving the efficiency of work and the quality of implemented projects,
- appropriate training on knowledge management tools and methods is important so that employees have the necessary skills to use them,
- there is a need for greater use of good practices, tools and methods of knowledge management in strategic R&D projects and organizations. Staff training is necessary to raise awareness in this field and make better use of the relevant tools, practices and methodological approaches.

As a result of the conducted research, the need to broaden the knowledge and experience of bank employees and managers of projects implemented there on the real benefits of applying good and well-thought-out knowledge management practices in strategic R&D projects was identified. It is therefore necessary to develop training programs related to this as appropriately qualified employees can significantly contribute to the implementation of banks' strategic goals and create conditions for their competitiveness. Allocating more funds to employee training may therefore contribute to the growth of banks' long-term strategic potential. In particular, it is important to improve the qualifications of employees in the effective use of new ICT and AI solutions supporting knowledge management in projects. The currently undertaken research is preliminary and needs to be continued among a wider group of respondents from a larger number of banks.

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University-Industry Technology Transfer and Coproduction: A Case Study

Fernanda Guimarães, Roberto Carlos dos Santos Pacheco, Mônica Ramos Carneiro and Fernando Alvaro Ostuni Gauthier
Universidade Federal de Santa Catarina, Florianópolis, Brazil

fernanda.g@ufsc.br
pacheco@stela.org.br
monicarcbr@gmail.com
fernando.gauthier@gmail.com

Abstract: Universities can promote entrepreneurship and innovation both by training professionals and by offering knowledge resulting from their research. Traditionally, industrial development has benefited from technology transfer (TT) from universities. Although the TT is very known and used, co-ownership and economic exploitation after a TT process remain a challenge to formal University-Industry agreements. In this study we discuss the notion of university-industry coproduction as a means to address formal agreement after TT. The case study is a Brazilian national Program, called CEURS - "Training and Studies for Urban and Regional Sustainability". The main goal of CEURS is to provide practical training to individuals and teams on sustainability matters, focused on how to fulfill the UN's SDG 2030 Agenda locally (i.e., how to empower projects that are already at the community level so that they can become city programs). To do so, CEURS project was led by an academic network, sponsored by national government agencies. The project was developed at the Federal University of Santa Catarina (UFSC) by academics and students of the Graduate Program in Engineering and Knowledge Management, from the research group on Co-production in Digital Commons, in Brazil. CEURS team has developed *CEURS Platform*, a digital education platform, currently in the process of being publicly transferred to be augmented and operated at a national level. In this article, we analyze the institutional technology transfer agreements available to CEURS regarding the need to meet project demands for technology licensing, technology transfer, open innovation, and joint patents. We offer a critical analysis of a current regulatory process in technology transfer in an academic project that combines education, development, and social demand fulfillment. We conclude that a technology transfer licensing agreement can include principles that may fulfill CEURS project needs for nationalization through university-industry co-production. This study contributes to academics, innovation offices, policymakers, and university managers in formulating diligent and fast processes and strategies through technology transfers.

Keywords: University-Company, Technology transfer, Knowledge transfer, Coproduction, Innovation, CEURS Platform

1. Introduction

University-Industry relationship is an engine for the emergence of innovations and new technologies, given that researchers and professionals from different areas interact (Santana and Porto, 2009), benefiting both by complementing knowledge, skills and resources (Santoro and Betts, 2002). Universities learn from the entrepreneurial commercial vocation and companies take advantage of the university structure and qualified labor, thus reducing their research costs (Closs and Ferreira, 2012).

Traditionally, these relationships include Technology Transfer (TT), with legal instruments designed to formalize the university as the licensor and the industry as the licensee of the created technology. In this view, Universities offer to partners knowledge and/or technologies produced by their academics, to be used directly or as components of goods and/or services to the market. Besides promoting economic growth and local/regional competitiveness, universities hope that TT projects can create opportunities not only to support their economic sustainability (royalties), but also to improve their training processes.

When the project involves co-production between the university and industrial partners, factors such as co-ownership and exploitation of results challenge the terms of TT agreements.

In this paper we study the CEURS project - a program funded by federal funds and designed by an academic network to be applied nationwide through a digital education platform. We check specifically for the regulatory mark available to make CEURS a future industry-collaboration, as initially presumed by its authors.

2. Technology Transfer

Technology Transfer (TT) is the process by which organizations or individuals transfer information, knowledge, technology, or innovation to partner individuals or organizations (Parker and Zilberman, 1993; Roessner and Bean, 1991). It can be a highly complex process, as it involves transferring tacit, explicit, and operational knowledge, and not just the technology itself and its supporting mechanisms (Souza, 2010).

In this core, universities with traditional precepts of teaching and research, move towards a third mission, associated with has been called “entrepreneurial universities” (Asheim, Smith and Oughton, 2011; Klofsten et al, 2019; Autio et al, 2014).

In this new vision, universities act towards social and economic development (D'Este and Patel, 2007; Klofsten et al, 2019; Mendoza and Sanchez, 2018; Bercovitz and Feldmann, 2006), committing to the local community and regional and adding value to the environment in which they operate (Khan et al, 2020).

Universities for standing out in qualified human capital (Romero, Ferreira and Fernandes, 2020), in the production, dissemination, implementation of knowledge, innovation (Bercovitz and Feldmann, 2006; Santos, Veloso and Urze, 2021; Khan et al, 2020), have long collaborated with other organizations on technological advances. These collaborations have intensified in recent years due to the development of new technological platforms (Bercovitz and Feldmann, 2006), the need for funding sources and government policies for academic research (Bercovitz and Feldmann, 2006; Romero, Ferreira and Fernandes, 2020).

Thus, TT has been expanded to University Technology Transfer (UTT) referring to the process in which universities transfer and commercialize knowledge resulting from their scientific discoveries and technological innovations to the market (Li and Tang, 2021). Bercovitz and Feldmann (2006) summarize that UTT is the commercialization of university research through transactions between university and company.

Given the importance of these relationships in knowledge production, innovation and sustainable social development, national and local governments have dedicated budgets, incentives, subsidies and infrastructure for innovation. UTT has been one of these instruments (Gonzalez-Pernía, Kuechle and Pena-Legazkue, 2013), where both actors, universities and firms seek competitive advantage (Li and Tang, 2021).

More recently, universities have been demanded by public agencies to not only foster academic multi and interdisciplinary research networks in scientific projects, but also to promote transdisciplinarity by enrolling social players into research, development and innovation projects. This can be seen by current interest in investigating University-Industry (UI) coauthorship (Kohus, Baracskai and Czako, 2020), UI joint patents (Petruzzelli and Murgia, 2020), and UI open innovation (Neves, Costa and Reis, 2021).

The combination between scientific and practical knowledge performed by academic-industry teams changes the traditional roles that universities and firms play in innovation projects.

2.1 UTT and the Brazilian Innovation System

In Brazil, TT is directy addressed by the 1988 Magna Carta. The Federal Constitution provides that the State shall promote and encourage scientific development, research, scientific and technological training and innovation, with a view to the public good, the progress of science, technology and innovation and technological research aimed at solving the Brazilian problems and for the development of the national and regional productive system (Brasil. *Constituição da República Federativa do Brasil de 1988*)

The first regulatory instrument for innovation was the Innovation Law of 2004 (Law No. 10.973 - 2004). This Law offers to the Brazilian State and universities means to foster innovation, research and scientific and technological training, including cooperation and interaction between the public and private sectors and between companies (Brasil. *Lei nº 10.973, de 2 de dezembro de 2004*).

After a decade, the law has evolved into the National Science, Technology and Innovation Code (Law No. 13.243 - 2016), with incentives for scientific development, research, scientific and technological training and innovation. In 2018 this National Code was regulated by the Decree No. 9.283, that established measures to encourage innovation and scientific and technological research in the productive environment, aiming at technological capacity building, achieving technological autonomy, and developing the national and regional productive system (Brasil. *Decreto nº 9.283, de 7 de fevereiro de 2018*).

In 2020, Brazil created its National Innovation Policy (Decree No. 10.534). With the aim of increasing the country's competitiveness and, foremost, improving the population's quality of life, this decree establishes measures to foster research and development, protect intellectual property, encourage collaboration between companies, universities, and research institutions, and other actions to promote innovation (Brasil. *Decreto nº 10.534 de 28 de outubro de 2020*).

In all four regulatory instruments, cooperation projects among universities, companies, and private research and development non-profit entities, have been considered strategic to generate new products, processes and innovative services and the transfer and dissemination of technology.

At the operational level, university-industry projects can be formalized by the following ways: (1) *Technology Licensing* (TL) - an agreement in which the university grants a company the right to use a technology developed in its laboratories in exchange for payment of royalties or other forms of remuneration; (2) *Technology Transfer* (TT) - a process by which a university transfers knowledge and technology to a company, which can involve the creation of spin-offs (companies that emerge from academic research) or strategic partnerships between the university and the company; (3) *Open Innovation Projects* (OI) - collaborative projects between companies and universities, in which both parties contribute knowledge and resources to the development of new technologies or products; (4) *Joint Patents* (JP) - patents resulting from joint research and development projects between universities and companies, in which both parties share the intellectual property and the economic benefits arising from the developed technology.

In the following section we study a recent Brazilian case of technology development fostered by the federal government and that is currently in its phase of choosing one or more of these approaches to go nationally.

3. CEURS Program

CEURS is a portuguese acronym for “Urban and Regional Training and Studies for Sustainability”. This program is funded by Brazilian federal agencies (both National Parliament and Science, Technology and Innovation Ministry) and developed by an academic network to develop courses to empower public officials and civil society organization collaborators in cities on how to localize the Sustainable Development Goals (SDGs) of the 2030 Agenda.

CEURS has been developed at Universidade Federal de Santa Catarina (UFSC), by academics of the Graduate Program in Engineering and Knowledge Management (PPGEGC), from the research group of Digital Commons Coproduction (DCC). In order to achieve CEURS national capacitation goal, the group has developed “CEURS Platform”, a digital education platform designed by DCC members with the support of suppliers, with several technological and pedagogical components to apply Neo-learning methodology (Bresolin, Freire and Pacheco, 2021).

To offer its courses, CEURS Platform has learning objects, content and videos designed under the Neo-learning methodology. These components are accessed through a Virtual Learning Environment (VLE) developed in Moodle. There are also complementary information systems that support CEURS courses learning trajectories. In addition to the "CEURS" brand, the technological components of CEURS Platform have been registered at the National Institute of Industrial Property (INPI). Contents such as the eBook "Introduction to the Municipalization of the 2030 Agenda" (Pacheco and Carneiro, 2020), are also part of the CEURS Platform.

Therefore, in relation to the ownership of the technology presented, the CEURS Platform has copyright for each type of component and is the intellectual property of UFSC. This implies recognizing and explaining the intellectual authors in the technical sheets of books, learning objects, videos and information systems created to compose the Platform. Intellectual property is institutional to UFSC, respecting the respective clauses of use and communication of each contract signed under the CEURS Program.

Since October 2021 CEURS courses have been offered to city employees and social organization collaborators, mainly from Santa Catarina State. Using its national academic network, one of the main goals of CEURS project is to take its courses to the other Brazilian States. In order to do so, CEURS Platform has to be transferred and improved to support thousands of students. This challenge is a typical coproduction project where University intends to invite private partners to adopt and improve its initial technology. In the following section we examine the TT and U-I coproduction options, considering current Brazilian Innovation regulatory mark and its potential impact to CEURS goals.

4. CEURS Platform Licensing as a UTT Process

CEURS Platform is the main technological result of CEURS project. It was developed to not only deliver the current courses offered mainly in Santa Catarina state, but also to foster CEURS regionalization in all other Brazilian states. In order to do so, CEURS Platform has to be expanded with more scalability capacity, on-demand support, with a technological evolution plan to instrumentalize digital training on a national scale.

To provide this evolution, DCC research group and UFSC Innovation Department (SINOVA) are preparing a CEURS Platform licensing process. The goal is to enable the use, operation, development and evolution of the training instrument created for the CEURS, taking the Program incrementally to other Brazilian States.

In the following sections we describe how CEURS program was designed as a multi-institutional program, the regulatory references applied to CEURS Platform licensing, and the licensing term that is currently being developed to fulfill CEURS Program goals.

4.1 CEURS Multi-Institutional Cooperation Agreements

CEURS Program was designed to establish a network of academic and governmental organizations to enable its courses and offer them with technological tools to city halls, city councils, and citizens of Brazilian cities. To this end, UFSC signed a series of agreements with academic and research organizations, understood as disseminators of the CEURS Program and potential leaders of its regionalization projects.

As can be seen in Table 1, CEURS has been funded by the federal government (both Parliament and MCTI), developed by a leading university (UFSC), in cooperation with university partners in other states (currently USP and UTFPR). At UFSC, there is a founding contract with FAPEU that allows the management of scholarships and contracts with third parties, necessary for the completion of services in CEURS.

Table 1: Institutional CEURS Players

Player	Sector	CEURS responsibility
Federal Parliament	Government	Federal deputies offer parliamentary amendments to CEURS, submitted to MCTI with the indication of the beneficiary university.
MCTI	Government	MCTI receives the parliamentary amendments and, through a Decentralized Execution Agreement (TED), transfers the funds to the University to carry out the project.
UFSC	Academy	Leads the research and development process of the CEURS project, including the creation of the CEURS technology, offering courses to Brazilian cities, as well as coproduction and knowledge transfer to partner academic groups.
FAPEU	University Foundation	Manages the CEURS project and the contracts with individual and business suppliers to CEURS technologies
USP	Academy	Coproduction of videos and workshops in CEURS, as well as regionalization of the Program in the State of São Paulo, expanding the model of evolution and application of its courses.
UTFPR	Academy	CEURS regionalization in the state of Paraná, with participation in its evolution and dissemination.
Instituto Stela	R&D institute	Through the UFSC-Stela agreement, it provided infrastructure for the project development during the pandemic and has been carrying out an agreement for the dissemination of the Program with partner organizations.
SEBRAE-SC	Business	Provides infrastructure for CEURS online workshops and has been promoting the program to cities in Santa Catarina.
FECAM	Government	The Federation of Municipalities of Santa Catarina promotes CEURS to city halls, as a reference for training in sustainable urban development.
FAPESC	Government	Santa Catarina State Foundation for Science, Technology and Innovation Support that funds the project of creating educational games in the CEURS Program.

In addition to the relationships between the federal government and universities, CEURS has been supported by partner organizations that have offered technological infrastructure (Instituto Stela), technologies and spaces for course transmission (SEBRAE-SC), and dissemination to municipalities and cities in Santa Catarina (FECAM and SEBRAE-SC).

Recently, in 2022, a research contract was signed with the Support Foundation for Scientific and Technological Research of the State of Santa Catarina - FAPESC, through a competitive research funding process, in which the CEURS Team proposed the development of recreational games for the dissemination of the 2030 Agenda.

In sum, CEURS has been developed based on a series of cooperation agreements. These formal partnerships have been fulfilled for specific purposes through a project and work plans (Portella and Sabença, 2019).

After three years of research, development, communication and application in Santa Catarina State, CEURS project has reached its moment to go national. In the CEURS regionalization UFSC will no longer be solely responsible for the instrumental technology of digital training. It is expected to have the adhesion of the other universities partners, and, particularly regarding CEURS Platform, it is expected that the course services and technology evolution can be provided by a responsible and experienced organization. On the economic level, it is also intended that the transfer of technology generates financial resources to be applied in the evolution of research in the CEURS Program, in its continuity in the national network that is planned to be formed from its regionalization.

4.2 Instrumentalization of CEURS Technology Transfer

At UFSC, the CEURS platform licensing process is subject to the recently approved University's Innovation and Entrepreneurship Policy - UFSC IE-Policy (Universidade Federal de Santa Catarina, 2022). Respecting the national innovation regulatory framework, UFSC IE-Policy encourages innovation and entrepreneurship in the activities of research groups at the University. The IE-Policy provides guidelines for UFSC to offer technological training, promote technological autonomy, and cooperation with the country's innovation systems and from abroad. The Policy recognizes innovation and entrepreneurship as instruments for social inclusion and development of the regional and national productive system.

At CEURS project, these innovation principles will be applied to the CEURS Platform licensing process. A licensing agreement is a formal contract that enables the use and exploitation by a company of a technology produced at the university, without transferring ownership of the technology (Agência Unesp de Inovação, 2020; González-Pernia, Kuechle and Peña- Legazkue, 2013).

In order to make CEURS Platform licensing agreement, the DCC research group contacted Sinova/UFSC to request a *public call* for licensing. A public call is an administrative procedure established by law for selecting the most advantageous proposal for the public administration and guaranteeing compliance with the principles of public administration, especially the principles of impersonality and publicity (Brasil. *Lei nº 13.019, de 31 de julho de 2014*; Portella and Sabença, 2019).

In Table 2 we present the main CEURS Platform licensing regulatory terms presented by DCC research group to Sinova/UFSC, in order to elaborate the public call.

Table 2: CEURS Public Call Instrument

Public Call Element	CEURS expectation
Object	Enabling the use, operation, development, evolution, production, commercial exploitation, provision of services, or obtaining of economic advantage within the scope of CEURS Platform, owned by UFSC.
Target Audience	Public or private organizations with proven competence and history in the conception, development, implementation, and evolution of digital platforms may participate in this selection process.
Objectives	To ensure equal opportunities for organizations interested in promoting the CEURS Program by licensing CEURS Platform. To enable the regionalization of the CEURS Program in Brazil

Public Call Element	CEURS expectation
	To find an organization with technical-scientific capacity to offer and evolve the Platform, in order to meet the emerging demands of the CEURS Program regionalization process.
Legal Basis	Law No. 10.973/2004, which establishes the obligation to publish a summary of technological offers on the official website of the ICT for exclusive contracting situations, guaranteeing the constitutional command of the principle of publicity. As applicable, additionally: Decree No. 9.283/18; Law No. 13.243/2016; Law No. 9.279/1996; Law No. 9.784/1999; Law No. 9.279; Law No. 9.609; and Law No. 14.133/2021.
Licensing Mode	1 - Exclusivity of the license of the CEURS® Platform. 2 - Eventual sublicensing subject to UFSC authorization. 3 - Provision for corrective and evolutionary CEURS Platform maintenance. 4 - Economic compensation (royalties) when licensing under contract. 5 - Costs of maintenance or creation of new intellectual property registrations to be defined in complementary projects. 6 - The term of the license will be 10 (ten) years.
Intellectual Proprietary Rights	1 - Acknowledgement that the UFSC is the exclusive owner of CEURS Platform. 2 - This license does not imply ownership transfer.

As it can be seen in Table 2, CEURS Platform licensing public call has the following principles:

- *Exclusivity*: as CEURS will be taken to different states and CEURS Platform will need to be not only maintained but also improved, a single partnership reduces the complexity of management and governance of the technological offer of the CEURS Program.
- *Previous experience:* the organization partner has to have competence and a proven track record in the conception, development, implementation and evolution of digital platforms (i.e., e-government solutions for a broad target audience).
- *Academic Royalties:* the licensing has to bring economic compensation to the University, when CEURS Platform is used in a digital education project;
- *Sustainable business model:* it is required that the organization partner suggest a business model to foster CEURS that go beyond the current funds from federal Parliament, respecting national and institutional innovation regulation;

The principles of CEURS Platform licensing public aim to bring to CEURS project four ways of formalizing coproduction between university and industry: (1) *Technology Licensing* (TL) - the agreement allows UFSC grant to a company the right to use a technology developed in CEURS project in exchange for royalties; (2) *Technology Transfer* (TT) - CEURS team will transfer knowledge and technology to a company; (3) *Open Innovation Projects* (OI) - the licensing includes complementary projects that can be developed as a joint effort between university and the partner; (4) *Joint Patents* (JP) - these complementary projects are related to intellectual property rights to be discussed case by case.

5. Final Remarks

Technology transfer between university and industry has been an effective instrument to bring academic knowledge and products to market. Nevertheless, the complexity of digital society has demanded not only linear relationships but mainly a coproduction between university and industry. Regarding government, modern innovation systems have demanded new regulatory marks and the alignment between different public levels (federal, regional and municipal) decisions.

Academic research groups can meet the demand for university-industry co-production through innovation projects. However, technology transfer regulatory processes should not only focus on delivering results to the industry but also enable the elaboration and development of joint projects.

The case we have studied in this paper is a current challenge to CEURS research group: the only way they can take their project mission to all Brazilian cities is by multisectorial and multi-institutional coproduction. However, the regulatory mark has to include multiple government levels, academic network and open innovation with private companies has been a challenge. CEURS Platform licensing agreement is one of the UTT instruments that can help the university to take the project to other states. It is also a case to help university innovation policy to include multisectorial and multi-institutional coproduction factors in its regulatory mark.

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Virtual Reality for Supporting Knowledge Sharing: An Exercise of Technology Assessment

Gennifer Gurian[1], Kathrin Kirchner[2] and Ettore Bolisani[1,3]
[1]Department of Management and Engineering - University of Padua, Vicenza, Italy
[2]DTU – Technical University of Denmark, Lyngby, Denmark
[3]Venice International University, Italy

gennifer.gurian@studenti.unipd.it
kakir@dtu.dk
ettore.bolisani@unipd.it

Abstract: Knowledge sharing is an important process in knowledge management to foster collaboration. For its effective management, it is often suggested to use the support of adequate technologies. Virtual reality (VR) is a promising technology whose application in business increasingly attracts attention in activities, such as business meetings or training, where participants need to share knowledge in a complex context with communicational, social, and management implications. Due to the immersive capabilities, VR may provide new ways of sharing knowledge. However, due to the novelty of this technology, research is needed to evaluate its potential and drawbacks. This study aims to contribute to further understanding of whether and how the introduction of VR in organizations can favour knowledge sharing and collaboration between employees and to evaluate its potential, challenges, and prospects. It is based on a qualitative exercise of technology assessment based on two approaches: technology monitoring and collection of expert opinions using interviews with experts in organisations specialised in VR. Our analysis shows that VR has the potential to break barriers of time and space that may hinder effective human interactions. It can simplify the sharing of notions, data, and, more generally, knowledge, and allow people to connect and communicate as active protagonists. However, adopting VR may require organisational changes and has some limitations. In addition, appropriate knowledge-sharing models for VR applications still need to be developed. Consequently, our paper argues that although much is possible today with VR, further developments are still needed for this technology to reach complete maturity.

Keywords: Virtual reality, Knowledge sharing, Technology assessment

1. Introduction

Knowledge sharing (KS) is a primary process in Knowledge Management (Edwards, 2016) and key to fostering collaboration and knowledge creation. However, KS can be complicated (Liebowitz and Yan, 2004), and consequently, for effective knowledge sharing, it is often suggested to use the support of adequate technologies (Mueller et al., 2011; Newell et al., 2009). Virtual reality (VR) is a promising technology whose application in business increasingly attracts attention (Wohlgenannt et al., 2020), especially in situations like business meetings, where participants need to share knowledge in a complex context, which has communicational, social, and management implications (Standaert et al., 2021).

Virtual Reality (VR) provides users with a 3-dimensional, 360-degree computer-generated virtual environment (Kandaurova & Lee, 2019). VR can be seen as a knowledge-sharing support system due to the immersive capabilities offered to its users (Cambpell et al., 2019). However, due to the novelty of this technology, which has not yet reached its maturity in business, the application of VR for knowledge sharing still requires research to evaluate its potential and current drawbacks. Therefore, our study aims to understand whether and how the introduction of virtual reality in organizations can favour knowledge sharing and collaboration between employees and to evaluate its potential, challenges, and prospects. It is based on a qualitative exercise of technology assessment (Braun, 1998) based on two approaches: technology monitoring and a collection of expert opinions (Porter, 2011) using interviews of experts working in organizations specializing in VR.

Our study finds, on the one hand, that VR provides benefits as human interactions are supported despite differences in time and space. VR can simplify the data and knowledge sharing, as it allows people to connect and communicate as active protagonists in a virtual space. On the other hand, VR use requires organizational changes and has some limitations. Appropriate knowledge-sharing models for VR applications still need to be developed. Although VR provides new opportunities for KS, further developments are still needed to reach complete maturity in technical and organizational terms to enable successful knowledge sharing in the virtual world.

2. Methodology

This study is based on the technology assessment methodologies described in Porter (2011) and Braun (1998). In particular, it combines two approaches: Technology monitoring and Expert opinion. Technology monitoring consists of a systematic collection, from the specialized literature, of information about the technology and the analysis of its state-of-the-art (i.e., technical features, functioning, main components, and configurations), likely advancements, and future research directions, actual or potential business applications, and its implications for manufacturing and marketing. This process can be divided into steps which, in the case of our study, were defined as follows:

- Set objects and goals of the monitoring (in our case, an analysis of virtual reality, its applications to knowledge-sharing situations in business, its potential pros and cons, and its likely future)
- Select sources of information (mainly scientific journals and books, technical papers, and specialised websites)
- Collect documents and perform a systematic analysis
- Summarise information

The most critical issues are the selection of documents and the analysis of information. In our case, a cross-analysis was performed to seek confirmation between independent sources. The second point was that VR is not often explicitly considered a KS application. Therefore, it was necessary to derive information employing an analysis of its current applications, especially in activities (namely, business meetings and training) where VR can support KS.

The second approach - Expert opinion - is based on the assumption that experts who work in a field can have important elements and new perspectives, especially on the potential and problems of research and on the current applications of technology, information that may be difficult to find in the literature. The method is based on: a) a selection of one or more experts to consult; b) interviews or other methods of collection of information; c) recording, transcription, and data analysis; d) comparisons and synthesis. A problem with this method is that the experts can mix objective data with their personal opinions, so it may be important to contact more experts and conduct a cross-analysis of the collected information. In our case, we selected three technical experts of VR working in three different companies (one in Italy and two in Denmark). Interviews with these experts were conducted based on a set of open questions regarding a) the possible business applications of VR; b) the potential for knowledge sharing in organizations; c) the possible barriers to adoption; d) the impact on humans; and e) the prospects of this technology. Specifically, in the questions, the interviewees were asked to confirm or discuss the main points learned through technology monitoring. The collection of information was conducted in the second half of 2022.

In short, the collection and analysis of data were conducted by adopting the model described in figure 1. First, a technology monitoring was conducted to collect and analyse the available documentary data about the current configurations of the technology, the prospective business applications, the possible trends of market and research, the possible issues and practical problems, etc. This analysis was especially conducted with reference to the application of VR for knowledge sharing, by using the definitions and notions derived from the KM literature. After that, expert opinions were conducted to seek confirmation of what was found in the literature and documentary sources. A set of questions to guide expert interviews were defined, and an analysis of the expert views was conducted.

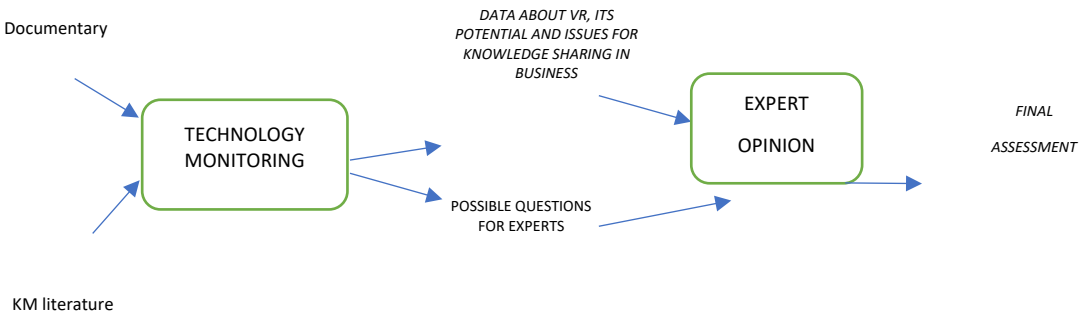


Figure 1: Analytical Framework

Regarding how the analysis was conducted, some further clarifications can be added. The preliminary analysis of the technology by means of the monitoring analysis revealed that VR is a very wide area that includes several applications in different contexts. Being apparent that its use and the specific technical configurations that are implemented can be different and context-dependant, the analysis then focused more specifically on the most promising application areas for business and, especially, those where knowledge sharing processes can be more impacted. As will be illustrated below, the application areas where the use of VR was investigated are internal business training and internal meetings.

In the following sections, we summarise the main findings of Technology monitoring that mainly focused on a description of the technology and its potential for KS (sections 3 and 4), and later of Expert opinion, which primarily focused on business applications, to find confirmation about pros and cons of VR (section 5) as derived from technology monitoring. Section 5 compares the results obtained by the technology monitoring analysis with the information collected from experts.

3. Virtual Reality: State of the art and Prospects

In this section, we describe the state-of-the-art and prospects of VR. We will also frame the notion of VR in the broader picture of the so-called "immersive technologies".

Technologies that allow to extend or create an environment with a high degree of involvement, thanks to a greater sensory isolation, are named immersive virtual reality. This immersive environment is created through interactive interfaces, which reduce the boundary between the physical world and the virtual environment, thus generating a multisensory virtual experience for the user.

This experience can be achieved using different devices, some of which make it possible to extend the physical space by adding virtual elements. Other kinds of technologies transfer the user to another environment with a fully immersive experience that allows forgetting about the physical and material environment in which the user is physically located. Here the concepts of VR and Mixed Reality (MR) emerge. These technologically advanced realities are identified with the all-encompassing term of extended reality (XR) that, according to Fast-Berglund et al. (2018), "refers to all real and virtual combined environments and human-machine interactions generated by computer technology and wearables".

The concepts of AR (Augmented Reality) and AV (Augmented virtuality) are positioned in the middle between the completely real and completely virtual environments. All technologies that "allow the overlay, in real-time, of images, markers or information generated virtually, on images of the real world" are identified under the term AR (Telefónica Fundación, 2011). On the other hand, the term Augmented Virtuality (AV) is less used. According to Valente et al. (2016) it consists "of a virtual world augmented with the mapping of an image or video from the real world in virtual objects".

The two terms combined fall into the broader concept of Mixed Reality (MR), the environment where the physical world and elements of the virtual context are displayed together on a single screen. Therefore, it is appropriate to refer to AR and AV as technologies that offer the opportunity to enhance the real environment with virtual information and elements.

The focus of our study is especially on VR, whose special and distinctive characteristic is that it creates a totally virtual space where the user is completely immersed and that is accessible only through the use of a special headset and, if necessary and possible, other sensorial applications (e.g., gloves) and a high-performance software (Wohlgenannt et al., 2020). Although there is sometimes a variegated use of the adjective “immersive”, in this study we will use the term VR to specifically consider those applications that engage the user in a total or almost total sensorial experience. In these terms, VR represents a more “immersive” technology compared to other categories like AR or AV applications. To perform effective immersive simulations, the headset becomes one of the critical elements of a VR system. A basic version of a technology tool like the head-mounted display (HMD) was already introduced in the 1960s, but several barriers limited its adoption. In recent years, the devices have become more affordable and performant, and VR has been again put at the center of attention. Its market is growing especially in the areas of entertainment and gaming. Still, there are now many other sectors of employment, with a wide variety of applications, for instance, healthcare, education, or tourism (Wohlgenannt et al., 2020).

VR is therefore seen as a medium in which users are involved with their entire body and respond to perceptions of that environment as if they were real. A computer feeds a digital description of an environment, and several visual, tactile, and auditory equipment provide a high level of realism and, consequently, immersion. The

tracking tools used for virtual experience ensure that the displayed images are updated according to the orientation of the head and possibly other body parts with respect to the synthetic environment. The quality of a virtual reality experience, defined as a medium, depends on how the user perceives the virtual world.

In the virtual experience, the user's perception of the digital environment is fundamental. For this reason, sensory displays or VR system output instruments are essential because they stimulate the human senses. These devices feature different characteristics and, in particular, are classified as visual, haptic, and aural displays. The input devices control movements and actions performed by the user and monitor them during the virtual world experience. This allows the participant to be immersed in that environment and to interact with the digital simulations. In addition, user monitoring makes rendering activity possible.

The user can send information to the system both actively and passively. The active method requires physical tools such as keyboards or joysticks that are activated by the user's action; on the other hand, passive inputs include body and position control tasks detected by the monitoring system. There is also the possibility of carrying out a worldwide monitoring where the information of the physical environment mixes with the virtual one, for example, data from meteorological stations.

The performance of the technical system is critical. For the users to perceive that they are totally immersed in a virtual environment, the interaction with their sensorial system must be effective. Telepresence is defined as "the experience of presence in an environment by means of a medium" (Steuer, 1992). As shown in figure 2, to ensure that, the technology must have high performance as regards both the vivid reproduction of the simulated environment and the interactivity of the users with the digital objects.

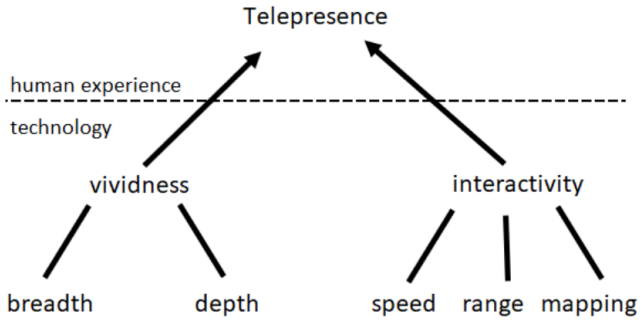


Figure 2: Dimensions of Effective Telepresence (Adapted from Steuer, 1992)

In a VR system, the most relevant tracking device is the position sensor that detects the user's orientation in the digital world through head and hand tracking. In position sensors, three basic parameters are to consider: the speed and accuracy of the detected orientation, the footprint, and the interfering means. Finding systems that ensure optimal conditions in each feature is difficult, so designers must seek compromises based on using the virtual system. Another critical device is the head-mounted display. Although the recent versions of this device are lighter and more comfortable than in the past, these objects are still bulky and have some limitations.

4. Knowledge Sharing and VR Applications

In this section, we summarize the technology monitoring results explicitly focused on using virtual reality for Knowledge sharing. KS is one of the most important processes in knowledge management, and this term is one of the most cited in the literature (Bolisani and Scarso, 2019). In general terms, it can be defined as the activities by which two or more people share a piece of knowledge with or without the support of information technology. Actually, it can involve a combination of different processes: an exchange or transfer of pieces of knowledge and information from someone to someone else, a process by which elements of knowledge become available and easily usable to all interested people in an organization, a process of mutual learning by all parties involved where people learn together and learn from one another, a process of creation and use of a common language and reference so that people can more easily, interact and communicate, etc. Therefore, it is different from a pure “knowledge transfer” (Edwards, 2016), where one person simply provides a piece of knowledge to somebody else, for example, through a document: sharing involves more active participation of both “giver” and “taker” and, actually, the “giver” of knowledge also receives feedback from the “taker” and, in turn, learns from this interaction. In addition, KS necessarily involves human beings and is, therefore, influenced by their attitude to interact, disclose their knowledge, be open to others, change their perspectives, etc. In other words, KS is

substantially a social process and a way for the organization to learn collectively (Cantamessa and Montagna, 2016).

The KM literature has underlined that several factors influence it. The first is a "technical" dimension. Following Nonaka and Tageuchi's (1996) model of knowledge conversion, to effectively share knowledge contents a proper conversion between their formats is needed. Therefore, every single case may require different modalities of conversion. A second important dimension is related to the social context (Asrar-ul-Haq and Anwar, 2016), which is influenced both by the personal attitudes of individuals and by the organizational settings. An important factor is mutual trust between knowledge sharers, which may affect the willingness to share knowledge and also the effectiveness of the process. Culture - i.e., the set of values of individuals in the context where knowledge sharing occurs - can also influence KS and can stimulate or reduce the motivation of individuals. Culture is related to people, but an organization can favour open-mindedness towards different positions and viewpoints, facilitating KS. Finally, the active presence of a "leader" or facilitator of KS can also be an important support.

The KM literature has often studied the technologies that can support KM and KS (Mueller et al., 2011; Newell et al. 2009), and attempts have been made to assess the effectiveness of different technology supports. The literature especially emphasizes two applications where VR can be particularly important in relation to KS: meetings and training. Meetings are a common method used in companies for several purposes and are especially important when there is something to discuss or to decide.

In meetings, people need to share elements of knowledge and, possibly, should actively participate with their contribution to the creation of "collective" knowledge in the group. The objectives of a business meeting can be multiple (Griffin, 2020; Standaert et al., 2021) and include not only exchanging information and making decisions but also communicating sentiments or building relationships, which recalls psychological aspects.

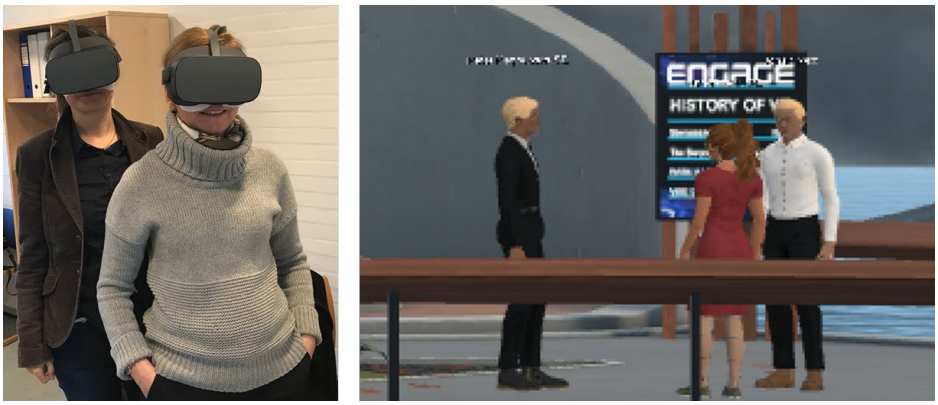


Figure 3: Wearing Head-Mounted Displays (Left) to Meet Colleagues in VR for Knowledge Sharing (Right)

Information and communication technologies can support these more or less effectively. Campbell et al. (2019) discuss that VR functions can reproduce the context where meetings take place with all the sensorial effects so that participants can feel like they are in a face-to-face meeting, but at the same time, the burden of hierarchies and inequalities can be reduced by means of the use of avatars that encourage participants to express their opinions more freely (Fromm, 2020). For example, in a brainstorming meeting, VR could lead to higher and more active participation. In a social event facilitated by VR, participants as avatars walk around freely in the virtual space and share knowledge with others (Figure 3) - which they may feel to be more lively and interactive than video conferences (Kirchner and Nordin Forsberg, 2021).

In training, knowledge must not simply pass from instructors to learners because the latter must be actively involved in the learning process to construct their own knowledge, and the former must take into account the feedback coming from learners and must adapt to their needs; in short, there is a sharing of knowledge. Some studies claim that the use of VR can have several benefits (Xie et al., 2021) and especially, due to high cost or complexity, training in a physical environment would be difficult (Martirosov and Kopeček, 2021) and simulations of real-life cases can be more easily reproduced without risk. This can also result in a better understanding of the specific instructions whose knowledge trainers are sharing with learners with a high realism (Martirosov and Kopeček, 2017). The use of VR environments has some potential benefits. The first is to overcome the lack of qualified instructors: once a virtual environment is set up based on the directions of a skilled instructor, simulations can be run as many times as desired. This is a special form of KS between the instructor (that sets up the VR simulation) and the current and future trainees (that will use it).

The second potential benefit is that a deep immersion of trainees is ensured, and they are therefore not easily distracted. In addition, VR training can lead to a real engagement of trainees even in emotional terms, which is useful, especially in simulated situations where emotions can influence problem-solving and decision-making processes (Martirosov and Kopeček, 2017). Finally, VR allows the creation of contexts where errors are tolerated, producing lower stress levels in trainees. Training can help new employees to feel more included in the workplace and become familiar with their new job and equipment as quickly as possible. Also, by observing the reactions of trainers in the VR environment, instructors can interact with learners in the simulated environment in real-time, and learn more about the training process, its effectiveness, and the problems that may arise.

The analysis of the available studies also made it possible to underline some of the main obstacles of VR for KS. Some are technical. Even though there have been important improvements in technical performance, VR devices still have limitations (Garret et al., 2018) especially because even a minimal imperfection in the VR simulation can reduce its usability and effectiveness and can have negative effects like motion sickness (Jalo et al., 2020). Another point is related to how much the user feels comfortable with this technology (Jalo et al., 2020). Although it may be argued that the young generations, more familiar with digitally simulated gaming, can easily accept this technology, likely, companies willing to use this technology must also provide training courses to employees.

Another key issue is the cost. Despite the decreasing cost, the investments needed for the technology are still significant, especially if many users are involved at the same time. The necessity of highly performant devices and graphic simulations and the related cost can still be a barrier to adoption (Garret et al., 2018)

5. Expert Opinion: Findings and Comparison with the Elements Found in Technology Monitoring

In this section, we summarise the results of the collection and analysis of expert opinions. The main purpose was to find confirmation regarding the points that had emerged in the technology monitoring analysis. We will refer to the three experts as A, B and C for anonymity reasons.

The experts were identified by contacting 3 companies selected through names reported in the "Welp Magazine" repository (see https://welpmagazine.com). For reasons of convenience, companies in Denmark and in Italy, among those most actively engaged in VR research and commercialization (but not merely on videogames), were selected based on their performance in terms of innovation, growth, social impact and management capabilities. After sending invitations to participate in the investigation, those which replied were finally selected, and namely two based in Denmark and one in Italy. In these companies, some key experts were identified and directly contacted for interviews, and namely: for the first company, the current CEO and founder who is an expert in developing "virtual worlds"; for the second company, a sales manager and expert in design, communications, and marketing projects; for the third company, a developer of customized VR solutions and expert in immersive audio and virtual productions. The selected experts have different roles in their companies; therefore they cover various aspects and perspectives on the investigated issues. A semi-structured interview was conducted where respondents were asked to provide information about: their company, its activity and products (to better frame and understand the information they provide); the current use of VR; their opinion about VR and its applications in business; their idea of VR as a tool for knowledge sharing; their opinion about how easy it can be for companies to implement and use of VR, the necessary training, and all the related issues; the current feedbacks and feelings they have regarding their market (i.e., other companies using VR and how they are experimenting and using it); their opinion about the current and future challenges of VR in business, related to technical, management, or market issues; the potential impact on humans; the expectations regarding future demand, and the business applications with more potential.

The interviews were conducted in person (for the Danish experts) or online (for the Italian expert) in the second semester of 2022. The collected answers were then analysed thoroughly by means of a discourse analysis, and the main aspects were compared with the information collected by means of the technology monitoring analysis.

5.1 Benefits of VR for KS

According to the information collected via technology monitoring, it is reported that VR, due to its media richness and synchronous functioning, can help to overcome some barriers that hinder KS. In addition, it can help favor knowledge transfer and an engaging learning experience. The experts confirmed these points at least partially.

The companies where the experts work as technology developers work, have their business in the development of immersive solutions, and VR consulting. However, the consulted experts admit that their organizations are not using VR in their own processes, as it is mainly used as a demonstration prototype for customers. They do confirm that, based on their experience, VR can bring many potential benefits especially due to the ability to provide the user with a realistic and emotional experience. Moreover, VR can reduce costs, time, and space barriers for KS activities requiring face-to-face meetings.

For example, as affirmed by A and B, VR allows recreating scenarios to play role games which is very effective in training, even reproducing dangerous situations, for instance, how to set a fire. This would be expensive and risky if performed physically, but VR, due to the immersive conditions, can effectively replicate decision-making under emotional stress and allow effective learning while avoiding risks. According to C, VR also makes it possible to overcome time barriers by presenting the users something that is not yet existing (for example, simulating interactions in a future situation) or even reducing some social challenges (e.g.: virtual experience can be proposed even to people with physical disabilities). In substance, VR can even extend the opportunities for KS in organizations.

5.2 Business Applications

The experts also confirm that VR's characteristics apply to different use cases and business fields. This is in line with recent reports affirming that thanks to the big investments by major companies, VR is finding more and more space (Wohlgenannt et al., 2020).

More specifically, regarding business meetings, the interviewed experts confirm that, more than other existing technologies, VR is effective in covering certain moments of human interactions, so it can be used for some parts of the collaboration process. An interesting point is made by expert A, who noticed that this can still be a conservative view - substantially, a mere transposition of traditional meetings to the virtual world. In other words, the real novelty of VR may emerge when new perspectives or modalities of KS will be implemented with the support of this technology.

Regarding training, according to expert A, there are a number of indicators that show that the use of immersive technologies has a high added value in learning. In fact, all experts confirm what was found in the technology monitoring analysis: immediate and lasting learning is favoured thanks to the learning-by-doing simulated method in an immersive environment, where users become protagonists of the actions, enabling them to familiarise themselves and improve their procedures and tasks. Training is, therefore, an elective field of introduction to VR, especially as regards learning about how to use products, production sites, and for safety instructions. In short, the interviews lead to expectations that VR will continue to significantly impact these business activities.

5.3 Limits and Problems

As analysed in the technology monitoring, there are some challenges to fully introducing VR in business. First, it was underlined that the companies could be held back by the economic expenditure required to purchase the devices. In addition, there may be costs associated with introducing VR related to required organizational changes. Firstly, virtual technologies must be adapted to internal systems. Although he considered VR to be an intuitive technology, Expert C admits that teaching employees how to use the technology properly may be necessary. Also, the complexity of headsets and the problem of motion sickness may not encourage their use. However, the experts pointed out that motion sickness is due to the insufficient quality of some headsets available in the market at a low cost. Probably, this problem will be reduced by improvements in performance.

The interviews also confirmed that some risks of digital technologies - e.g., privacy - are amplified in the virtual context; for example, the issue of fake news and false perceptions is amplified. Moreover, the experts also admitted that immersive technologies might affect users' emotions and psyches. This is still an unexplored area.

According to the experts, predicting what negative aspects can be improved and what limitations will not be easily overcome is difficult. However, there is a lot of research being carried out, and as was declared by experts A and B, over time, many problems with information technologies that were thought to be unresolvable have been overcome later, so the same can happen in the case of VR.

5.4 Future Expectations of Business Impact

The experts affirmed that the spread of VR can significantly impact how we work; and increased requests of working from home have already changed how we interact in business and normal life. This has further increased

the demand for collaborative virtual environments. Although, even for the experts, it is difficult to predict if and when the current limits of VR will be overcome, they all agree that the areas with the greatest potential for development and success are those of collaborative meetings and training.

6. Conclusion

Figure 4 summarises the analysis results and the main points regarding the potential benefits and current limits of VR, especially regarding knowledge sharing. The figure includes the points derived from the technology monitoring and later confirmed through expert interviews.

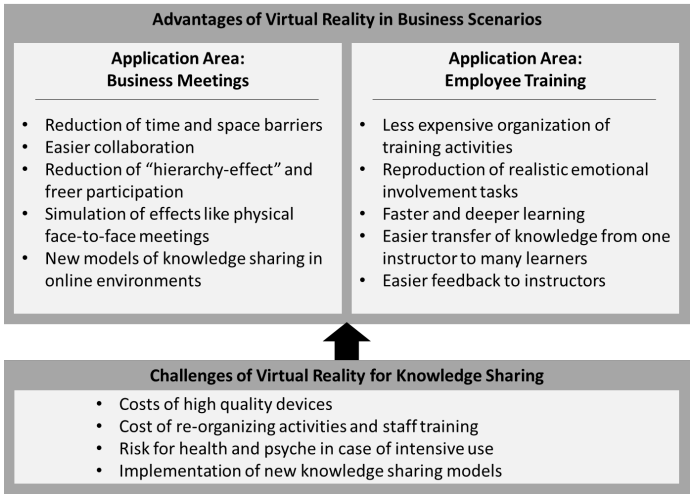


Figure 4: Advantages and Challenges of VR use for Knowledge Sharing in Business Activities

A general comment can be made on the real novelty of VR especially compared to other online communication tools. An important characteristic of VR is its capability to reproduce a context where participants can be involved emotionally and with all their senses. In other words, it is the closest possible reproduction of a real-life experience but in a simulated environment.

For this reason, knowledge sharing can be supported in entirely new ways compared to traditional technologies used in both meetings and training - such as, e.g., video conferencing. As is well known, knowledge sharing using human interactions can require, to be effective, a "total involvement" or sharers. Therefore, VR can be a really new approach.

It must, however, be noted that the technology still has some limitations, especially as regards its cost (at least, for high-quality devices), the organization of the activities (that can imply the adoption of new models for knowledge sharing), and the familiarity of use by the staff (which may be laggard to adopt the innovation). For this, there is still work to be done regarding technological advancements and managerial modifications. There is also an interesting implication for KM research: VR and immersive technologies can show new ways and processes of knowledge sharing and can need new interpretative models to understand how these processes can take place.

This study has some limitations. First, the approach used to collect and analyze data, although it was based on popular methods of technology assessment, is qualitative. Second, the selection of experts was subjective. A larger sample can be used, and other techniques (for example, a Delphi analysis) may be used. In any case, it is believed that the study still provides a preliminary picture of an important issue and can provide inspiration for further research.

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Onboarding and Knowledge Sharing: Cases From the Netherlands and Norway

Hanne Haave[2], Pascale Peters[1, 2], Yasmina Khadir-Poggi[1] and Tone Vold[2]
[1]Nyenrode Business University, The Netherlands
[2]Inland Norway University of Applied Sciences, Norway

hanne.haave@inn.no
tone.vold@inn.no

Abstract: Whereas some organizations struggled and had to let staff due to the COVID-19 pandemic, others had to expand to keep their business running. In this case, new employees had to be onboarded remotely due to the governmental restrictions regarding physical appearance in the workplace. The newcomers needed interactions to learn about organizational rules and regulations (compliance) and develop personal mastery (Clarification). To adopt and internalize the organizational norms and values (culture) and to become part of the work community (connection) interactions with leaders and co-workers are important. In this paper, we focus on the onboarding process of newcomers during the COVID-19-pandemic and what we can learn from this after the COVID-19 pandemic. By building on Bauer's 6C framework for onboarding (compliance, clarification, culture, connection, confidence and checkback), we analyse the data from two countries: the Netherlands and Norway. Two main themes are elaborated from the study: uncertainty regarding the work to be done and sensemaking of the introductory courses and follow-ups. We discuss possible implications for a post-Covid onboarding processes. Our findings show that the newcomers experience uncertainty with little or no personal contact. At the same time, they claim that the e-learning is supporting their learning process and their introduction to the organization. The perception of information varies and some of the newcomers' experience solitude and the responsibility of actively seeking information is placed with them, whilst others perceive the team designated for their onboarding sufficient to becoming a full member of the organization.

Keywords: Onboarding, Knowledge sharing, Telework, Sensemaking, Uncertainty

1. Introduction

The onboarding of new staff is important to reduce the time they need to be fully operative, as this can reduce costs of unproductive time for the organization (Filstad, 2016). During the COVID-19 pandemic, most organizations had to send their workforce to a home office and any newcomers had to be onboarded without any opportunities to meet a future colleague. All introductions and trainings were online (with exception of going onsite to collect working equipment such as a laptop for example) (Haave, Kaloudis and Vold, 2023). The rest of the onboarding had to remain digital and online. The opportunities for socializing the organization could have provided through formal and informal practices and programs, were inexistent (Klein and Polin, 2012; Klein, Polin and Leigh Sutton, 2015), perhaps coming at the expense of a successful onboarding process and reducing newcomers intention to stay (Feldman, 1981; Taskin and Bridoux, 2010a, 2010b). An unsuccessful onboarding process may be very costly for organizations. Since the end of the pandemic, in a time called now the "New Normal" (Bergum, Peters and Vold, 2023), most organizations agreed with their employee to continue with the practice of working from home for few days a week.

Due to the absence of homeworkers from the office, opportunities for face-to-face interactions with new colleagues may be reduced. In this paper, we will look at the results from onboarding processes from two countries; The Netherlands and Norway. Our research question is thus:

What are the consequences of less face-to-face interaction during an onboarding process?

Based on the study of the evidence collected from these two countries, it can be said that the times of digital onboarding are more than likely to have an impact on onboarding processes within the "new normal". For example, what may be offered digitally in an onboarding process, and what is important to maintain in a face-to-face interaction in order to secure a successful onboarding?

In the following paragraphs, the first section introduces the theoretical background concerning the two themes of uncertainty and sensemaking. Second, we describe the data collection process and results from the study. The paper closes on a discussion and way forward.

2. Theoretical Foundation

Onboarding is about bringing newcomers to a state where they are able to do the work that they were hired to do using formal and informal practices and programs (Klein and Polin, 2012). It is about bringing an "outsider"

to participate with efficiency in the organization (Feldman, 1976, 1981). Hence, the onboarding process require knowledge sharing where the organization and designated members share their knowledge with the newcomers in order to make them participants in the organization.

Russo, Morandin and Manca (2023) claim that "the objectives of the onboarding process, regardless of its format, revolve around the reduction of initial uncertainty and time for productivity" (Russo, Morandin and Manca, 2023, p. 207). They further state that during the COVID-19 pandemic, there was a risk of social isolation leading to a slower learning process, and that trust became an issue (Russo, Morandin and Manca, 2023).

Socializing is about acquiring "asset of appropriate role behaviours", develop "work skills and abilities", and adjusting "to the work group's norms an values" (Feldman, 1981, p. 309). Feldman (1981) proposes a three-phase process; "anticipatory socialization" – the learning before the newcomer joins the organization, "encounter" – engages with the organization and get a clearer picture of values, skills, and attitudes, and "change and acquisition" – where the newcomers learn to master their work and adjust to their roles and adjust to the norms and values (Feldman, 1981). In this last phase, it is important to master the tasks and, through this, gain self-confidence and "attain consistently positive performance levels" (Feldman, 1981, p. 310). The outcome is "general satisfaction," "internal work motivation," and "job involvement" (Feldman, 1981, p. 311). This is also tied to performance evaluation. With positive evaluations, it is possible to enhance the performance and the opposite: negative evaluations may lead to loss of self-confidence. Also, newcomers contact other staff members to interpret experiences and to learn the different codes of conduct. General satisfaction encompasses role definition, handling role conflicts within the work groups and obtaining work life balance. Internal work motivation is connected to experiencing personal growth and a sense of meaningful work (Feldman, 1981). The social interaction (working in teams) support task mastery and thus job involvement (Feldman, 1981). Although onboarding is about newcomers, organizational socialization may embrace other members of the organization too (Haaland, 2019). Van Maanen and Schein (1979) claim that the newcomers will try to reduce their uncertainty and Berger's uncertainty reduction theory (1986) suggests that newcomers will use different channels and both peers and superiors to reduce uncertainty. Within this theory, sensemaking and seeking information are two important dimensions. Sensemaking is a key in newcomers' adjustment as it is about how they construct meaning from their work day (Weick, 1995; Weick and Sutcliffe, 2015). Klein and Heuser (2008) developed the Inform Welcome Guide (IWG) framework based on academics' and practitioners' reviews. Inform is about providing the newcomer with all necessary information needed prior to the entrance in the organization. This includes communication, resources, and training prior to entering the organization. Upon entering, the welcome includes meeting other members of the organization and here the social capital may be developed (Klein and Polin, 2012). In the "Guide"-part, one may be assigned a "buddy" or a mentor. Klein, Polin, and Sutton (2015) also touch upon self-determination theory (Ryan and Deci, 2017), mentioning the dispute about triggering intrinsic motivation when newcomers maximize the outcome of the training programs. Below, an overview of the IWG- framework is presented (Figure 1).

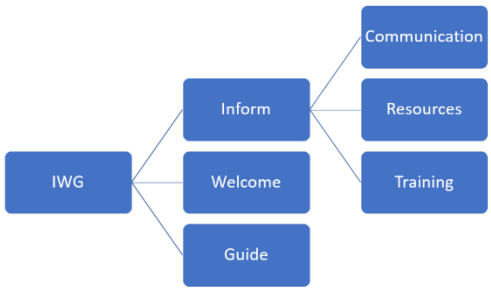


Figure 1: The IWG Framework

According to Bauer and Green (1998), managers also have an impact on newcomers' information seeking. If managers supported and clarified behaviours, the information seeking would be of less importance to the newcomer. Bauer (Preppio, 2022) developed a checklist for onboarding consisting of 6 C'; Compliance, Clarity, Culture, Connection, Confidence and Checkback, see table 1 below:

Table 1: Bauer's 6 C's

Compliance	Clarity	Culture	Connection	Confidence	Checkback
How the organization adapt for the newcomer to understand organizational knowledge regarding rules and routines	How the organization facilitate for the newcomer getting a clear idea about expectations and understanding of the job tasks	How the organization contribute towards the newcomer adapting to the organizational culture	How the organization facilitate for building the necessary connections and network in the organization	How the organization contribute towards the newcomers' personal mastery	How the organization keep track of the onboarding and feedback on the different facilitations – how they are adapted and how they work

In the 6 C model, there is a focus not only on understanding the job and environment but also on securing the "confidence" of the newcomer and making sure that the different initiatives in the onboarding process really work or whether they need to be adjusted (Preppio, 2022). In our case studies we have mainly utilized the first four of these C's.

3. Method of Inquiry

In this paper, we present the results from two different research studies: the "Millennials study" performed in the Netherlands and the "Onboarding under the pandemic-study" from Norway. Both studies aim to reveal how the participants experienced the onboarding process during the COVID-19 pandemic and had a qualitative approach, using semi-structured interviews. In the Dutch study, 14 informants were interviewed, all working in different organisations and recruited among the researchers' network (Table 2). The interviews were carried out both physically and online. In the Norwegian Onboarding-study, a total of six persons, all working in the same organisation were interviewed about their experiences with onboarding under the COVID-19 pandemic. The interviews were carried out digitally in November 2021.

Table 2: Overview of respondents

	Study from The Netherlands	Study from Norway
Informants	Interviewees nr. 1-14	Informants 1-6
Selection criteria	Ages 25-41 From different organisations Both employees and managers	Ages 25-41 Newly hired during 2021 In one organisation. Employees

The themes for the studies in both countries were to investigate how the newcomers perceived being onboarded without being able to meet physically at work, and about how they experienced support in their onboarding process from their "buddy"/supervisor/manager. Our particular foci have been on experiencing uncertainty and sensemaking.

The data analysis started by reading through the transcribed texts and coding the interviews by highlighting sentences with relevance to issues and themes that are central to the research question. In the process, both empirical and theoretical categories were developed. Furthermore, we discussed our findings up against the theoretical perspectives presented above.

4. Findings

As previously stated, we focussed on "uncertainty and sensemaking," as these were amongst the most common features in the data material in both countries. In the study from The Netherlands one of the respondents claim that "The clarity about the roles was not sufficient, due to little guidance. The best seems to be having a regular one-to-one meeting with the manager." (Interviewee 1Ne) In the Norwegian study two respondents claimed : "Most of the newcomers experienced that they "felt thrown into the work" with little support and had to take action themselves to work it out." (Interviewee 1No) and "The supervisor that were appointed to me was new to the organization and was not able to answer some of my questions. Hence, I contacted our manager instead" (Interviewee 2No).

Here, we see an example of unclear roles, what Bauer would call "Clarity/Clarification" (Bauer, 2010; Preppio, 2022). In the Dutch study, the informant turned to the manager. This may be an example of confusion that needs to be sorted out and where the newcomer/respondent turned to another than the designated mentor/buddy just like described in Feldman (1981) and Bauer and Green (1998). The Norwegian informants also displays uncertainty but has a slightly different approach as the informant shows independence regarding figuring things out by him/herself. It is possible that this is a display of the self-determination theory (Ryan and Deci, 2017). The informants also have to make sense of whatever is possible to work out (Weick, 1995). In the case where the closest supervisor/"buddy" lacks the necessary information, the next level (up) is approached in order to obtain the needed input.

Study from The Netherlands	**Study from Norway**
Many reports on partly passive information, partly interactive via e-learning videos "You receive an email with the pieces that are relevant to read." (Interviewee 1)	Information via e-learning videos about the organization. Since all were in the same organization, most report a positive learning experience about the organizations.

The above mentioned forms of information can be seen as a part of the "Welcome" in the "IWG" framework (Klein and Heuser, 2008). Again, it is about making sense of the information given, mostly to get an insight into the structure and culture of the organization. Learning about the organization via e-learning initiatives seems in both countries to work well.

Study from The Netherlands	**Study from Norway**
Though they often are being introduced to relevant contacts by having an appointment, but then the newcomer finds themselves responsible for follow up. This can be difficult when not knowing many colleagues. …"sometimes I didn't really have a clue who to contact…" (Interviewee 2)	Statement 1: One of the informants was followed up by colleagues with the same profession. (Interviewee 3) Statement 2: "I did not want to trouble the same person all the time, so I found others to ask my questions." (Interviewee 2)

This "connection" (Bauer, 2010) shows a difference in the organizations' approaches to follow up on their newcomers. The Dutch study shows what potentially may be a very unsecure position for the newcomers as they are responsible for making contacts in the organisation. In the Norwegian study, this seems be resolved in as shown in Statement 1, as there was a team that followed up the newcomer. In Statement 2, there again was uncertainty and a wish not to "tire out" one designated person and that the uncertainty reduction theory applies (Van Maanen and Schein, 1979; Berger, 1986).

5. Conclusion

In the data from the two studies there seems to be minor differences in approaches to handling uncertainty and sensemaking. The findings show that the digital information about the organization may contribute positively towards being a part of the "Compliance" (in the 6 C's) or "Welcome" in the IWG framework. "Clarity" regarding job understanding and expectancies require more than a video course, it requires either a "buddy", a manager, or the newcomer must be encouraged to find the information themselves. Obtaining the "Clarity" through asking the presented network, may also aid both building the "Culture" as well as support the "Connections" – the networking. Regarding "Inform", some of the communication would benefit from being personal, but may also be conducted via technology.

Our investigations show that introductory courses and some of the basic training can be offered digitally. Depending on the nature of the job, some job training that for example provide a deeper understanding should be conducted in a face-to-face setting for clarity and sensemaking regarding job content and enabling the newcomer to perform.

Stabilizing uncertainty and supporting sensemaking will for newcomers in most organizations contribute to the onboarding process being successful such that it will bring the newcomers to a level of being compliant with their work situation and thus be contributing in the organization rather than being a cost.

5.1 Further Research

This paper look into the evidence collected from two countries. The data requires more studying to see if there are other differences/similarities that may contribute towards reducing insecurity and enhancing sensemaking for newcomers to become full members of their new organization. For example, will differences in age groups in the material impact on insecurity/sensemaking issues? And are there any differences in how organizations facilitate their onboarding programmes.

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Knowledge Management for the Micro Enterprise: A Taxonomy

Stephen Hall, Serengul Smith, Can Baskent and Clifford De Raffaele
Middlesex University, London, UK

sh1436@live.mdx.ac.uk
s.smith@mdx.ac.uk
c.baskent@mdx.ac.uk
c.deraffaele@mdx.ac.uk

Abstract: Knowledge Management Systems enhance innovation, increase operational efficiency, and improve decision-making in business organisations. The administrative and resource overheads required to implement and maintain such systems, however, inherently exclude the smallest of firms from reaping these benefits. This paper aims to identify, evaluate, and summarize the distribution of research on knowledge management and supporting systems across business size classifications with a particular focus on micro-enterprises. It also seeks to establish if existing knowledge management models, practices, and systems have invested due consideration in their design to cater for the limited resources typically found in the micro-enterprise. It contributes new insight into the applicability of knowledge management systems to micro-enterprises and stimulates a possible re-think of how such systems can cater for the specific constraints of this prolific business type. This taxonomy provides a thorough analysis of 168 research papers from a total of 10511 papers published in reputable conference proceedings since 2012. It focuses on key knowledge management themes covered, including the size of the enterprise, the adoption challenges, the potential benefits, the technologies used, and the aspects of the knowledge management cycle that are being employed. Furthermore, it draws on this analysis to highlight the appropriateness of existing knowledge management systems to the distinctive risk and opportunity characteristics of the micro-enterprise.

Keywords: Knowledge Management, Micro-enterprise, Small and medium business, KM Cycle, KM Adoption Challenges, Taxonomy

1. Introduction

Since Karl Wiig's keynote address 'Management of Knowledge' in 1986, a steady flow of milestone implementations on knowledge management (KM) in the industry have been studied and recorded. KM brings particular benefits to enterprises by registering a lowered incidence of repeated mistakes, enhanced personal knowledge base, improved organisational competence and a saving in operating costs and expenses (Cheng and Kuan Yew, 2015). These benefits are attained through the adoption of a cyclic approach that manages knowledge from the point of its creation, dissemination, throughout its application, and eventual destruction. The motivators for KM system (KMS) adoption are diverse, and "in an economy where the only certainty is uncertainty, the one sure source of lasting competitive advantage is knowledge"(Nonaka, 2007). Strengthening the collective expertise of staff and partners contributes to increased success in the marketplace (Fred *et al.*, 2016). KM "continues to be a critical strategy for an organization to achieve a sustainable competitive advantage, and consequently survive in today's knowledge-based economy" (Halawi, Mccarthy and Aronson, 2017). A reduction in project timings, an improvement in the quality of products, and a higher level of customer satisfaction have all been attributed to effective KM, particularly when used for guiding the firm's actions in these areas (Rhem, 2018). Recent studies established that micro-enterprises largely employ personalization strategies that depend heavily on the tacit recollection of memories and experiences rather than explicit knowledge (Alvarez, Cilleruelo and Zamanillo, 2016; Sadat, 2018). Despite their ability to rapidly adapt to market changes, the limited resources available to the micro-enterprise constrain this size of firm from leveraging the benefits and strategically applying a KMS to their often-incongruent IT systems. The "existing KM tools seem too difficult to use for micro-companies due to their lack of available time and resources" (Camille, Huret and Segonds, 2017), a position reaffirmed by Michna, Kmieciak and Brzostek, (2018) who state that given their particular characteristics of "limited human, financial and material resources and a lack of time for creativity development" a different approach in terms of tools and resources to those appropriate to large organisations is necessary. KM literature often assumes the micro-enterprise to be sufficiently similar to a 'start-up' or 'small to medium-sized enterprise' (SME). This has led to the general perception that the micro-enterprise is sufficiently catered for in this domain. Although a start-up may, particularly in its early existence, classify as a micro-enterprise, its primary survival objective is to secure the largest market share in the shortest possible time. SMEs have similar objectives but use significantly more resources to satisfy market demands. The micro-enterprise is different, it typically serves a niche market without necessarily warranting an increase in resources for its survival (Gherhes *et al.*, 2016). However, the

enduring resource limitations that characterize the micro-enterprise present unique challenges to its adoption of KM.

This taxonomy paper aims to identify, evaluate, and summarize the distribution of research on KM and KMS across business size classifications with a particular focus on that specific to, or in its absence, relates closely to micro-enterprise. It also seeks to establish if any existing KM models, systems, and practices, have catered for the limited resources of the micro-enterprise. It contributes new insight into the applicability of KMS to micro-enterprises and stimulates a possible re-think of how KMS can cater for the specific constraints of this prolific business type. The next sections present the methodology used, the findings and a discussion of the results to further research.

2. Methodology

This research investigates whether the micro-enterprise needs a different approach to KM by seeking evidence of 'organizational size' factors as pivotal to the realization of KM utility, i.e., it questions whether due consideration needs to be applied to the size of an organisation when designing, implementing, and operating a KM system to realize maximum benefit. This research takes a bottom-up approach and is divided into two main phases. The first is a preliminary selection based on search criteria applied to the advanced search facilities of selected databases. It results in a set of shortlisted peer-reviewed academic papers that form the basis for this study. The second phase conducts a content analysis on the shortlisted papers, and through a series of structured queries addresses the research question and yields the taxonomic hierarchy. A taxonomy needs to be concise, robust, comprehensive, extendible, and explanatory (Bailey, 1994). In a recent review of 33 taxonomy articles used in Information Systems Research, Lösser et al. (2020) observed that most taxonomies that took an ad hoc approach lacked these essential aspects. In search for a more structured form, Nickerson proposes an iterative seven-step method (Nickerson, Varshney and Muntermann, 2013). Therefore, to ensure that this taxonomy is explicit, transferrable and reproducible, an adaptation of the Nickerson et al. (2013) seven-stage approach is used.

For this first phase, the IEEE Xplore and ACM databases have been purposefully selected to ensure that the output yields empirical primary research data about KM that is rooted within the field of information systems and computer science. This selection avoids the inevitable influences from the predominant 'business management' perspective of KM which can misrepresent the intended focus and results. The "Full-Text Collection" of the ACM database is being used to limit results to articles that are sponsored or published by the ACM rather than the 'ACM Guide to Computing Literature' since this would dilute the scope through the inclusion of other third-party publishers. The data collected from this phase is intentionally constrained by date range, initially excluding papers that had been published before the establishment of the term 'Micro-enterprise' by the European Union (EU) in May 2003 and further still to papers published within the last 10 years. This further constrained date range allows the use of the term to have become well understood and applied within its new EU context.

A sequence of three exclusion filters, illustrated in Figure 1, are applied to the databases to ensure the relevance and intended scope of the resulting papers. This phase will produce the set of shortlisted papers on which the second phase is conducted. The first filter looks for the presence of the phrase "Knowledge Management" or any variant key phrases such as KM, KMS, or Knowledge Acquisition, within the abstract part of the paper. This initial filter serves to exclude papers where KM is not the main topic of discussion. The second filter searches for the presence of the word "business" or any variant key phrases or words such as Firm, Company and Organisation, within the abstract part of the paper. This second filter serves to exclude papers that do not discuss KM within the context of business activity. The third filter searches for the presence of the word "size" or any variant key phrases such as SME, Small or Micro, that indicate the size of the business is a relevant point of discussion. This third filter serves to exclude papers that disregard business size as a factor that impacts KM.

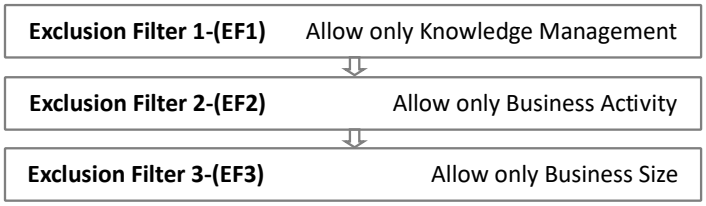


Figure 1: DB Exclusion Filters of Phase 1

The second phase consists of three stages, a preliminary manual screening stage for establishing paper eligibility, a series of close-ended questions that address the research question, and a concluding set of open-ended questions that serve to complement the data collected from the close-ended questions toward constructing the taxonomy. This three-stage process is represented in Figure 2.

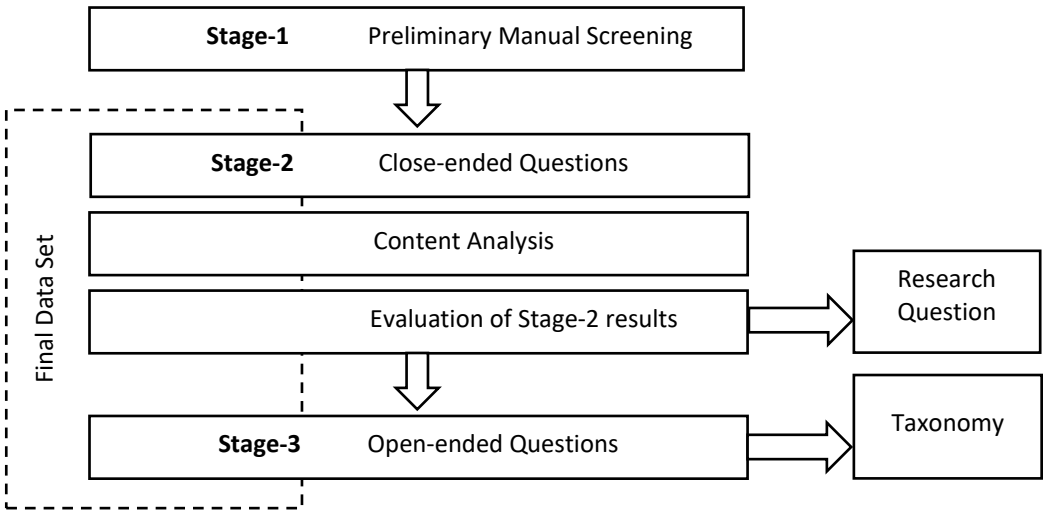


Figure 2: The Three Stages of Phase 2 - Showing the flow of Investigative Analysis, Addressing the Research Question, and Building the Taxonomy

3. Findings

The Phase-1 preliminary paper selection process is conducted against the ACM and IEEE Xplore databases. Table 1 details the resulting values from the application of each of the exclusion filters illustrated in Figure 1. The search criteria used, and respective variants of the principal keywords and phrases applied are also detailed for the purpose of replicability. A total of 168 papers were shortlisted for the Phase-2 analysis.

Table 1: Phase 1– Preliminary Paper Selection as of 12th Nov 2022

Search Criteria	IEEE Xplore	ACM	Total Papers
EF1- Abstract:("knowledge management" OR "Management of knowledge" OR "Knowledge transfer" OR "Knowledge acquisition" OR "Knowledge capture" OR "Knowledge distribution" OR "Knowledge dissemination" OR "Knowledge share" OR "Knowledge sharing" OR "Knowledge application" OR "Knowledge retrieval" OR "Knowledge use" OR "Knowledge creation" OR "Knowledge Usage")	9284	1227	10511
AND			
EF2- Abstract:(business OR firm OR organization OR organisation OR company OR enterprise)	3564	278	3931
AND			
EF3- Abstract:(size OR smb OR sme OR medium OR small OR "Very small" OR micro)	278	52	330
AND			
since 2003	247	52	299
AND			
since 2012	131	37	168

3.1 Stage 1 – Manual Eligibility Screening

This next phase begins with a manual screening process that assesses whether the key phrases, words, and their respective variants were filtered correctly by the databases' advanced search facilities. Furthermore, the

evaluation seeks to confirm that the context within which the key phrases and words are used is relevant to the study and to address the research question. The series of close-ended Assessment Criteria Questions (ACQs) used to manually screen the papers are detailed in Table 2.

Table 2: Phase 2 - Stage 1 ACQs for the Manual Paper Screening Process

ACQ#	Manual Paper Screening Criteria	Yes	No	Set
1.0	Is the paper unique within this dataset? (NO for Duplicate)	166	2	168
1.1	From 1.0 is EF1 met? (the phrase 'Knowledge Management' or variants)	166	0	166
1.2	From 1.1 is the paper's primary discussion on KM?	132	34	166
1.3	From 1.2 is EF2 met? (the word 'Business' or variants)	132	0	132
1.4	From 1.3 is the paper's primary discussion on Business Activity?	112	20	132
1.5	From 1.4 is EF3 met? (word 'Size' or variants)	112	0	112
1.6	From 1.5 is 'size' used within the context of business size?	81	31	112
1.7	From 1.6 does the paper present primary research? 'NO' represents literature review, systematic review, or taxonomy	72	9	81
1.8	Exclude paper from further review if the value of 1.0 to 1.7 = 'NO'	N/A	96	N/A

Of the initial 168 papers that were eligible for Phase 1, the manual screening process found 96 papers to have failed the screening criteria and were therefore excluded from further processing. 2 papers were found to be duplicated and 34 papers did not tackle KM as the primary focus of the research (ACQ# 1.2). A further 20 papers failed to meet ACQ# 1.4 which requires the paper to discuss the application of KM within the context of business organizations. Of these, 31 papers were found to have used the term 'size' as a measure for aspects other than to describe the size of a business entity (ACQ# 1.6). A final 9 papers were excluded since they analyze secondary research (ACQ# 1.7) and would include data that is duplicated from other papers that already form part of this study. In summary, a total of 72 papers passed the manual screening process and formed the final data set.

3.2 Stage 2 – Does the Micro-Enterprise Need a Different Approach to KM?

This stage seeks to answer the research question by performing an in-depth analysis of the 72 shortlisted papers. The first series of questions (Series 2.1) seeks evidence supporting the existence of research on KM that specifically caters for a particular size of an organisation. Each paper is assessed against the close-ended ACQs detailed in Table 3. The results are not mutually exclusive and therefore if a single paper meets the criteria for mentioning large and small enterprises it is added to each row accordingly.

Table 3: Series 2.1 - Close-Ended ACQs to Determine the Sizes of Organisations Being Discussed

ACQ#	Series 2.1 - What research on KM exists that considers organisational size?	Yes	No	Set
2.1.1	Does the paper mention Large Enterprises?	32	40	72
2.1.2	Does the paper mention Small or Medium Sized Businesses?	66	6	72
2.1.3	Does the paper mention Very Small or Micro-enterprise?	9	63	72
2.1.3.1	From 2.1.3 does the paper mention Very Small or Micro-enterprise exclusively?	0	9	9
2.1.3.2	From 2.1.3 is Micro-enterprise a key focus of the paper?	7	2	9
2.1.3.3	From 2.1.3.2 does the paper suggest a different KM approach for Micro Ent.?	4	3	7
2.1.4	Does the paper mention more than one size of enterprise?	30	42	72
2.1.4.1	From 2.1.4 does the paper consider firm size to be a key factor influencing KM use?	9	21	30
2.1.5	Does the paper discuss issues that challenge SMEs or Micro Ent. when using KMS?	20	52	72

As a result of this series of criteria assessments, 32 papers mention Large Enterprises, 66 mention Small or Medium sized and 9 mention Micro-enterprise (ACQ# 2.1.1 to 2.1.3). 30 papers mention more than one size of

organization and will be assessed further since they have the potential to discuss firm size as a key factor in KMS utility. Of these 30, only 9 discuss firm size within their study. Of the 9 papers that mention micro-enterprises, none mention it exclusively, implying that all the papers in this set have some correlation to at least two firm sizes. 2 of these papers Rumanti *et al.*, (2016) and, Rahim, Mahmood and Masrom, (2016) make an insignificant mention to micro-enterprise choosing to focus on the larger firm sizes, however, 7 papers make a notable contribution toward organisational size being a key factor of KM utility. Torres-Blasido *et al.*, (2019), validate a production model within a manufacturing micro-enterprise that seeks to increase productivity by encouraging its staff to share knowledge through the process of socialization. Pham and Nguyen, (2017), explore the impact of KM on business performance and provides evidence that "there is a difference in understanding and applying KM across three categories of firm size: medium, small and very small enterprises." Hall and De Raffaele, (2013), discuss the increased threat of corporate amnesia to the micro-enterprise due to its size and the dissemination of the entire organization's tacit knowledge among the few staff members. Hartono *et al.*, (2017), conduct a qualitative study that compares KM strategy to various organization sizes. The paper finds that a codification-based KM strategy benefits the larger firms whereas a personalization strategy benefits the smaller firms. The findings on micro-enterprise are largely inconclusive and "more follow-up studies" are required (Hartono *et al.*, 2016)(Mahmod, Rosnan and Hazman-Fitri, 2013). Whilst mostly informal, Knowledge Sharing is at its highest level in the smallest of firms and proportionately less in firms of increasing size (Riaz, Buriro and Mahboob, 2019). Holistically, Hartono *et al.*, (2016), determine that, unlike large and medium-sized firms, smaller firms suffice with a simple KM system without the need to pursue a level of KM maturity. Their study recognizes that research "often treat firms as a single monolithic group" and disregards firm size to be a moderating factor in KMS'. Mahmod, Rosnan and Hazman-Fitri, (2013), claim that "most of the studies conducted have not considered the differences of company size as well as specific features of SME that could affect KM" and "is largely disregarded by SMEs". Of these 7 papers, Pham and Nguyen, (2017), Hall and De Raffaele, (2013), Hartono *et al.*, (2017), and Hartono *et al.*, (2016) suggest that a different approach to KM for the micro-enterprise is necessary.

The second series of questions (Series 2.2) evaluates each paper on the KM models and cycles studied. Table 4 summarizes the findings and shows that 67 of the 72 papers discuss at least one stage of the KM cycle, and 57 of these include Knowledge Sharing amongst other stages. Despite only 20 of the 72 papers referencing an established KM model, there exists a fair distribution of papers that discuss each of the main KM cycle stages. However, the discussion on knowledge sharing has a significantly higher presence across the papers than in other stages of the KM cycle.

Table 4: Series 2.2 - KM Models and Cycles Used

ACQ#	Series 2.2 – What KM Models and Cycles are being used or proposed	Yes	No	Set
2.2.1	Does the paper reference an established KM model? (Wiig, Zack, Bukowitz, McElroy, Dalkir, Nonaka, SECI, ICAS, Boisot, Choo, I-Sense, von Krogh and Roos etc.)	20	52	72
2.2.2	Does the paper discuss specific KM-Cycle stages?	67	5	72
2.2.2.1	From 2.2.2 does the paper discuss K-Capture / Collection?	34	33	67
2.2.2.2	From 2.2.2 does the paper discuss K-Creation / Innovation?	45	22	67
2.2.2.3	From 2.2.2 does the paper discuss K-Dissemination / Distribution / Sharing?	57	10	67
2.2.2.4	From 2.2.2 does the paper discuss K-Application / Retrieval / Usage?	24	43	67

The third series of questions (Series 2.3) seeks to establish the implementation/adoption challenges of KM for Micro, Small and Medium-sized enterprises (MSME). Table 5 summarizes the findings.

Table 5: Series 2.3 - The State of Research on KM Implementation for MSME

ACQ#	Series 2.3 - What are the implementation challenges of KM for MSME?	Yes	No	Set
2.3.1	Does the paper argue firm size to be a key factor affecting KMS implementation?	25	47	72
2.3.2	Does the paper argue firm size to be a key factor affecting KMS's usable features and functions?	10	62	72
2.3.3	Does the paper identify implementation challenges?	21	51	72

This series of ACQs found 25 papers that support business size to be a determining factor affecting the use of KM. Mansfield et al.'s (2021) paper identifies the "lack of resources", the "paucity of data governance policies" and opposition toward "accepting new practices and knowledge" as the main factors in smaller enterprises that determine the use of KM. Sadler & Evans (2016) supports this by stating that although "KM is now easier to implement and manage" it should "not be underestimated as 'easy to implement'" and proceeds to explain that "it requires change from all levels of management and a shift in culture" to be of potential value. This implies that the smallest of firms would find it easier to change organizational culture and have fewer strata of management to contend with. Despite Alvarez et al. (2019) focus on KM in a factory production line, their paper recognizes that a key challenge of SMEs is "low human productivity" which they attribute to the prioritization of production numbers over a "practice of knowledge management within their production chain". This is evidence that SMEs involved in a production line setting either negate the benefits of KM or may not justify its implementation. Hartono et al. (2017) found recent studies suggesting that the "size of the organization may be considered as a key moderating variable" in the implementation of KM. The paper explains that there exists "a statistically significant relationship between the level of implementation of KMS and a construction firm's performance", and that a "codification-dominant KMS" is more attuned to the requirements of the larger firm. The paper also found that the statistics relating to the smaller firms were inconclusive and required further study. Only 10 papers presented evidence that firm size determines the usable features and functions of KMS. Key amongst these was Wiratmadja et al. (2014) who identify "six areas of SME technical competence that became a crucial source of knowledge in its business processes". Although they are specific to the firm being studied, the identification of key technical competencies and key business activities would determine the applicable KMS features and functions that would feasibly yield the desired benefits. Implementation challenges were identified by 21 of the 72 papers reviewed. Mahmod, Rosnan and Hazman-Fitri, (2013) argue "organizational policy, a knowledge-friendly culture, an information system culture and training" are essential prerequisites for KM implementation. Risman, (2012) consider the lack of motivation to be among the key challenges, and Torres-Blasido *et al.*, (2019) perceive cultural change as being the largest challenge. From the Stage 2 analysis, too few papers make any substantial contribution toward KM for the micro-enterprise, clearly indicating that the amount of research in this area from a computer science perspective is in very short supply. Although this analysis cannot be considered conclusive for addressing the research question due to the limited number of qualifying papers, there is, however, clear evidence that indicates the need for further research to determine this with certainty.

3.3 Stage 3 – The Taxonomy

Through a series of open-ended questions, this third stage builds on the data gathered from the previous two stages, results in a reflective analysis of the findings, and forms the structure of the taxonomy. Four specific focus areas were extracted from the set of 72 papers, these are Adoption Challenges, Perceived Benefits, and Suggested Technologies.

The taxonomic elements in bold print detailed in Figure 3 represent those extracted from the subset of 7 papers (ACQ# 2.1.3.2) and therefore exclusively represent the Micro-enterprise.

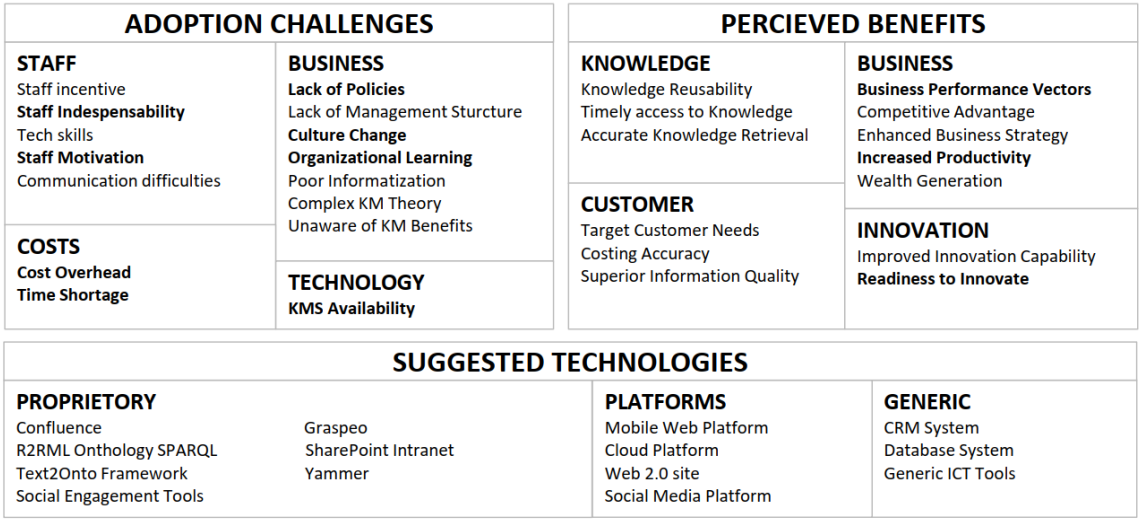


Figure 3: The Taxonomy

The phenomenon of Staff Indispensability is found to be accentuated in micro-enterprise. Staff members feel that they personally own certain knowledge and refuse to share it with others out of fear of losing the value they contribute toward the firm. A constant need to keep staff motivated to capture and share knowledge is also noted together with a lack of organizational policies in the micro-enterprise. This allows for processes to be applied out of convenience rather than need. Furthermore, the need for cultural change toward organizational learning is paramount to successfully realizing the benefits of a KMS. The lack of KMS availability for micro-enterprise, together with the overhead costs resulting from licensing, skills training and administrative time required is also recorded in the taxonomy.

4. Conclusion

This paper summarizes the distribution of recent studies on KM and KMS across the European Union's MSME business size classifications. This endeavour is supported by a rigorously structured and formal approach within the research area and outlines the analysis of the literature represented. It exposes the existence of a gross imbalance in KM research through a resulting emphasis on knowledge sharing and dissemination over other KM stages. The resulting taxonomy contributes new insight into the applicability of current KM research to MSMEs. Furthermore, it establishes that there is insufficient consideration for micro-enterprise in existing KM models, designs, systems, and practices, and provokes a re-think on how KMS can specifically cater for this business size.

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Effect of Knowledge Creation Practices on Managerial and Marketing Innovation Through Creativity

Rawâa Hammami and Karima Bouzguenda
Faculty of Economics and Management Sfax, Tunisia

rawaa.hammemi@gmail.com
ka.bouzguenda@gmail.com

Abstract: Knowledge creation (KC) is viewed as one of the important practices in knowledge management (KM) process. It is argued that the success of the firm is measured, to a great extent, by its level of innovation. In fact, an innovation-oriented perspective contributes to sustainability. Moreover, innovation is usually developed through new knowledge and creative ideas. That's why; it is relevant to examine the relationship between KC, creativity, and innovation. The first objective of the present paper is to study three direct relationships: The first relation is between KC and innovation (managerial, marketing). The second direct relation is between knowledge creation and creativity. The Third direct relation is between creativity and innovation. The second objective is to analyze the relationship between KC and innovation through the mediation of creativity. Finally, we will compare the results and identify the strongest and significant links useful for practice. The focus is on non-technological innovation because the majority of studies dealt with technological innovation. Added to that, managerial and marketing innovation is supposed to procure an advantage for emergent economies in a post-revolutionary and Covid context. The quantitative approach is adopted upon which 83 valid questionnaires are analyzed using the SEM with Pls3 to test the relationships between the variables. The results show that KC has a positive and significant effect on the two considered types of innovation. In addition, since KC dynamics allow organizations to develop and generate new ideas favorable to innovation, it has a positive effect on creativity. The test of mediation proves that creativity intervenes in the relation between KC, operationalized by the SECI model, and innovation. Based on these results, we may conclude that the relationship between KC and innovation becomes the strongest with the mediation of creativity. Certainly, these results have several implications both on the theoretical and empirical sides.

Ke words: Knowledge creation, Creativity, Marketing innovation, Managerial innovation, PLS

1. Introduction

In reference to knowledge-based view (KBV), knowledge is considered as a resource that is a source of competitive advantage (Costa et al, 2016; Davenport et al, 1998). Even though KM is often recapped in a non-exhaustive list of practices, the importance of the creation's phase, as a foremost and critical practice, has been largely emphasized in assuring the success of KM initiatives (Grimsdottir et al, 2018; Ermine, 2003). In fact, organizations focusing on innovation must be able to inspire and create new knowledge that can be translated into innovative output.

Furthermore and due to the changes that have marked the environment, among the most recent ones is the propagation of Covid19 that has dominated the whole World, organizations were confronted with an obligatory change in their managerial modes and their marketing approaches; we may evoke the appearance of the phenomenon of the delivery service and the online sale that did not frequently exist before. Companies must, therefore, manage themselves internally and develop new knowledge that aligns with the new needs and challenges. Despite the importance such new innovations' needs, the majority of research has been dealing with technological innovation mainly process and product innovation (Ferreira, 2018).

Referring to previous work, some researchers have identified the relationship between KM and innovation (Sankowska, 2013, Wang et al, 2012) by considering KM as a holistic variable (Ode, 2020). Moreover, the effect of creativity has been often overlooked (Sigala et al, 2015). Yet the latter constitutes an antecedent and a determinant of successful innovation.

The present study suggests overcoming this gap by examining the relationship between KC and managerial and marketing innovation while highlighting the mediating role of creativity. Such inquiry is realized, in a first part, on the theoretical side by mobilizing some hypothesis. In a second part, an empirical study is engaged to test the relevant links between the variables, discuss the results, and infer the implications useful for practice.

2. Theoretical Background

In this section, we present the concepts related to the study and establish their link to research question.

2.1 Knowledge Creation as an Important Step of KM Process

By recurring to KM practices, it is argued that the firm may benefit from a build-up in its competencies which may contribute to the development of its competitive advantage (Rahimli, 2012). In fact, literature review reveals that KM process is usually initiated by the KC phase (Miller, (1999); Bose, (2004); Lee et al, (2005); Torabi et al, (2017); Antunes et al, (2020). It follows that the success of the KM process is, a great extent, attributed to the effectiveness and dynamics of KC. Knowledge created "is sometimes more important than the existing knowledge" (Tajpour et al, 2022).

The present study is based on the KC theory founded by Nonaka and colleagues (1995) which is one of the best known in knowledge-based theories (Nguyen et al, 2016). This theory focuses on the conversion of the two dimensions of knowledge, namely tacit and explicit, yielding to four modes of KC:

- - Socialization from tacit to tacit: the conversion is achieved through shared experiences and know-how and realized through observation, imitation, and practice (Nguyen et al, 2016).
- - Externalization from tacit to explicit: this step is about formalizing tacit knowledge into supports in order to make it more understandable, accessible, and useful.
- - Combination from explicit to explicit: this conversion corresponds to the social interaction between the members of the organization on the shared explicit knowledge. This step refers to the activities of synthesizing, sorting, and collecting explicit knowledge (Schulze et al, 2008). These activities allow for a new combination in a way to create new knowledge (Nguyen et al, 2016).
- - Internalization: from explicit to tacit: the new knowledge resulting from the new combination is applied through its implementation. Learning by doing is the appropriate tool during this stage of KC (Nonaka et al, 2000).

As a result of the social interaction during the KC process and the transition from one mode of conversion to another, new interpretations and ideas are developed. In this regard, Chang et al (2014), confirm that the KC process is directly related to creativity.

2.2 Creativity as a Dynamic of new Ideas' Generation

Creativity is one of the factors that facilitate the path to innovation (Ferraira, 2018) and a vital necessity for organizations (Botega, et al, 2020). More specifically, creativity is viewed as the ability to create useful and new ideas (Amabile, 1997) that are appropriate to the context in which they are applied (Howard et al, 2008). These characteristics related to ideas constitute a pillar that guarantees a high level of creativity (Amabile, 1988; Sternberg, 2005). Moreover, it is, in essence, a cognitive activity that allows for the development of new ideas (Fadaee et al, 2014). It is aimed at the development, selection, and enhancement of creative ideas (Rietzschel et al., 2018). If these ideas are evaluated and valued, they are ready to be applied and translated into innovation.

2.3 Innovation Typologies as Opportunities for Organizational Development

According to Shumpeter (1934), innovation includes all innovations related to products, processes, markets or organizational modes. The OECD defines innovation as "the implementation of a new or significantly improved product (good or service) or process, a new marketing method or a new organizational method in business practices, workplace organization or external relations" (OECD, 2005, pp. 46-47). Based on this definition, the notion of innovation may take several forms: - Product/service, process, marketing, and managerial. Such forms are classified as technological innovations (the first two types) and non-technological innovations.

Since the majority of studies has focused on technological innovation (Lam, 2005; Damanpour et al, 2012; Apanasovich et al, 2016), we will pay attention to non-technological innovation as they constitute potential sources of opportunities for organizational development especially for the developing countries.

2.3.1 Managerial innovation and new forms of organizations

The Oslo's Manual defines organizational innovation as "the implementation of a new organizational method in business practices, workplace organization or external relations." (OECD, 2005, p.51). It is based on the creation of new modes of organization and management that can improve firm's performance (Besbes et al, 2013; p.163). It "is a new administrative system, new managerial practices, or new techniques that can create value for the organization that adopts them." (Damanpour et al, 2012, p. 424). Given the fact that it affects all functions of the organization (Le Roy et al, 2013), the development of NFOs would have not taken place

without the engagement in managerial innovation due to its incidence on performance as preconized by Hamel (2009).

2.3.2 Marketing innovation

It deals with any "introduction of new marketing methods that involve significant changes in product design, product placement, and product promotion or pricing (OECD, 2005, p.49). It reflects any changes in marketing tools and techniques which would lead to the increase in sales volumes while continuously satisfying customer needs or conquering new markets (Kalkan et al, 2014). According to Chen (2006), the success of the organization depends on innovation as it provides some opportunities to collect information from customers, understand their needs as well as to conquer new markets globally. Indeed, the proliferation of e-commerce and online business witnesses the value-added of new marketing methods.

The specification of the conceptual framework of the study leads to two main deductions: On the one hand, the terms “new “ and “newness” seem to be the common denominator of KC, creativity, and innovation. On the other hand, the latter are grounded both in the RBV and the evolutionist view as paradigms of apprehending and explaining organizational phenomenon related to the capacity to face challenges and environmental changes.

3. Hypothesis Development and Conceptual Model

In this section, we will develop the conceptual model and the underlying hypotheses dealing with the nature of the links between KC, creativity, and innovation.

3.1 Effect of KC on Innovation

KC is the principal core of innovation (Nisula et al, 2022). It is considered as the output of a cooperative and collaborative effort instead of a new work from a unique entity (Krishnan et al, 2021). Collaborative dimension represent the capacity of an organization to create, integrate and transform knowledge and idea into innovation (Shen et al, 2021). It is argued that KM process and innovation start mainly from KC (Grimsdottir et al, 2018) which is considered as a core activity to innovation path (Nonaka et al, 1995; Wang et al, 2012 and Xue, 2017). In fact, created knowledge may be used to enhance management and marketing policies.

3.1.1 Effect of KC on managerial innovation

Given that the effective functioning of an organization depends first of all on its working strategy and its mode of management, it is then important to give more attention to these administrative procedures, to make adjustments in a permanent way, and to create new specific strategies that align with the internal and external needs.

On the theoretical side, authors demonstrate that KC is a cornerstone of management (Nonaka, et al, 1995, and Lam, 2005). On the empirical side, a study conducted in the Vietnamese context confirms that the SECI model influences innovation initiatives (Nguyen et al, 2016).

Based on the above, we propose the following hypothesis:

Hypothesis 1: KC practices (SECI) have a positive effect on Managerial innovation.

3.1.2 Effect of KC on marketing innovation

The focus is on the marketing factors that enable the organization to improve its market position. Thus, creating new knowledge allows the organization to develop new ways to promote the level of sales and increase its revenues. Also, the launching of new product needs knowledge related to the place of distribution and the way in which the product is commercialized. The creation of a packaging and distinguishable design requires so much knowledge to have a distinctive image compared to the competitors.

In other words, it is the process of SECI that guarantees the incorporation of such new knowledge (Popadiuk, 2006; Nguyen et al, 2016).

On the basis of the above, we hypothesize the following:

Hypothesis 2: KC practices have a positive effect on marketing innovation.

3.2 Effect of KC on Creativity

In an environment characterized by continuous change, creativity is the appropriate response for any organization aiming at succeeding (Egan, 2005). As knowledge mobilization (transfer and conversion) is the basis of KC practices, the development of new ideas is achieved through social interactions and the conversion of knowledge from one mode to another. Then, KC practices are closely related to creativity (Chang, 2014 Rhimi et al, 2011) and may serve as a facilitator for creativity (Bladé et al, 2018). Empirically, the study of Lee et al (2003) provides evidence of the positive and significant relationship between KC and creativity.

Based on this reasoning, we propose the following hypothesis:

Hypothesis 3: KC practices (SECI) have a positive effect on creativity

3.3 Effect of Creativity on Innovation

If creativity is simply the ability to create and develop new ideas that meet needs (Amabile, 1996), innovation refers to the application of effective implementation of these ideas (Péres-Luño et al, 2011; Rietzschel et al, 2018). As all novelty starts mainly from new knowledge, the SECI nurtures the innovation process through which knowledge emerges, develops, and is shared and translated into new market practices and/or management methods.

Based on the above, we make the following hypothesis:

Hypothesis 4: Creativity has a positive effect on managerial innovation.

Hypothesis 5: Creativity has a positive effect on marketing innovation.

3.3.1 Mediating role of creativity on the relation between KC and innovation

The starting point is that creativity is the basis of all types of innovation (Sarooghi et al, 2015) and it is founded on knowledge. The latter facilitates the generation of new ideas that are susceptible to be translated into innovation (Borghini, 2005). It follows that the relation between innovation and creativity is etymologically grounded; what is needed is the implementation of creative ideas, for them to be innovation. Moreover, empirically studies showed that creativity has a mediating effect on the relationship between market orientation and new product performance and between the encouragement of risk-taking and new product performance (Sethi et al, 2009). The research of Chang et al (2014) assesses the intermediary role of creativity between KC and the performance of new products. The present study takes another angle by treating creativity as a mediating variable between KC and innovation as proposed in the following hypotheses:

Hypothesis 6: Creativity has a mediating effect on the relationship between KC and Marketing innovation.

Hypothesis 7: Creativity has a mediating effect on the relationship between KC and Managerial innovation.

Based on the theoretical argumentation, the issue related to the extent to which the SECI model influences non-technological innovation through creativity becomes more relevant than ever before as illustrated in the figure 1. Such relevance needs to be validated empirically.

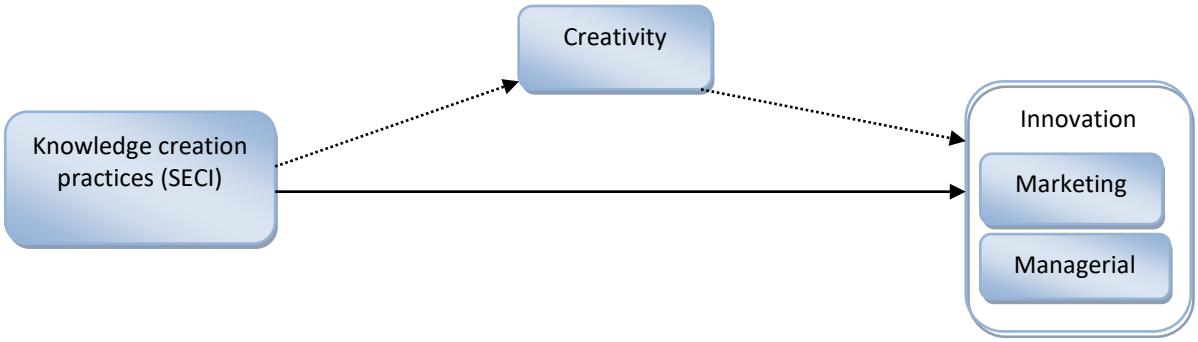


Figure 1: Conceptual Model of the Study

4. Methodology of Research and Results

In this section, we present the methodology of the empirical study and the results obtained.

4.1 Methodology of Research

A quantitative study through a survey is conducted. The sample concerns 83 to Tunisian companies operating in the agri-food sector and certified ISO 9001 which requires the implementation of KM practices. In this context, Gardeazabal et al (2023) argued that Knowledge is an important factor for agri-food systems. Table 1 presents the variables and the sources of scales used.

Table 1: Measurement of Variables

Variables	Nature	Reference
KC (SECI)	Independent	Lee et al (2003)
Creativity	Mediator	Lee et al (2003)
MkgInnov	Dependent	OCDE (2005)
ManagInnov	Dependent	OCDE (2005)

4.2 Descriptive Analysis

In this section we present a detailed description of our sample.

4.2.1 Distribution of the sample by geographical area

Our sample is composed of 83 companies geographically distributed as shown in Table 2 below.

Table 2: Distribution of the Sample by Geographical Area

Zone	%
Tunis	37%
Coastal	41%
South	22%

Representing a fertile agricultural zone, the Coastal zone was the primary source of data collection with 41% of the total sample.

4.2.2 Distribution of the sample by company size

Based on table3 below, we notice that the majority of the companies surveyed have a medium size.

Table 3: Distribution of the Sample by Company Size

Size	%
Medium	55%
Large	30%
Small	50%

4.2.3 Distribution according to the respondents' profile

The distribution of the respondents' profile is based on the criteria of gender and age (see Table 4).

Table 4: Distribution by Gender of Respondent

Gender	%
Male	55%
Female	45%

The majority of respondents are men 55%. Women represent 45% of the total population (see Table 5).

Table 5: Distribution of the Sample According to the age of the Respondent

Age	[25-35]	[36-45]	[46-55]	>55
percentage	15%	42%	35%	8%

Based on this classification, we note that the majority of respondents are young, as they are between 36 and 45 years old.

We note that more than half of the respondents are young. 57% of them are between 25 and 45 years old.

4.3 Exploratory Factor Analysis (EFA)

The results of EFA show that all variables have a determinant different at 0, and at 1 and a KMO value between 0.6 and 0.7 (Table 6). Hence, principal component analysis can be applied.

Table 6: Results of the Exploratory Factor Analysis

Variable	*Determinant*	KMO	Proper value	Explained variance
Socialisation	0,366	0,732	2,271	56,78%
Externalisation	0,378	0,655	2,117	52,93%
Combination	0,151	0,764	2,88	57,775%
Internalisation	0,433	0,665	1,969	65,61%
MkgInnov	0,177	0,884	2,602	65,043%
ManagInnov	0,195	0,746	2,686	67,16%
Creativity	0,02	0,771	3,850	77%

4.4 Results of Research

The reliability and validity of the constructs are verified before testing the hypotheses.

4.4.1 Validity and reliability results

Table 7 indicates that the constructs have high levels of reliability with values between 0.817 and 0.927 as recommended by Hair et al. (2014). All constructs have satisfactory average variance extracted indices that exceed the threshold recommended by Fornell et Larcker (1981) and Bagozzi et al. (1988).

Table 7: Results of Reliability and Validity Tests

Constructs	Reliability composite	AVE	Alpha de Cronbach
Socialisation	0,841	0,570	0,749
Externalisation	0,817	0,529	0,701
Combination	0,870	0,576	0,812
Internalisation	0,850	0,655	0,737
MkgInnov	0,881	0,650	0,819
ManagInnov	0,890	0,670	0,836
Creativity	0,927	0,762	0,895

4.4.2 Hypothesis testing

Our research model is composed of 5 direct relationships and 2 indirect relationships.

The alleged effects tested using SEM with PLS, yield to the following results as exhibited in table 8. The analysis confirms the positive and significant effects between all the variables supporting the hypotheses proposed. There is evidence on the effect of SECI on creativity and managerial and marketing innovation in the studied firms.

Table 8: Results of Direct Relations

H	Relation	Path coefficient	t-Student	P value	Decision
H.1	KC => ManagInnov	0,413	3,590	0,000	Accepted
H.2	KC =>MkgInnov	0,463	3,369	0,001	Accepted
H.3	KC => Creativity	0,860	20,502	0,000	Accepted

H	Relation	Path coefficient	t-Student	P value	Decision
H.4	Creativity => MkgInnov	0,346	2,482	0,013	Accepted
H.5	Creativity => ManagInnov	0,474	4,118	0,000	Accepted

As for the mediating effect of creativity, table 9 shows that the latter intervenes positively in the relationship between KC and both types of innovation. The mediation was tested by Sobel test.

Table 9: Results of Mediation Relations

H	Relation	t-Student	p-value	Z	p-value	Decision
H.6	KC=> Creativity => MkgInnov	2,383	0,017	2,4710168	0,006	Accepted
H.7	KC => Creativity => ManagInnov	3,749	0,000	4,0406889	0,000	Accepted

5. Discussion of the Results and Conclusion

Three main paths of relationships addressed in the present study are grounded not only theoretically but also empirically. These paths witness the existence of some dynamics favorable to KC, creativity, and innovation in the studied context.

5.1 Discussion of the Results

The first path deals with the effect of KC on innovation and creativity which is statistically significant and positive. Such effect may be explained by the following reasons.

- Social interactions seem to be useful, to a great extent, to identify problems and stimulate the creativity and innovation process (socialization). As a matter of fact, in order to find solutions, new opinions emerge as a result of discussions (exteriorization) and changes in behavior are likely to happen (combination and interiorization) as asserted by Le Roy et al (2013).
- In reference to RBV, training policy strengthening the competencies and skills of participants facilitates the delegation of decision making. The emergence of new structures and methods would add value to all functions and shape internal and external relations (Rajapathirana et al, 2018).
- Recently, the proliferation of social networks and the digital transformation are having a strong influence on business models and organizational behavior.

The results corroborate those of Lee et al (2003), Pezzillo Iacono et al. (2012), Hira et al. (2019), and Barua (2018); a fact that show a certain steadiness in the effect of KC on innovation.

The second path confirms the link between creativity and innovation which is conditioned by the capacity to transform new ideas into practical new managerial modes and marketing techniques perceived as valuable by all stakeholders. Studied firms have been able to develop a certain level of congruence between creative ideas generated and changes in organizational functioning and marketing strategy. Creativity provides, thus, the novelty of ideas in reference to the market and not in reference to what exists within the organization. This result aligns with that of Sarooghi et al (2015) yet diverges from the study of Stupa et al (2017) conducted in the Indonesian context. We may advance the contingent nature of the effect of creativity on innovation.

The third path examined concerns the mediating effect of creativity on the relation between KC and innovation. The results that KC practices have more direct effect on MkgInnov and ManagInnov with β indices respectively (β=0.463; β=0.413) than with creativity mediation (β=0.297; β=0.408). This partial effect may be explained by the relative dynamic of KC, creativity, and innovation characterized by a certain level of timidity and ineffectiveness in exploiting available resources and knowledge created. It seems that studied firms fail to either stimulate the detection of useful new ideas or develop new organizational modes and marketing methods that are appropriate to the context. KC is deemed important but insufficient to innovation performance.

Anyway, the findings may be traced to the premises of the institutional theory which emphasizes the weight of some pressures on the adoption of new managerial and marketing techniques becoming “fashion fads” more than “innovative practices”. It seems that coercive and mimetic pressures have been exerted on the studied firms leading to a fictive innovation resulting from the imitation of successful practices of big companies.

Such observation is relevant since Tunisian firms have been engaged in quality certification following coercive and mimetic pressures from government and external partners. As a matter of fact, the number of firms certified ISO 9001 keeps falling down since the revolution in 2011 and along with the propagation of COVID-19. Consequently, the changes in managerial and marketing methods are “superficial” and did not undergo real changes in paradigms and practices. Or, practices related to "benchmarking" may constitute a source of false innovation (Demil & al, 1998) and what DiMaggio et al (2012) calls "mimetic isomorphism". Besides, the relative innovation stems from the lack of creativity (Li et al, 2018) and the absence of favorable conditions to KC. For that, studied firms have a long way to go in order to conceive “new structures” approving the effective conversion modes of KC and targeting creative ideas.

5.2 Conclusion

Even though the question related to the performance of innovation is not new, one may assert that the majority of research has studied innovation from a global perspective by considering it as a holistic variable with the exception of the work of Nguyen et al (2016). Moreover, no research work has taken into consideration the mediating role of creativity in the relationship between KC and different types of innovation.

The idea is that creativity and the development of new ideas are generated from the activities carried out during the implementation of KC practices (SECI) (Lee et al, 2003; Riaz et al, 2019 and Barua, 2018).

The literature argues that creativity is a level that stimulates innovation (Parmentier et al, 2015) and that it is developed from knowledge (Lee et al, 2003). So it can be considered as a mediator between KC and innovation. This is our theoretical contribution.

At the managerial level, the results proved the role played by KC on non-technological innovation. Tunisian organizations need to give more attention to KC practices and take seriously the process of SECI by aiming the generation of ideas leading to value-added innovation. Some deficiencies are observed knowing that Tunisian firms have been losing their competitiveness in the international market and many contracts have been canceled. Despite the pressures of the institutional framework, managers must be creative in order to avoid different types of isomorphism.

This research can be enriched by conducting a qualitative study to detect best practices in KM and to analyze the meaning of innovation according to managers' perceptions. As KC practices are not well practiced, it seems important to study the facilitator of KC such as the use of social media.

To improve our research, it’s able to study the role of human resource practices to enhance KC practices. Also, the analysis of the cultural dimension may be deepened as it constitutes an important framework that can provide some answers since the Tunisian culture is characterized by haziness (Zghal, 1994).

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Towards Industry 5.0: Developing Knowledge and Skills in a Research and Innovation Lab

Irina-Emily Hansen, Ola Jon Mork, Paul Steffen Kleppe and Lars Andre Langøyli Giske
Department of Ocean Operations and Civil Engineering, Norwegian University of Science and Technology, Aalesund, Norway

irina-emily.hansen@ntnu.no
ola.j.mork@ntnu.no
paul.s.kleppe@ntnu.no
lars.a.l.giske@ntnu.no

Abstract: The challenging global environmental, economic, and societal transformations urge Norwegian industry to capitalize on all value creation from the manufacturing processes. For many companies, this implies taking manufacturing back to Norway. However, high labour costs do not allow Norway to compete in the global market, and therefore industry needs to take advantage of state-of-the-art technologies. Norwegian society is experiencing a steep learning curve: the acquisition of new knowledge and skills for engineers and managers in companies, while simultaneously transforming and aligning educational programs in universities with Industry 4.0 and Industry 5.0. This research presents a knowledge management perspective of the Industry 5.0 competence platform from the viewpoint of Manulab, a research and innovation lab specializing in Industry 4.0 technologies for the small-scale production of customized products. Located at the Norwegian University of Science and Technology in Ålesund, Manulab collaborates closely with regional industries, including marine, maritime, furniture, and food production, as well as suppliers to these sectors. While Industry 4.0 concepts developed in Manulab have significant potential for value creation, companies and stakeholders have yet to fully capitalize on them. To address this issue, the research adopts Nonaka and Takeuchi's organizational knowledge creation model and applies it to the competence building processes in Manulab, investigating the contribution from different knowledge workers to each phase. The term "knowledge workers" refers to individuals with specialized knowledge and expertise who create value for their organization. The study shows that involving additional knowledge workers in various phases of the Manulab competence building process is crucial for successful implementation of research projects in industry. Furthermore, this human-centric approach can assist companies in transitioning to the Industry 5.0 paradigm. The research is a collaborative effort among researchers, students, and employees holding various positions within industrial companies

Keywords: Knowledge management, Industry 5.0, industry-university, Research laboratory

1. Introduction. A new Vision for Norwegian Industry

The tremendous global environmental, economic, political changes have pushed everyone into looking beyond the conventional emphasis on technology and economic-driven growth that characterizes the current production and consumption-based economic model. Instead, the global community now promotes a more transformative approach that prioritizes human progress and well-being. This approach is a new paradigm Industry 5.0 (i5.0)(Renda *et al.*, 2022). It entails reducing and shifting consumption towards sustainable, circular, and regenerative economic value creation, and promoting equitable prosperity. Industry 5.0 does not merely represent a technological advancement but rather builds upon the Industry 4.0 (i4.0) approach to provide a regenerative purpose and direction for industrial production (Huang *et al.*, 2022). This shift focuses on creating value for people, the planet, and prosperity, rather than solely benefiting shareholders through value extraction.

But what knowledge and skills are needed for the transition to Industry 5.0?

Researchers at the Norwegian University of Science and Technology have used industry-university projects conducted in a research and innovation laboratory to find an answer to this question. The laboratory, known as Manulab, is equipped with Industry 4.0 technology and has been a valuable arena for exploring and using knowledge about Industry 4.0 technology in research, education, and industry. Some of the industrial cases conducted in Manulab have revealed the challenges of implementing Industry 4.0 technology in companies. This led the researchers to question how companies can benefit more from Industry 4.0-advantages and become ready for Industry 5.0. Since the knowledge and its application in organizations were central for the study, the researchers took Nonaka and Takeuchi's organizational knowledge creation model and applied it to the competence-building processes in industry-university projects in Manulab (Nonaka and Takeuchi, 1995). Furthermore, the researchers investigated how different knowledge workers contributed to competence building processes within i4.0 and i5.0.

"Knowledge workers" refers to individuals who possess specialized knowledge and expertise that they use to create value for their organization (Drucker, 2011). These workers are involved in knowledge creation, dissemination, and application, and are critical for organizations that rely on knowledge-intensive processes. Nonaka and Takeuchi argue that knowledge workers are not just passive recipients of information, but active participants in the knowledge creation process, constantly synthesizing and transforming information to generate new knowledge. They also emphasize the importance of socialization and interaction among knowledge workers, as knowledge is often created through dialogue and collaboration.

This study unveils the vital roles of specific knowledge workers in the distinct phases of the competence building process within i4.0 and i5.0. The application of these findings does not only enhance the adoption of Manulab i4.0 concepts by industry but also facilitates companies in transitioning to the new Industry 5.0 paradigm. The results are of significant interest to researchers and companies worldwide who are engaged in innovation projects within i4.0 and i5.0.

This article covers the following topics: an introduction to the Manulab i4.0 concept, a brief overview of Nonaka and Takeuchi's organizational knowledge creation model, a detailed description of the Manulab-industry competence building process, and the findings and conclusions.

2. Manulab i4.0

The Norwegian University of Science and Technology, campus Aalesund, opened the Manufacturing laboratory, (Manulab), in 2020 (Kleppe *et al.*, 2022). The lab was developed as a collaborative effort between the campus and local industries, with a prominent presence from the marine and maritime sectors such as shipbuilding and aquaculture (Madappilly and Mork, 2021). Additionally, the district boasts a strong representation by the furniture industry.

Despite broad variation in types of products, the industrial companies had shared manufacturing goals which became a foundation for the design of the Manulab, as shown in Figure 1 . To respond quicky to evolving customer needs, companies had to transform their manufacturing approach from producing big batches of a narrow range of products to producing a wider range of products at lower volumes. Furthermore, Norwegian companies recognized the importance of transitioning from manual or semi-automated to fully automated production to decrease production costs and remain competitive in the global market. Keeping these industrial goals in mind, the Manulab was created as a small-scale factory that used Industry 4.0-technology - Manulab-i4.0 concept. The concept involves both creating and developing technological products, as well as designing and assessing adaptable and automated manufacturing processes for these products. The Manulab equipment includes 3d-printers, laser-cutters, collaborative, mobile and industrial robots that communicate with each other through sensors, cameras and IoT technology. The equipment incorporates simulation software, machine learning, virtual reality, and artificial intelligence to enhance the functioning of Manulab (Kleppe and Bjelland, 2022).

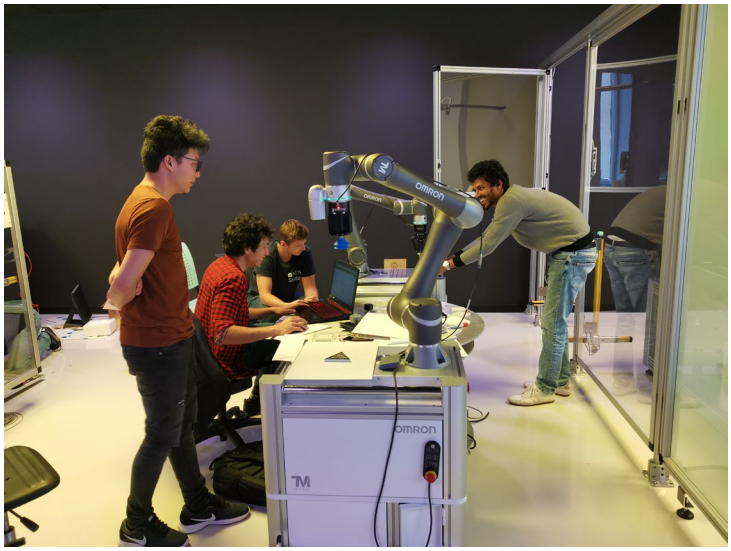


Figure 1: Students Working on the Industrial Case in Manulab Using Industry 4.0 Technology

From the day it opened, Manulab has been actively used for research, education, and industrial innovation projects. These activities intersect in the laboratory. For example, industrial cases can be elaborated in engineering courses. In addition to PhD students doing research, there are bachelor and master students, who are working as research assistants on research and innovation projects. Thereby, Manulab has emerged as a potent platform for building competencies by fostering collaboration among students, researchers, and industrial companies. However, not all industrial cases have yielded successful outcomes, as some of the industry 4.0 concepts developed in Manulab have encountered obstacles for their implementation in the industry. To tackle these challenges, the four authors of this article used a knowledge management approach to analyze industry-university cases in Manulab. All four authors are researchers, three of them are associated with the university while one is the head of research and development in an industrial company. The researchers employed the Nonaka and Takeuchi's organizational knowledge creation model on competence building process in Manulab, a brief introduction to which is given below.

3. Five-Phase Model of Organizational Knowledge Creation Process

According to this model, knowledge creation is a spiralling process of interaction between tacit and explicit knowledge, that goes through five phases as shown in the upper segment of Figure 2 (Nonaka and Takeuchi, 1995).

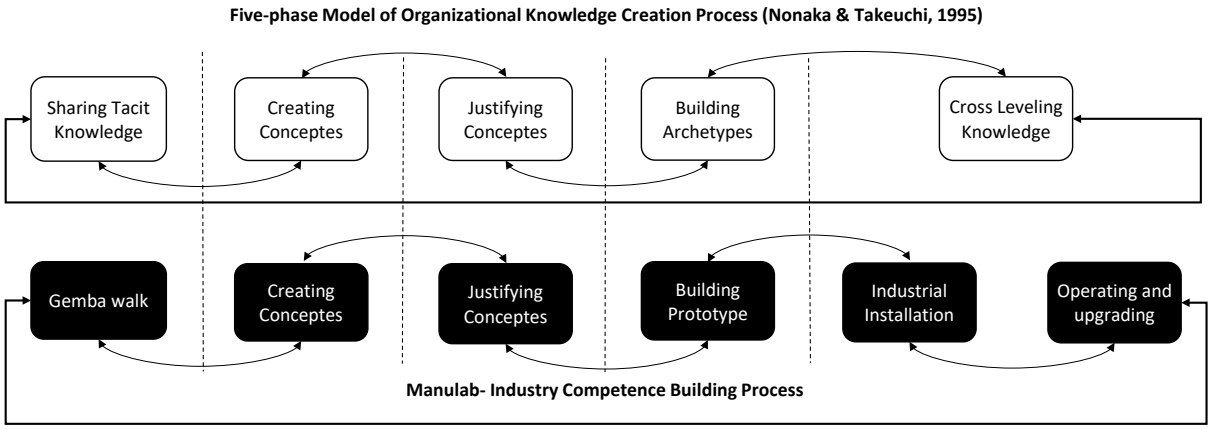


Figure 2: Nonaka and Takeuchi's Organizational Knowledge Creation Process and the Manulab-Industry Competence Building Process, Showing the Interrelations Between Their Phases

Nonaka and Takeuchi's organizational knowledge creation model describes five phases, which are:

Sharing tacit knowledge: This phase involves the sharing of tacit knowledge between individuals through interaction, observation, and communication. Tacit knowledge is difficult to articulate and is based on subjective experiences and insights.

Creating concepts: In this phase, individuals combine their tacit knowledge to create new concepts and ideas. This process involves a combination of intuition, insight, and creativity, and can lead to the development of new products, services, or processes.

Justifying concepts: In this phase, the new concepts and ideas are tested and refined to ensure their validity and usefulness. This process involves testing the concepts against existing knowledge and experience and adjusting, as necessary.

Building archetypes: In this phase, the validated concepts are used to create archetypes or models that represent the underlying principles and ideas. These archetypes can be used to guide future actions and decisions, and to communicate the knowledge to others.

Cross-leveling knowledge: In this final phase, the knowledge and insights gained through the previous four phases are shared and integrated throughout the organization. This involves creating a culture of knowledge sharing and collaboration and ensuring that the knowledge is accessible and useful to everyone in the organization, regardless of their level or position. By doing so, the organization can create a shared understanding and language around the knowledge, which can lead to ongoing innovation and improvement.

4. Manulab - Industry Competence Building Process

Guided by Nonaka and Takeuchi's model, the researchers set the phases of the competence building process in the Manulab industry projects, as illustrated in Figure 2. The process of competence building in Manulab follows the same pattern as the organizational knowledge creation process proposed by Nonaka and Takeuchi, with the exception that the Manulab process encompasses six distinct phases. The final two phases of the Manulab process, namely "industrial installation" and "operating and upgrading," are equivalent to a single phase of cross-leveling of knowledge in Nonaka and Takeuchi's model. The phases in the Manulab-industry competence building process are as follows.

The first phase is a Gemba-walk, which corresponds to the sharing of tacit knowledge in Nonaka and Takeuchi's model. This is the phase of socialization between a company and the Manulab team. The Manulab team typically consists of three to four researchers and two to three students, all from different fields of study. These are people with knowledge within information communication technology, mechanical engineering, automation, and manufacturing design. From the industrial side, it is usually engineers that work with product design and production in the company. If the company and Manulab team do not already know each other, the collaboration starts with several Gemba-walk-visits to the factory and to the Manulab. Gemba is a Japanese term that translates to "the actual place" or "the real place". The term is often used in the context of the Toyota Production System and lean management (Womack, Jones and Roos, 2007). It refers to the place where value is created and where problems can be identified and solved by observing and engaging with the work being done. The Manulab team has had several Gemba-walks at places where industrial work is done, such as a factory floor or construction site. The industry has had Gemba-walks in the laboratory workspace to observe and engage with the Manulab team working on production cases. Gemba-walks help to build relationships, promote understanding of each other's working methods, values, and clarify the expectations for the collaboration. The Gemba walks also help to find several industrial challenges that can be solved in the Manulab workplace. Once the specific challenging case has been selected, the company and the Manulab team initiate the project to tackle the challenge. This typically involves developing and testing an Industry 4.0 production robot cell, as well as modifying the product design to suit automated flexible production.

The next phases in the Manulab-Industry competence building process are 'creating' and 'justifying the concept' and 'building the prototype'. These phases are intricately linked, with continual iteration between modifying the concept and building a prototype. Prototype building goes through many virtual and physical interactions between product- and production design concepts, before arriving at a version that is approved by the company for industrialization.

The next phase is 'industrial installation' when the technology solution is implemented in the industrial company facility. Installation of the solution in an existing manufacturing process can often take time and interrupts production activity. Industrial installation is usually the responsibility of the system integrator, another partner in the Manulab-industry competence building process. System integrator is a supplier of the industrial version of a technological prototype. In this phase, the system integrator's role also includes training operators that will use the system.

The last phase is 'operating and upgrading'. Operators and engineers in an industrial company run the system, while the system integrator's responsibility involves servicing and upgrading the delivered system.

5. Research Method

Researchers conducted a series of four workshops with four industrial companies to gain insights into how knowledge workers contribute to competence building processes within Manulab i4.0 and i5.0 projects. A separate workshop was organized for each company. The purpose of using workshops as a research method is to generate dependable and accurate information concerning forward-thinking procedures, such as organizational change and design, in order to obtain reliable and valid data about the specific field under investigation (Ørngreen and Levinsen, 2017). In each workshop, there were between two and three people from the industry. The participants were middle management with engineering backgrounds, with the exception of one CEO. In each workshop, there were also two to four researchers who had dual roles as discussion partners and researchers.

The workshops began with presentations of industrial cases and demonstrations of technology prototypes in Manulab. Next, the researchers explained these cases from the perspectives of Nonaka and Takeuchi's knowledge creation process and the Manulab-industry competence building process, drawing upon Figure 2 to

illustrate the parallels between these processes. This approach facilitated in-depth discussions about the involvement of knowledge workers in the Manulab i4.0 and i5.0 projects.

Each workshop lasted for approximately one-hour during which researchers took detailed notes to capture the key points. Following the workshops, the researchers analyzed the collected data and later presented the findings to the workshop participants for final discussion and approval. The findings will be presented in the following section.

6. Findings and Discussions

6.1 Partners' Involvement in Distinct Phases of Manulab-Industry Competence Building Process

Figure 3 visualizes how industry, Manulab and the system integrator are involved in distinct phases of the competence building process.

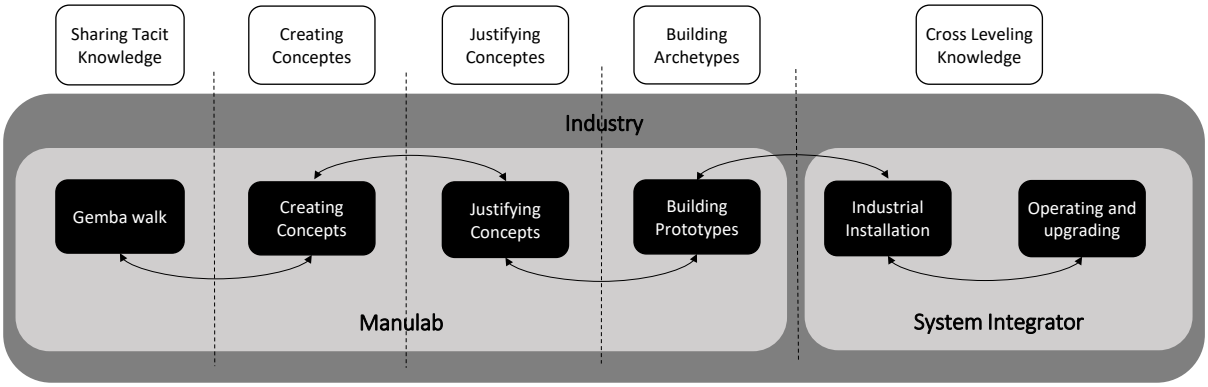


Figure 3: Involvement of Partners in Manulab i4.0- Competence Building Process and Corresponding Nonaka and Takeuchi's Organizational Knowledge Creation Process

As Figure 3 shows, the only partner that participates in the entire process is industry. The Manulab team collaborates with industry in the first four phases of the process, which involve the exchange of tacit knowledge, conceptualization, justification, and prototyping. When it comes to installation of the industrial system in a company's facility, a system integrator is typically brought in to take over. The system integrator utilizes their own concepts, often based on prior experience from other projects, to develop and install the technological solution, providing a warranty for the operating system and training for operators. Together with the system integrator, industry is cross-leveling knowledge by learning from the installation, operating and upgrading of the system. Meanwhile, the Manulab team is not involved in these last phases of the competence building process as it is today in the Manulab i4.0 concept.

While the system integrator's expertise is invaluable in the installation phase, they do not typically contribute to the Gemba, concept creation, concept justification, and prototyping phases. By involving the system integrator in the earlier phases, it is possible to create a shared Manulab-industry-system integrator concept, leading to a higher quality industrial solution.

The involvement of Manulab in the installation phase would benefit the collaborative competence building process. For instance, testing the industrial version of the technological solution in the Manulab facility can reduce the risk of new system errors that often arise during the initial stages of system usage.

Manulab can also assist in operating and upgrading systems by enabling the design and testing of enhanced systems in the laboratory before deploying them in the industrial company's facilities.

The participation of all three partners, industry, system integrator and Manulab in all phases would allow cross-leveling of knowledge by lifting the level of competence across and inside all three organizations. It would also, in accordance with Nonaka and Takechi's model, trigger a new spiral of knowledge building in organizations, which means the adjustment of organizational knowledge building strategies based on 'lessons learned' from each collaborative project.

6.2 Involvement of Specific Knowledge Workers in Different Phases of the Manulab-Industry Competence Building Process

Analyzing the Manulab competence building process from the knowledge management perspective not only highlighted the need for the participation of all three organizations along the whole competence building process, but also emphasized the importance of involving specific knowledge workers from these organizations.

Table 1 shows the knowledge workers and their involvement in the Manulab-industry competence building phases in the current Manulab i4.0 concept and how the researchers and industrial partners see knowledge workers' involvement in the Manulab i5.0 concept. The plus-symbol in Table 1 shows the need to involve knowledge workers. The higher degree of need for involvement is shown with two plus symbols.

Regarding the Manulab team, the knowledge workers, comprising of students and researchers, possess the necessary skills for both the i4.0 and i5.0 concepts. However, it is crucial to include them in the final two phases of the Manulab i5.0 competence building process.

For the system integrator, engineers are the knowledge workers needed for i5.0. However, it is necessary to involve them in the first four phases of the process.

Engineers from the industrial company have been actively involved in all phases of competence building for the Manulab i4.0 concept, and this level of full involvement will remain relevant for i5.0.

Table 1: Knowledge Workers Involvement in Manulab i4.0 and Manulab i5.0

Organizations	Knowledge workers	Ind.	Gemba walk	Creating concepts	Justifying Concepts	Building Prototype	Industrial Installation	Operating Upgrading
Manulab	Students & Researchers	4.0	++	++	++	++		
		5.0	++	++	++	++	+	+
System integrator	Engineers	4.0					++	++
		5.0	+	+	++	+	++	++
Industrial company	Operators	4.0					+	++
		5.0	+	+	+	+	+	++
	Engineers	4.0	+	+	+	+	+	+
		5.0	+	+	+	+	+	+
	Decision makers	4.0					++	
		5.0	+	+	++	+	++	+
	Sales Managers	4.0						
		5.0	+	+	+	+		+

Compared to Industry 4.0, Industry 5.0 has a broader approach to value creation by promoting sustainability, human-centricity, and resilience in manufacturing (as stated by the EU). As the industry moves towards the integration of smart technologies and the cognitive skills and critical thinking of employees, it becomes increasingly crucial to involve knowledge workers such as operators, sales managers, and decision makers from the industrial company in the process.

Manufacturing operators should be involved in all phases of knowledge creation. In the context of human-centric automation in Industry 5.0, operators' knowledge and skills are essential for manufacturing processes and procedures. It is also crucial to introduce operators to new products and manufacturing technologies early on. Their input is valuable for concept creation, prototyping, and installation. Since operators are the ones who use the technological solution in the operation phase, their knowledge is essential for upgrading the solution.

The decision maker should participate in all the Manulab i5.0 knowledge process phases. The experience so far in the Manulab, is that the decision maker enters the process too late. The consequence is that the valuable early phases, like the Gemba walk, creating the concept, concept justification and prototyping, are not

receiving the required attention, and neither will the project be properly funded. It is a common challenge in industrial companies that automation has too much focus on eliminating operators and less on value creation. By involving decision makers early on, the potential for industrial performance, sustainability, and value creation for society can be maximized. Decision makers can provide valuable insights into business objectives, investment decisions, and strategic planning that can inform and enhance the Manulab-industry collaboration. As such, their participation is crucial for the success of the competence building process and the realization of the Industry 5.0 paradigm.

In Industry 5.0, there is an increased emphasis on meeting customer needs through continuous improvement and upgrading of the manufacturing system to enhance the overall customer experience and make the supply chain more resilient (Renda *et al.*, 2022). As such, the role of the sales manager as a representative of the "voice of the customer" is crucial in the Manulab-industry competence building process. Sales managers should participate in the introductory phases to ensure customer preferences, wishes, and experiences are considered.

Overall, the involvement of certain knowledge workers in specific phases of the process is essential for the successful utilization of Manulab projects within the Industry 4.0 concept and can support Manulab's transition to Industry 5.0. The next section presents how the researchers used their findings to plan the Manulab-industry competence building process within the Manulab i5.0 concept.

6.3 Manulab i.5.0 – Concept: Proposing Competence Building, Learning Contexts and Tools in the Knowledge Creation Process

Based on the findings, the researchers designed the Manulab-industry competence building process to support the Industry 5.0 paradigm.

The first phase is a Gemba walk. The knowledge workers from the industrial company, the system integrator and university's Manulab meet for socialization sessions and to experience each other's learning and innovation contexts. The Manulab team arranges a Gemba walk in the Manulab with the knowledge workers who need to be involved in Manulab i5.0, that is, researchers and students from Manulab, industrial engineers from the system integrator and the industrial company, operators, decision makers and the sales manager from the industrial company. Design tools, rapid prototyping, collaborative and mobile robotics, should be demonstrated at this point. The knowledge workers can explore the design of products, jigs, fixtures, and grippers and combine it with automatic manufacturing both in simulators and in the physical Manulab factory. The industrial company should arrange a corresponding workshop with the design department and manufacturing department in their factory to explain how they work. The customers' experiences can be presented by customers if possible. The industrial company may use digital market research or IOT (Internet of Things) technology to collect and present data from customer experience and product and services performance. The operator's knowledge is important to build in the human centric approach for manufacturing systems, and therefore it is important to study the operators' work in the factory. The decision maker should participate in the Gemba walk to understand the opportunities of innovative technology. The decision maker has knowledge about the industrial company's value chain strategy and approach to sustainability. The decision maker is also the enabler of financial and human resources. Drawing a parallel between the Gemba phase and Nonaka and Takeuchi's initial phase of tacit knowledge sharing, there are several methods for exchanging tacit knowledge, including direct observation, narration accompanied by direct observation, imitation, experimentation, comparison, and joint execution (Nonaka and Takeuchi, 2019).

Concept creation phase – here the aim is to enable tacit knowledge, and use this to develop product, process, and business concepts. It is important that the creating concept phase also includes 'high flying' ideas and thoughts. The concept creation phase must evaluate whether we have the needed knowledge and skills onboard. Do we use the right methodology to externalize tacit knowledge? Do we use creative language and metaphors? Are we able to understand tacit knowledge to its full potential? If certain knowledge is not included in the second phase, it will be absent in the concept creation phase and will not be integrated into the prototype at a later phase. Innovative product and service concepts, and automatic manufacturing concepts should be made, and combined with customer experiences. Operators' role and how to use human knowledge in combination with artificial intelligence should be elaborated in several scenarios. Manulab's facilities and features, such as design and prototyping equipment, should be effectively utilized for this purpose.

Justifying the concept phase is where the concept is tested and elaborated relating to the industrial company's short term and long-term business strategy, human centric automation, sustainability performance and value

for society. The sustainability view should be elaborated and highlighted within the design, manufacturing, transport, and use and recycling of products and services. If the justification of concept does not meet the industrial companies' business advancement and strategy, there should be a low threshold for creation of a new or modified concept. Concept can include pay-back time, return on investment, costs, and profit margins. The industrial company could invite customers, suppliers, and authorities to contribute to the justification of the concept.

Building a prototype phase is where the justified concept is built into a prototype of the product and an automatic manufacturing line. This means that the concept is combined with the industrial companies' existing concepts, products, components, and manufacturing facilities. It can be useful to use CAD and CAM System for visualization and simulation of the product and the manufacturing processes. However, building of physical product prototypes and real life set up of a manufacturing line will give more insights for verification and validation.

The industrial Installation phase refers to installing the automatic manufacturing line in the industrial company's factory. The industrial installation can be related to a completely new automatic manufacturing line or an upgrading of an existing manufacturing line. The industrial installation phase can be costly and critical for the industrial company since in many cases, it is done in parallel with daily operations. The engineers from the system integrator are responsible for this phase. Their knowledge, skills, experience, and access to technological resources are vital for the performance of the industrial installation process. High complexity of the product, components and manufacturing equipment can lead to delays in manufacturing, because substantial numbers of failures must be fixed 'on the line.' This can be avoided if Manulab supports the industrial installation work, by making proof of concept and even delivering the needed products and services for a period, to the customer.

The operating and upgrading phase are the normal industrial operations where the industrial company is responsible. However, in a dynamic business world customers will continuously ask for new variants of the products and services. The price of the products and components will normally decrease by 2% to 4% every year, and this puts pressure on the industrial company to find more efficient manufacturing methods. This is done as an iterative development process aiming to lower the cost of the product and components. It is also likely that both the system integrator and Manulab can take an active role and contribute with ideas and concepts if they create a lifelong partnership with the industrial company.

The knowledge and skills required for development of Industry 5.0 concepts are intertwined among the three partners and represent a common knowledge foundation. This knowledge foundation is vital for the industrial company's performance.

Following Nonaka and Takeuchi's KM model, organizational knowledge creation is a spiral process, with each new project building on the knowledge gained from previous collaborations. Long-term collaboration, lasting a minimum of three to four years, would enhance the partners' competences and equip them to meet future industry demands. To achieve this, the three partners will establish procedures and routines for their work, with the socialization process at the foundation of all knowledge creation and application. Care, trust, and commitment are the key factors that will enable the partners to create and apply new knowledge effectively.

7. Conclusion

The research findings propose a long-term cooperation between the industrial company, the system integrator and the Manulab team. Decision makers, sales managers and manufacturing operators should participate throughout the knowledge creation process, and their participation is considered crucial for human centric automation, sustainability in product and processes, and value creation for business and society. The Manulab i.5.0 concept also bridges university and industry collaboration with students participating as knowledge workers. This is regarded as beneficial for knowledge diffusion and societal development.

The findings show that Nonaka' s five phase model can support the Manulab i.4.0 concept for a transition towards the Manulab i.5.0 concept. Involving both industry, system integrator and Manulab with all the relevant knowledge workers, throughout the Manulab-industry competence building process is likely to support enabling tacit knowledge, and more innovative product concepts, production concepts and business models. A more dedicated concept creation phase and justification of concept phase can connect and adapt products, services, and manufacturing concepts more to the industrial company's short-term and long-term business strategy.

However, the Manulab i.5.0 concept must be validated with case studies. Future research should concentrate on elaborate real-life industrial cases, collecting and analyzing qualitative and quantitative data.

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A new Framework for Gaining Emotional Health Knowledge Through Virtual Reality-IoT Technology

Lázaro Ismael Hardy Llins, Gabriel Ronney da Silva, Diego De Castro Rodrigues, Guilherme Agnolin and Marcela Purificação
SESI Innovation Center, Florianópolis, Brazil

lazaro.llins@sesisc.org.br
gabriel.r.silva@sesisc.org.br
diego.c.rodrigues@sesisc.org.br
guilherme-agnolin@sesisc.org.br
marcela-purificacao@sesisc.org.br

Abstract: This work presents a new framework for studying the emotional and physical conditions of workers in Virtual Reality (VR) environments. The framework collects data from simulated virtual environments and helps develop adaptable models for different contexts. It introduces an architecture based on immersion in virtual reality (IVR), focusing on sensory perception, natural actions, narrative engagement, and social features. The author proposes categories to assess the impact of each concept on IVR applications, supported by an artificial intelligence module for data analysis and feedback. The framework also enables the collection of physiological parameters using VR glasses with storage and processing capacity. This facilitates control, performance, and integration with IoT contexts. The primary objective is to identify behavioral patterns for decision-making and employee emotional health management.

Keywords: Knowledge management, Artificial intelligence, Emotional intelligence,Virtual reality,Information management, IoT technology

1. Introduction

The discipline of knowledge management has gained prominence worldwide in recent years. Focused on the business area, it addresses technical concepts about the processes that govern the creation, dissemination, and use of knowledge to meet organizational objectives (Zyngier, S. (2011)). In principle, most organizations face numerous challenges, which limit the efficiency of a knowledge management system, to name a few:

- Not using a significant amount of structured data.
- High complexity of analysis and organization of these data.
- The lack of technological systems capable of extracting and distributing useful information from unstructured content.

Thus, emerging technologies, such as *artificial intelligence*, play an important role in the protection and management of information, breaking down the obstacles that prevent the use of knowledge originating internally in organizations (An, X. and Wang, W. (2010); Albena, A, and Elissaveta, G. (2006).

The human factor is the fundamental slabon in the knowledge management chain and in recent years companies have highly valued their emotional health. Computational emotional intelligence (Sherer, K. R. (2005)) will be useful in all areas of human collaboration with AI, including entertainment, medicine, social work, education, and more. Modern intelligent agents, however, are below the human level in their ability to decide how to behave socially appropriately in a given situation involving others, how to respond to human emotions, or how to guide the climate of interaction with a partner. In order to bridge this gap between natural intelligence and AI, many attempts have been made in recent decades (de Melo, C. M. et al, 2013) to develop a universal approach. Still, a general model of human-compatible socially emotional behavior is needed to guide the design of intelligent agents. Currently, there are two main approaches used in the development of such models. One of them – statistical – relies primarily on deep learning in popular neural network models (e.g., Balan, O. (2019)) and requires large volumes of data annotated for training that are not normally available for high-level real-life moral and ethical decision-making. Therefore, this approach is primarily used for the recognition and expression of emotions (e.g., Reed, R. et al(2019)), rather than for the implementation of emotional intelligence itself.

The use of a virtual reality (VR) test may be a future solution to accurately and sensitively measure emotion regulation in experimental behavioral paradigms with social situations. Virtual reality tasks allow the simulation of naturalistic, multimodal, and complex cognitive challenges that are like real-life situations, maintaining a controlled environment and minimizing confounding variables (Nurn-berger et al., 2011).

VR simulations create a digital psychological sense of being immersed in a synthetic computer-generated virtual world as if it were a real-life place. This evokes a feeling of "being there," or as Witmer and Singer (1998) have defined it, a "sense of presence." As such, these unique immersive characteristics can increase students' affective arousal and boost their cognitive processing (Guan, Wang, Chen, Jin & Hwang, 2021; Parong & Mayer, 2021). Building on VR as a highly emotional and cognitively stimulating learning environment. With the increasing accessibility and representational fidelity of IVR technology, the number of researchers investigating the educational possibilities of IVR technology is increasing dramatically (From, J. et al (2020); Dubovi, I.,(2022)). Armourgun, A. et al (2019) analyze the effect of the cognitive load of train travelers in real-life situations by taking the VR model. Freeman, D. et al, (2019) conduct a review on the potential of VR technology for mental health. Yen, H. E and Chiu, H.-L. (2019) explore the effectiveness of VR exercises in improving cognition in older adults and improving depressive outcomes through a systematic review, meta-analysis, subgroup analysis, and meta-regression. Tawil, N. et al (2021) explore solutions for assessing psychological well-being and mental health in response to interiors presented in virtual reality. Despite the increased interest of researchers in the development of the study of mental health, there are still solutions that can be optimized and challenges to be solved.

Even the knowledge of the authors of this study was not found in the literature, a proposal that considers a management system that allows knowing all levels of detail of the structure of an organization in the area of emotional health or emotional intelligence. The purpose of this work is to create a framework that helps companies identify and manage information associated with emotional health using the integration of virtual reality immersion technologies and artificial intelligence.

2. Methodology

We discuss a new methodology to create a framework that assists in the management of information about the user subjected to a process of emotional analysis. The study was segmented into four areas based on the literature (Won, M et al (2023); Dede(2009)). Figure 1 represents the integration of the active and passive modules that make up the method infrastructure. The following are described as their functions.

The external *social feature* is classified as an active function in relation to the execution models of the proposed framework. The authors highlight a different function to the methods presented in other works (Won, M et al (2023)). Considering the function as a source of acquisition and knowledge management of our method. In this process, three important characteristics were highlighted:

- *Building an emotional questionnaire* is the basic pillar in emotional assessment through questions validated by protocols, instruments, and solid organizations in the area of emotional health studies (Watson, D. et al(1988)). These questionnaires are selected by health professionals for the purpose strongly related to the objectives of using our solution, an example, to help detect possible cases of depression and stress.
- The *Development of interaction environments* aims to construct virtual reality (VR) environments. These environments are created using the concepts discussed in the previous process. Each question of the questionnaire is associated with a virtual location, allowing for the identification and evaluation of emotions.
- *VR/IoT information collection planning*, the data collection process involves gathering information from the questionnaire and capturing all interactions within the virtual reality environment. Additionally, hardware devices are utilized to collect external data, including heartbeats, that are not directly part of the VR environment.

Narrative has two processes:

- *Gamification the* initial step aims to enhance the overall execution of subsequent processes by creating a more enjoyable and engaging experience. Its purpose is to motivate users to participate in all tests and interactions presented in the VR environment and questionnaires, ensuring a smoother and more seamless engagement.
- The *Elaboration of scripts* is aligned with *Gamification* to create a user-friendly VR environment that enhances the overall experience. Regarding the Sensory/Actional/Inner social feature, once the previous steps have been executed, information from the internal VR and physiological environment is collected using IoT devices.

- *VR/IoT information collection*, enables the system to collect the data through the questionnaire carried out in the virtual environment (Tawil, N. et al (2021)) and through the integration of hardware devices are obtained the associated physiological parameters HVR (Morales, J. M. et al (2020)).

The *AI Model* analyzes the collected data and performs various functions during this stage. These functions include data processing to prepare and format the data according to the required standard for the next phase. Additionally, the data is classified based on a pre-trained pattern using machine learning (ML) techniques. Finally, the data is specifically studied to identify any divergent or unique results that may need to be communicated to the registered models within the AI Model. This phase emphasizes the continuous updating of information and transforms the system into an evolving model of knowledge.

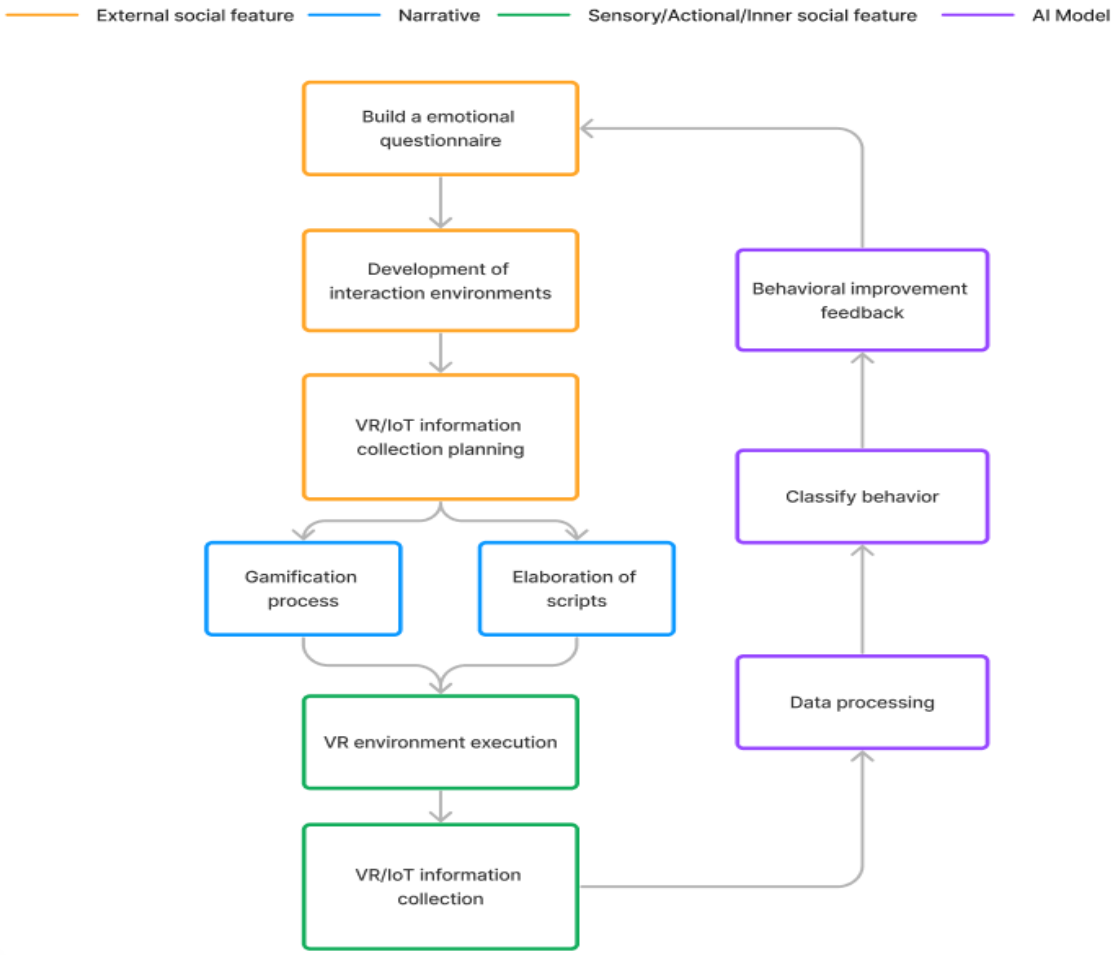


Figure 1: Operational Functions of the Information Technology Model

The *External social feature* consists of three processes, starting with the creation of an emotional questionnaire. This involves using validated emotional assessment questions from reputable instruments and organizations specializing in emotional health studies. Healthcare professionals carefully select these questionnaires to support our solution's objectives, such as detecting potential cases of depression.

The *development of interaction environments* aims to create immersive virtual reality (VR) environments that align with the selected questions from the previous process. For example, if there are ten questions in a questionnaire aimed at assessing depression, an environment is constructed for each question with the specific objective of capturing the essence required by the instrument. This ensures that the VR environments effectively meet the intended purpose.

VR/IoT information collection planning collects the data related to the questionnaire being applied as well as all the interactions with the applied virtual reality environment. In addition, hardware is used to collect data external to the VR environment, such as heart rate.

The narrative has two processes, *Gamification* is the first of them, with the purpose of making the execution of all other processes lighter and more fun as far as possible, motivating the user to perform all the tests and interactions proposed in the VR environment and with the questionnaires in a more fluid way. It follows the process of *Elaboration of scripts*, which aligned with Gamification produces a user-friendly VR environment to be observed.

Sensory/Actional/Inner social feature, with the execution of the previous processes we run the VR environment and collect all information from the internal VR and external IoT environment. The data is processed in the *AI Model*, where we process the data collected in the previous steps and classify the information according to the instruments adopted.

Our framework operates cyclically, meaning that if the results are not deemed acceptable in the initial cycle, we continue to iterate until the solution becomes suitable and aligned with the health instrument being utilized, as well as the aspects of virtual reality (VR) and the Internet of Things (IoT) in the interactive process. This iterative approach allows for continuous improvement and ensures that the framework evolves to meet the desired standards and objectives.

3. Results

Our work aims to achieve a comprehensive framework that facilitates the identification of emotions through the use of standardized emotional health tools. Figure 2 visually depicts the relationship between the operational model and the user. Each component of the framework serves two primary functions: enabling immersive experiences within a virtual reality (VR) environment and gathering physiological parameters through the Internet of Things (IoT). The results of our efforts culminate in a well-defined structure that enhances emotion identification processes.

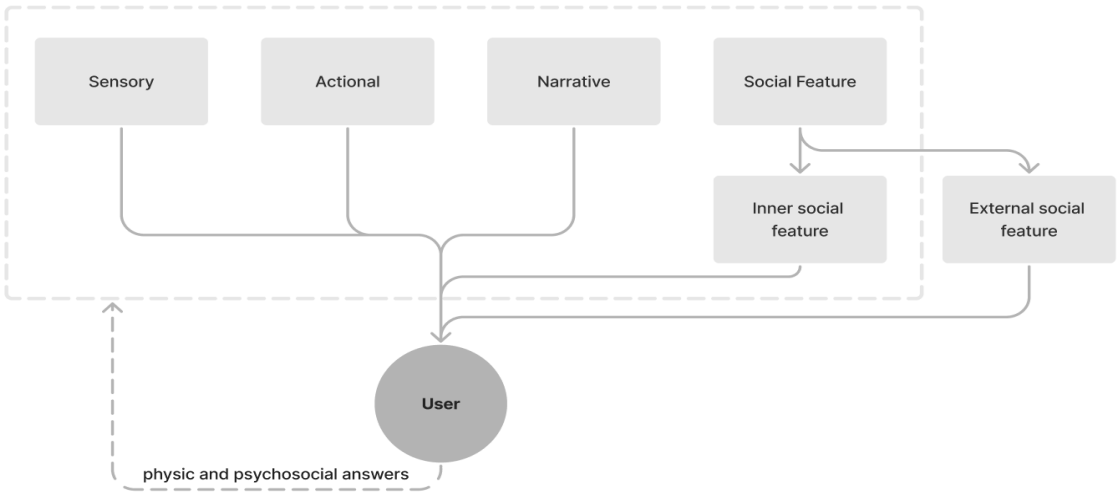


Figure 2: Diagram of the Interaction Between the *Framework and the User*

Immersion in the VR environment

During the immersion process, we begin by utilizing standard questionnaire models recommended by the literature. The user's responses to each scenario are then compared to predefined outcomes facilitated by the AI Model. The Sensory, Actional, and Narrative blocks collaborate with the Inner Social Feature, forming part of the Social Feature layer. This allows for periodic updates to the Social Feature, emphasizing its dynamic nature as the system evolves. The External Social Feature serves as a temporary validation mechanism for the generated information, emphasizing the model's robustness as a fundamental aspect. Consequently, it acquires sufficient data to directly engage with the user and enhance their social well-being.

IoT Technology

In Figure 3, an IoT technology was *designed,* being an extension of the *framework* to monitor the physiological parameters of *HVR.* As the figure shows, the data travels in one direction and is integrated into the overall system solution. The architecture helps to perform measurements through sensors that are connected to a processor to determine the values associated with stress and relaxation before an activity and finally the data is transferred

to a platform that will archive and analyze the data. The correlation of physiological and psychosocial data helps in the identification of the emotional state with greater precision.

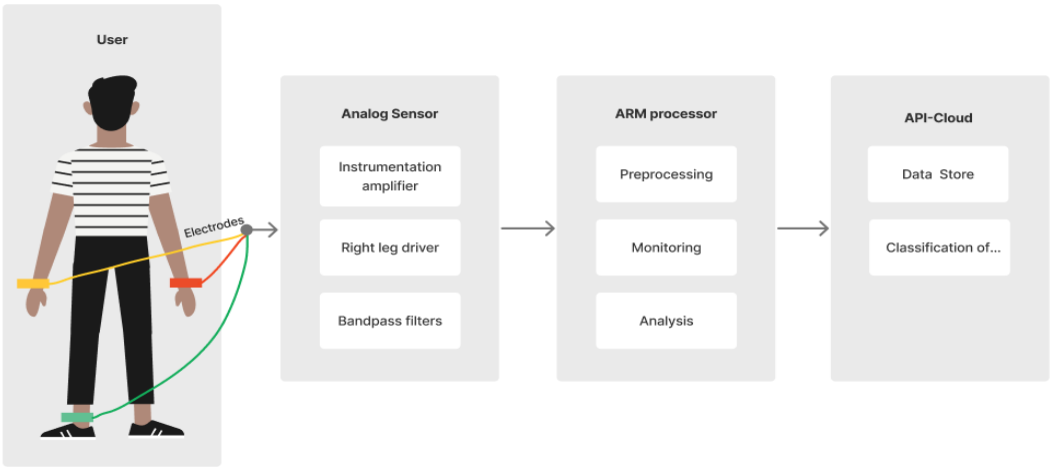


Figure 3: Representation of the IoT Diagram in the Collection of Physiological Parameters

The techniques employed synergistically contribute to the development of a comprehensive solution that encompasses a multidisciplinary evaluation of employees. A manager in a company or industry requires insights into the emotional well-being of their workforce to facilitate effective administrative supervision. Hence, our framework provides a means to acquire knowledge about various emotional aspects of employees, thereby enabling informed decision-making.

4. Conclusion

Our study introduces an innovative and comprehensive framework designed to develop virtual reality environments that assess emotional health characteristics. By combining advanced technologies, including medical instruments and IoT equipment, our framework offers a diverse range of tools to evaluate both external and internal aspects of emotional well-being.

The utilization of interactive virtual environments provides several advantages over traditional methods of assessing emotional health. Through immersive experiences, patients can engage with scenarios that elicit specific emotions, replicating situations relevant to their emotional challenges. This exposure allows patients to confront and address difficult circumstances within safe and controlled settings, offering a unique therapeutic approach for emotional disorders.

The integration of IoT equipment with virtual environments brings further benefits by enabling real-time monitoring of physical and emotional data. Wearable sensors, for instance, can track a patient's heart rate and brain activity during therapy sessions, granting healthcare professionals a comprehensive understanding of the patient's emotional state.

Moreover, our framework can be tailored to individual patients, accommodating their specific needs. Virtual environments can be customized to align with their emotional requirements, providing a personalized therapeutic experience that promotes more effective treatment.

Furthermore, our solution can contribute to the development of knowledge regarding the mental health aspects of employees in industries or companies. This empowers managers with insights to make informed decisions aimed at preserving and preventing issues related to the emotional well-being of their workforce.

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Gamification Influence on the Quality of Employee Knowledge Contributions: Gender Disparity in Service Organizations Post Covid-19

Ikramul Hasan[1], Jannatul Nahin Chandni[2] and Humayra Adiba Sheikh[3]
[1]Dept. of HRM, School of Business and Entrepreneurship, Independent University Bangladesh (IUB), Dhaka, Bangladesh
[2]International Hope School Bangladesh, Dhaka, Bangladesh
[3]Independent University Bangladesh (IUB), Dhaka, Bangladesh

ikramul@iub.edu.bd
ikramul@gmail.com
jannatulnahin19@gmail.com
1720795@iub.edu.bd

Abstract: Covid-19 has emerged with inevitable changes in societies around the world. Organizations face difficulties in both pandemic and post-pandemic situations, engaging people towards producing knowledge to remain competitive. Knowledge is deemed to be a crucial asset for organizations. Quality knowledge contribution among employees can provide a competitive advantage by enabling them to serve their clients in a more advanced and well-organized manner. Despite this, research on knowledge management activities in service organizations in South Asia, specifically in Bangladesh, is limited. This study is motivated to explore the post-pandemic scenario of a developing country based on the service sector. The study aims to understand the relationship between gamification and employee knowledge contribution with a diverse group response highlighting gender aspects in the context of Bangladesh. The study employs a quantitative method, gathering data from various service sector employees through a questionnaire survey. This study develops a research model relating organizational gamification activities (rewardability and competition) and quality knowledge contribution. The results confirm the impact of rewardability and competition on employee quality knowledge contribution, with the multi-group analysis based on gender showing disparities between male and female responses. Male responses found a significant relationship between gamification and quality knowledge contribution with both activities. In contrast, female responses are insignificant considering competition regarding quality knowledge contribution. The study result produces a unique context related to Bangladesh's service sector as the first initiative to the best of our knowledge. The study recommends modifications in service organizations to foster an environment that promotes quality knowledge contribution in day-to-day transactions. It will also enhance issues related to women's empowerment and the quest for new approaches the organization may rethink to remain competitive. Therefore, the study's findings can provide research pleas to the policymakers, academics, and practitioners and will explore diversity in similar economies related to the service sector.

Keywords: Gamification, Knowledge, SEM, Bangladesh

1. Introduction

The pandemic of COVID-19 has altered the manner in which businesses operate, introducing new opportunities and challenges. The pandemic has compelled many companies to modify their business models to survive. With an increased emphasis on innovation and competitiveness, the quality of employee knowledge contributions can assist organizations in generating new ideas, products, and services by leveraging their existing knowledge. By exchanging knowledge and expertise across departments, businesses can accelerate innovation processes and maintain a competitive advantage (Ram et al, 2021).

The post-COVID-19 environment is also linked to the fourth industrial revolution, characterized by rapid technological change, and requires organizations to adapt rapidly to remain relevant. This can result in a more agile and adaptable organization responding more effectively to shifting market conditions (Zieba et al, 2022). According to Riar et al. (2022) collaboration is essential as organizations increasingly rely on cross-functional teams to generate innovation and solve complex problems. Effective knowledge management systems can facilitate collaboration by dismantling silos and enabling employees to share their knowledge and expertise across departments and geographies (Chiu and Lin, 2022). Therefore, by encouraging employees to contribute their knowledge and expertise, organizations can better identify opportunities and develop new products and services to satisfy customers' evolving needs (Nguyen et al, 2022).

Prior research (e.g., Jalili 2020; Deterding et al. 2011; Davenport & Prusak 1998; O'Dell & Grayson 1998) also identified several reasons why employees might not be interested in making quality knowledge contributions,

such as a lack of motivation, engagement, or recognition for their efforts, fear of job loss or competition, or a lack of understanding of the benefits of knowledge sharing for the organization. To surmount these obstacles, organizations are increasingly employing gamification, applying game design principles to non-game contexts to increase engagement and motivation (Deterding et al, 2011). Gamification can be an effective instrument for promoting quality knowledge contributions in organizations, as it provides incentives and rewards for employees who make quality knowledge contributions, along with healthy competition (Hamari et al, 2014).

However, the relationship between gamification and employee quality knowledge contribution is crucial for today's businesses, particularly in the service sector. Service demand is changing, and organizations face a competitive challenge in developing new ideas to meet these demands. Given this context, it would be intriguing to investigate the Bangladesh service industry, as the country's economy is growing in tandem with the shift in consumer preferences.

2. Literature Review and Hypothesis Development

2.1 Quality of Knowledge Contribution

In recent years, organizations have substantially improved how they manage knowledge to help their businesses, but organizations still need to encourage employees to contribute more knowledge (Riar et al, 2022; Suh and Wagner, 2017). Gamification motivates and engages employees directly about their knowledge contribution. Organizations rely on their employees to provide data that can be used to develop in areas where they are deficient and to maintain success in areas where they excel (Bizzi, 2023). Knowledge contribution encompasses a wide range of activities, starting with contributing new ideas, refining old ideas, creating documents, assisting colleagues, and even teamwork (Suh and Wagner, 2017). Knowledge quality is regarded as a greater asset when making decisions than knowledge quantity. Knowledge quality is determined by the extent to which the knowledge is utilized and how it contributes to the organization's growth (Suh and Wagner, 2017). Suh and Wagner also discovered that gamification in the form of reward and competition encourages employees to acquire and contribute more knowledge to the organization (Lier and Breuer, 2020). Therefore, it is expected that the greater the use of gamification techniques in a business, the higher the quality of the knowledge contributed by its employees.

2.2 Gamification

Diverse industries have extensively implemented gamification to increase employee engagement. Gamification is used extensively in businesses to motivate employees because it makes many activities more enjoyable. Nevertheless, gamification needs to be more frequently understood. Gamification does not involve transforming a business or website into a game (Bizzi, 2023). According to Harris and O'Gorman (2014), gamification is "the presence or addition of game-like qualities to anything that is not traditionally considered a game." Gamification is not a game but an activity that employs game design principles (Riar et al, 2022). Gamification is a crucial concept that businesses should be familiar with. According to Harris and O'Gorman (2014), gamification is no longer merely a trendy business term. It has helped companies improve employee engagement, consumer loyalty, and revenue. The advantages of gamification are immense. Riar et al (2022) note that these include making monotonous tasks entertaining, making hard work pleasurable, increasing concentration on the job, enhancing employee contribution, assisting in maintaining motivation and satisfaction, and, most importantly, making employees more active in knowledge contribution. However, because gamification has been misconstrued, many strategies have failed to achieve their objectives. In late 2012, Gartner published a report predicting that, by 2014, the inadequate design would render 80 percent of gamified business strategies obsolete (Harris and O'Gorman 2014). Furthermore, critics have asserted that the increased visibility of employees' activities will create problems, resulting in unproductive employees and harming the organization's reputation (Suh and Wagner, 2017). Therefore, businesses must employ gamification with caution. Gamification implementations are as diverse as the businesses they serve and the business requirements they address (Harris and O'Gorman, 2014). This research paper examines the various approaches of gamification (e.g., rewardabilty, competition) to the service industry to explore the quality knowledge contribution of the employees.

2.2.1 Rewardability

Many gamification approaches focus on the reward system, where employees are given a material or non-material reward after accomplishing a particular task. Suh and Wagner provide one such example of rewardability: contribution of knowledge rewards the employees with points, and after reaching a certain

milestone, they are even given badges or trophies; they can also compete in challenges or set their own goals, which would reward more points (Riar et al., 2022; Suh and Wagner, 2017). Humans love positive feedback, and getting rewarded would encourage them to repeat even the most tedious tasks (Caton and Greenhill, 2014). Social media applications have already jumped in, and their reward systems which are more commonly found in the gaming world has kept more and more user enticed in their applications (Suh and Wagner, 2017). Gamification is tied closely to the reward system. Most computer games challenge players to complex tasks with rewards and penalties; therefore, even after repeated failures, the player stays engaged in the game (Caton and Greenhill, 2014). The quicker the feedback in terms of reward is given, the more focused the user stays on the activity, and this response has improved the hedonic value of performing required activities by quite a lot (Suh and Wagner, 2017). However, ensuring that the rewardability structure is sustainable and that the employees are not only doing the task to achieve rewards is important. Therefore, the study finds:

H1. The rewardabilty practice will increase the willingness of employees' quality knowledge contribution

2.2.2 Competition

Competition adds a new spark to gamification. Like the excitement of jumping to the top of the leaderboard in a game, competition makes employees' jobs more enjoyable. It incentivizes them to work harder to be ahead of their colleagues. Humans always have an innate desire to compete and be recognized for their achievements (Caton and Greenhill, 2014). Competition is, therefore, perfect for satisfying that desire as it helps them to compare their performances with everyone else, keeping them more motivated as they can challenge each other to achieve the best score in any given activity (Riar et al., 2022; Suh and Wagner, 2017). The effect of the competition is seen more in male employees, who are more motivated to stand out from the crowd (Lier and Breuer, 2020). The competition also helps people feel in control and allows them to introduce their ideas while working with others (Suh and Wagner, 2017). Gamification use has been proven beneficial in all workplace settings (Lier and Breuer, 2020). The friendly competition among employees has been successful because it induces teamwork at the end of the day and motivates employees to work positively on the project (Lier and Breuer, 2020). Despite all the positives of competition, this gamification approach must be carefully used. Employee motivation may be negatively affected as the pressure of competition may decrease creativity and limit the employees into a bubble, leading to less creation of new ideas (Suh and Wagner, 2017).

Thus, this study hypothesizes:

H2. The competition will increase the willingness of employees' quality knowledge contributions.

The impact of gender on the connection between gamification and quality knowledge generation is also a topic of debate. Males and females share some social and biological features used to classify gender. According to Hasan et al. (2022) and Kanter (1997), gender diversity in management practice is a demographic issue that is generally recognized. For instance, Hasan and Islam (2022); Eagly and Carli (2003) suggested that male staff members have knowledge sharpness and the ability to logically and analytically reason more than female staff members. On the other hand, female workers are preferable to male workers when establishing connections and maintaining positive relationships. More significantly, men and women behave differently in various social and cultural contexts. Therefore, this study also attempts to observe whether the male and female groups respond differently while considering gamification elements in their quality knowledge contribution.

3. Methodology

As the population of interest, this study concentrates on employees of service organizations, particularly those working in banks, telecom companies, hospitals, etc. This selection is based on the fact that these respondents are the largest contributors to the service sector in Bangladesh and are suitable for the study. Data were collected from respondents at various service organizations using a structured questionnaire. The questionnaire contained a measurement scale for rewardability, competition, and contribution of high-quality knowledge. The survey items were adapted from previous studies by Tang and Zhang (2019); Adornes, and Muniz (2019); Zeng, Tang and Wang (2017); Suh and Wagner (2017), with all items evaluated for internal consistency using Cronbach's alpha on a five-point Likert-type scale. PLS-based SEM was also used in this study. In this investigation, WarpPLS 8.0 was used to analyze the SEM. This study also introduces income and age as control variables to address the diverse thoughts. Questions regarding age and income are resented numbers with intervals.

4. Result

4.1 Sample Characteristics

A total of 170 samples were collected from various service organizations in Bangladesh, with 75 samples being male and 95 being female. The participants were from different age groups, with 28.2% belonging to the age group of 15-25 years, 39.4% falling in the age bracket of 26-35 years, 24.1% belonging to the age group of 36-45 years, and the remaining 8.2% of participants were aged above 46 years. In terms of income, 21.2% of the participants earned between 21000-30000, 23.5% earned between 31000-40000, 21.2% earned between 41000-50000, and the remaining 34.1% earned a salary of 50000 or above per month.

4.2 Validation and Measurement Model

This study confirms both convergent and discriminant validity. The factor loading presented in Table 1 shows adequate convergent validity since the loading range from 0.541 to 0.861, as approved by Hasan et al. (2022). In SEM analysis, latent variables are reliable if their Cronbach alpha is above 0.50. This analysis shows an acceptable range on Cronbach's alpha (0.563–0.592) and composite reliability (0.786–0.781). All variance inflation factors (VIF values) in Table 1 are less than 5, indicating no multicollinearity.

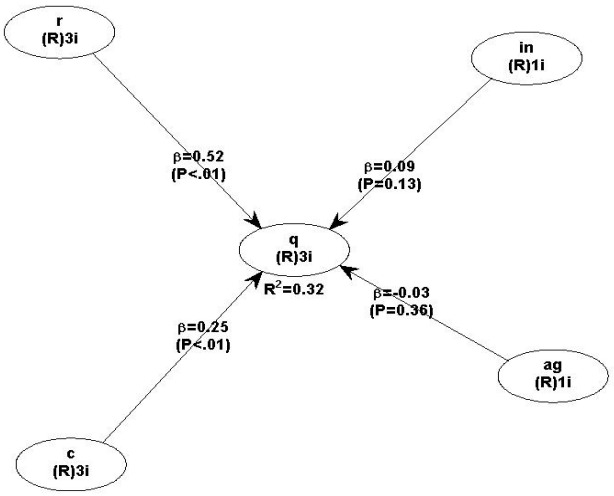
Table 1: Convergent and Discriminant Validity Measures

Latent Variable Items	Loadings	R-squared	Adjusted R-squared	Composite reliability	Cronbach's alpha	Average variances extracted	Full collinearity VIFs
Rewardabilty							
R1	0.800	0.320	0.311	0.774	0.563	0.539	1.313
R2	0.809						
R3	0.569						
Competition							
C1	0.742			0.786	0.592	0.550	1.054
C2	0.752						
C3	0.732						
Quality Knowledge Contribution							
Q1	0.861			0.781	0.576	0.551	1.348
Q2	0.541						
Q3	0.786						

The measurement model of the study also confirms the Discriminant validity as all square roots of average variances extracted in Table 2 are accepted, as Hasan et al. (2021) suggested.

Table 2: Correlations and Square Roots of AVES

	Rewardabilty	Competition	Quality Knowledge Contribution
Rewardabilty	0.734		
Competition	-0.053	0.742	
Quality Knowledge Contribution	0.469	0.17	0.742



Notes: r= Rewardability, c= Competition, q= Quality knowledge contribution, in= Income, ag= Age

Figure 1: Estimated Parameters in the Structural Equation

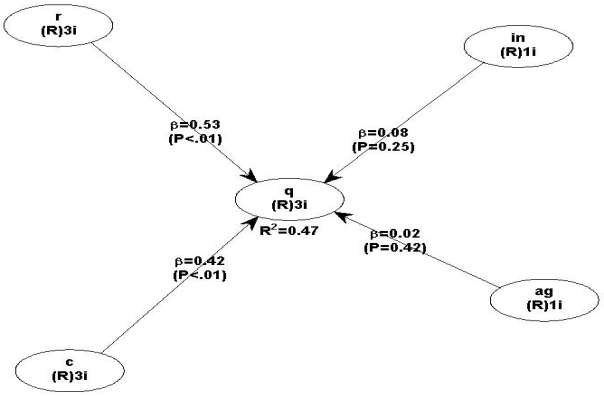


Figure 2: Estimated Parameters in the Structural Equation Model Based on Male Response

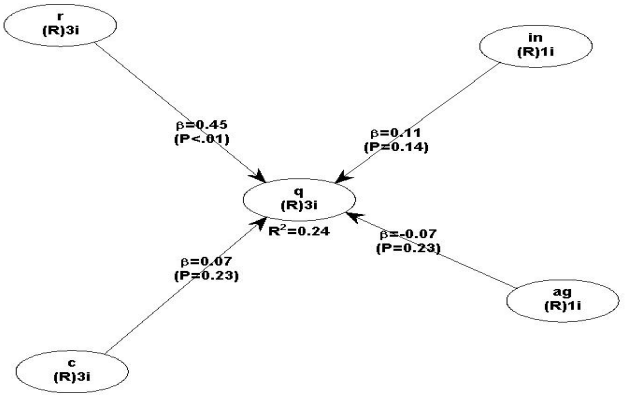


Figure 3: Estimated Parameters in the Structural Equation Model Based on Female Responses

The software utilized in this study measures three fit indices that are significant in variance-based Structural Equation Modeling (SEM) analysis, including average path coefficient (APC), average R-squared (ARS), and average inflation factor of variance (VIF) (Hasan and Islam 2022; Kock, 2011). The values obtained for the three indices are as follows: APC = 0.222, P = 0.011; ARS = 0.321, P < 0.001; and AVIF = 1.039. The results indicate a

good model fit with the data (statistically significant APC and ARS) and low overall collinearity (AVIF < 5) (for other indices, see Table 3).

Table 3: Model fit and Quality Indices

Measurement	Result	Remarks
Average path coefficient (APC)	0.222	P=0.011
Average R-squared (ARS)	0.321	P<0.001
Average adjusted R-squared (AARS)	0.305	P<0.001
Average block VIF (AVIF)	1.039	acceptable if <= 5, ideally <= 3.3
Average full collinearity VIF (AFVIF)	1.306	acceptable if <= 5, ideally <= 3.3
Tenenhaus GoF (GoF)	0.484	small >= 0.1, medium >= 0.25, large >= 0.36
Sympson's paradox ratio (SPR)	0.750	acceptable if >= 0.7, ideally = 1
R-squared contribution ratio (RSCR)	0.992	acceptable if >= 0.9, ideally = 1
Statistical suppression ratio (SSR)	0.750	acceptable if >= 0.7
Nonlinear bivariate causality direction ratio (NLBCDR)	0.875	acceptable if >= 0.7

The SEM analysis results are presented in Figures 1, 2, and 3, respectively, which depict a positive and significant relationship between rewardablity and quality knowledge contribution ($\beta = 0.52$, $P < 0.001$). Thus, we confirm Hypothesis 1, indicating that rewardablity confirms service organizations' quality knowledge contribution (QKC). The competition also impacted QKC positively (confirming Hypothesis 2, $\beta = 0.25$, $P < 0.001$). On the other hand, the study result shows some contrasting results while performing multi-group analysis where both the hypothesis for the male group was found significant with a better projection of H1 ($\beta = 0.53$, $P<0.001$) and H2 ($\beta =0.42$, $P <0.001$), respectively. Where female found H1 ($\beta = 0.45$, $P<0.001$) significant and H2 ($\beta = 0.07$, $P = 0.230$) found insignificant. Additionally, the effect of control variables, including Income ($P > 0.13$), age ($P > 0.36$) all-inclusive, male (Income ($P > 0.25$, age $P > 0.42$), female (Income $P > 0.14$, age $P > 0.23$) were also explained. The summary of the findings is also presented in Table 4.

Table 4: Path Coefficient and Significances

Path	Beta (*p*-value)	Supported or Not
H1: Rewardabilty → Quality Knowledge Contribution	0.52(<0.001)	Yes
H2: Competition → Quality Knowledge Contribution	0.25(<0.001)	Yes
Male Reflection		
H1: Rewardabilty → Quality Knowledge Contribution	0.53(<0.001)	Yes
H2: Competition → Quality Knowledge Contribution	0.42(<0.001)	Yes
Female reflection		
H1: Rewardabilty → Quality Knowledge Contribution	0.45(<0.001)	Yes
H2: Competition → Quality Knowledge Contribution	0.07(0.230)	No

5. Discussion

Gamification creates an environment that may make the work environment more pleasurable and vibrant for employees. Service organizations deem to be innovative for the customer preferences where quality knowledge contribution is fundamental to innovate new services for the customers. Therefore, gaining a competitive advantage and providing innovative service is challenging for organizations where engaging employees in contributing knowledge is a prerequisite. Different studies make various implications and highlight that the gamification approach attracts and engages employees in their work. The current study also finds these facts and wants to share the contemporary practices on post covid-19 to help the service organizations to develop their policies and strategies further to remain competitive in the market.

This study finds some interesting facts with its results exploring gamification in the Bangladesh context. This study explores rewardability and competition as gamification to assure quality knowledge contribution among service organization employees. The result of the study found that both rewardability and competition were related to the quality knowledge contribution behavior of the employees working in various organizations in Bangladesh. The result of the study also complies the prior studies of Riar et al. (2022), Jalili (2020), Suh and Wagner (2017), and Harris and O'Gorman (2014), where gamification is found to be an exciting concept of work which make the organization's monotonous tasks entertaining, making hard work pleasurable, increasing concentration on the job, enhancing employee contribution, assisting in maintaining motivation and satisfaction, and, most importantly, making employees more active in knowledge contribution.

Nevertheless, the study shares different results when comparing gender responses regarding gamification to quality knowledge contribution. Concentrating male group rewards and competition initiating gamification to sharing their knowledge was found significant, whereas, in the female group, it founds that females recognizing completion is a challenging issue in the Bangladesh context and makes insignificant relation to contributing their knowledge. According to Bizzi (2023), rewadabilty opens the opportunity for the employees to be appreciated for their jobs while gaining different points and recognition, which makes the monotonous or boring jobs interesting one where both groups agree to have this gamification mode in their jobs where competition makes different implication from the male and female perspectives. According to Caton and Greenhill (2014), competition sets the leaderboard in a game that excels the competition among colleagues to work harder and wants to be ahead of others. However, it will satisfy the individual's innate desire but create pressure in the jobs to reach this desire. In their study, Lier and Breuer (2020) found that male employees are more motivated to stand out from the crowd. The study results also comply with this fact for males, whereas females are not interested in this pressure game over their regular jobs in day-to-day transactions. Considering this finding, the service sector of Bangladesh is believed to be in quality knowledge contribution to their organizations through gamification. However, they are supposed to be certain of females' empowerment in policy and strategy-making to make the organization even more productive. The study result also could not find the impact of the control variables to share the diverse responses.

5.1 Implications and Future Research Suggestions

The significance of this research can be observed in several ways. Firstly, there need to be more studies on quality knowledge contribution in service organizations in Bangladesh, and this empirical research contributes to the advancement of theoretical knowledge on the subject. Secondly, this study stands out as the first initiative to our knowledge addressing gamification in the Bangladeshi context presenting service sector. The study tests a theoretical model and hypothesizes the relationship between gamification (rewardability and competition) and quality knowledge contribution. The results of this study also provide practical implications for the service organizations in Bangladesh, emphasizing the need to initiate gamification to enhance employee knowledge contribution to remain competitive in the market. Furthermore, Bangladeshi policymakers, academics, and industry experts can use this study's findings and future research to design a workplace practice or strategy that promotes viable quality knowledge contributions for service organizations.

In addition, the present study has identified various opportunities to conduct further research. It will examine the underlying causes for female participation in gamification to assure quality knowledge contribution in the current organizational setting in Bangladesh. Therefore, addressing the study's drawbacks, it would be beneficial to explore how other factors such as engagement, bullying, leadership, and workplace environment may be influential in exploring the knowledge contribution among the service sector employees in Bangladesh.

6. Conclusion

The present research has shed light on various literal constructs to emphasize the significance of quality knowledge contribution in service organizations in Bangladesh. Relating gamification with knowledge exercise is regarded as a crucial resource to enhance organizational performance and remain competitive in the market. Although the competition was found insignificant in knowledge contribution from the female group, it may not suffice to discourage the quality knowledge contribution in organizations. Therefore, to establish a successful practice in service organizations in Bangladesh, it is imperative to consider the overall impact of gamification to maximize its potential impact on employee quality knowledge contribution.

The present study has several limitations worth mentioning. Firstly, the sample size and sampling method employed may not be sufficient to confirm the generalizability of the findings. Secondly, the challenge of obtaining responses also poses limitations to the study. Lastly, it was not feasible to cover all service

organizations in Bangladesh. However, it is worth noting that this methodology is commonly utilized in empirical research (Hasan et al, 2022). Given these limitations, we recommend that future research endeavours consider other factors contributing to quality knowledge exploration in Bangladesh's service and manufacturing organizations.

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The Role of Marketing Knowledge Sharing in Building Organizational Immunity

Tareq Hashem
Marketing Department, Isra University, Amman, Jordan

tareq.hashem@iu.edu.jo

Abstract: This study aimed to assess the impact of sharing marketing knowledge on attaining organizational immunity in Jordanian industrial corporations using a quantitative methodology. Marketing managers from Jordan's 53 industrial corporations made up the study's population. 40 questionnaires were found to be valid for analysis. The following outcomes have been obtained: The sharing of marketing knowledge influences building organizational immunity in Jordanian industrial corporations. The benefit of marketing knowledge sharing on obtaining organizational immunity in Jordanian industrial corporations is linked to marketing managers' academic qualifications. The following are the researcher's recommendations: Creating unique procedures for assessing economic data relating to the company's operations to foresee any future marketing changes. In addition to focusing on educating marketing department employees in the art of gathering information about the external environment regularly, to confront and face any marketing changes that may arise in the surrounding environment.

Keywords: Organizational immunity, Marketing knowledge sharing, Marketing knowledge, Organizational learning, Organizational memory

1. Introduction

Organizations in the twenty-first century face significant quantity and quality challenges, including rapid changes in information and communication technology, global market openness and liberalization, the growing role of the knowledge economy, increased competition, merger movement, and joint ventures between organizations. These difficulties need companies, in general, to adapt to them with a clear vision that allows them to forecast the future, locate and embrace opportunities, and identify and avoid dangers and hazards. From these prospects, the notion of focusing on the knowledge resource of intangible knowledge assets evolved in the late twentieth century as a strategic resource that should be accorded the attention it deserves, no less than its interest in tangible assets(Hoegl et al., 2003).

It is well recognized that information plays a vital role in society, and knowledgeable people are the most valuable assets in businesses. Knowledge management in organizations is connected with several benefits that may help the firm retain its competitive position in today's marketplaces. Information sharing and production are two critical components of knowledge management that play a significant role in generating corporate value. Organizations must successfully develop the knowledge and skills of their personnel in order to attain an adequate degree of knowledge creation and innovation. This approach aims to emphasize the vital role that information exchange plays in a company (Hung et al., 2011).

The company's immune system is comparable to the human body's immune system, indicating the body's capacity to sustain it efficiently. Although its origins and early writings date back to the mid-1990s, this is a crucial problem in today's corporate climate and is rarely discussed theoretically (Ivanov, 2013).

To begin, it is vital to distinguish between an organization's immunity and its immune system. Organizational immunity exists at all times and can be represented in the organization by its people, systems, culture, procedures, policies, and programs that automatically show their impact in emergency incidents in the form of reaction, and organization immunity may be present there; this frequently occurs in developing countries where management is not a study area. Especially crucial, and vice versa, when departments understand the relevance of the immune system and aim to grow it based on scientific rather than arbitrary situations (Neilson et al., 2004). The random act of the immune system's presence makes the work of its immune system a system of action and reaction, which is the worst logic in administrative sciences today, so it is necessary to distinguish between the characteristics of the immune system and then a gap in the characteristics of the immune regulatory system in order to integrate the picture and reach a measure that is concerned with measuring the availability of The components of the system on the one hand and the nature of the work of the system on the other (Smith and Chris, 2013).

The significance of this study stems from the subject of the study, which is a new addition - according to the researcher's knowledge - in the field of knowledge and its participation in the field of industry and its application

in the field of improving the level of organizational immunity in industrial public shareholding companies. Furthermore, this research focuses on one of Jordan's most important economic sectors, the industrial sector.

The researcher believes there is a need to conduct a contemporary study that clarifies this significant concept and tests the degree to which it impacts knowledge sharing because there needs to be more clarity about the application of organizational immunity in industrial public shareholding companies. In light of this, the primary objective of the research was to respond to the following questions:

- What is the extent of Marketing knowledge sharing application in Jordanian industrial corporations?
- What is the level of organizational immunity in Jordanian industrial corporations?
- How does knowledge sharing affect organizational immunity in Jordanian industrial corporations?

The researcher highlighted the importance of Marketing Knowledge Sharing and Organizational Immunity in this study. As well as describing the study's population and sample size. in addition to the primary findings of the analysis and the study's recommendations.

2. Literature Review

2.1 Marketing Knowledge Sharing

Today, knowledge management is a crucial factor in progress and transformation. It's evidence of a dramatic improvement in the efficiency of several establishments. Knowledge management has been shown to have several positive effects on organizations, including higher levels of efficiency and effectiveness, better performance, higher levels of production, and more innovative thinking (Al Duwailah & Hashem, 2019).
Marketing knowledge is defined as market knowledge that is required via knowledge collecting, information transmission, interpretation, and storage in an organization's memory (Hanvanich et al. ,2003)
November (2008) outlined seven sorts of marketing expertise that businesses should be aware of:

1. Consumer knowledge;
2. Product knowledge
3. Competitors' knowledge
4. Understanding of the marketing services offered
5. Knowledge of the company's processes and systems
6. Knowledge of the current themes of interest to the organization.
7. Knowledge of the people with whom the company interacts, both within and outside.

Knowledge sharing describes the sharing of employees' ideas, knowledge, skills, abilities, and competencies with colleagues and group members. This requires a shared culture to entertain employees by providing access to relevant knowledge and using that knowledge to address problems and increase efficiency (Hoegl et al., 2003).

Lin (2007) defines knowledge sharing as "a culture of social interaction, which involves the exchange of employee knowledge, experience and skills through the entire department or organization."

Knowledge sharing refers to providing employees with information, ideas, know-how, and other assistance to perform a specific job or task (Wang et al., 2014; Hashem, 2016)).

Knowledge sharing can happen at the individual level between two employees where they can share their skills, knowledge, and experience to solve different problems and help each other to perform different tasks more quickly and effectively. It can also occur among group members where the knowledge, skills and abilities of one group member can help other group members to perform well to increase the efficiency and overall output of the group (Niqresh et al., 2021). At the organizational level, knowledge sharing is about collecting, arranging, transforming, reusing that knowledge and making it available to others in the organization. Any organization can successfully promote a culture of knowledge sharing by including knowledge sharing in its strategic formation. However, it can also be promoted through encouragement by changing the attitude and motivation that top management provides to its employees for knowledge sharing (Connelly and Kevin Kelloway, 2003; Hashem and Suleiman, 2019).

In their study, Paulin and Suneson (2012) proposed the idea that sharing knowledge increases the rate of customer satisfaction. This means that an organization whose members share their knowledge and experience is usually able to meet its obligations to its customers. This increases the rate of customer satisfaction because it takes less time to provide a service or product.

On the other hand, Paulin and Suneson (2012) said that knowledge sharing has many positive strategic effects on the organization because it helps to identify the basic and important knowledge, experiences, and skills of the organization that must be properly utilized and managed. Organizations can gain access to both explicit and tacit knowledge and cut losses through knowledge exchange.

On the other hand, knowledge sharing is strategically important because it is an effective way to make scarce expertise available to the whole organization through forums, training courses, presentations, research papers, etc..

2.2 Organizational Immunity

Organizational immunity is a company's ability to protect and defend itself, either by preventing or overcoming weaknesses and threats or by removing and avoiding them by preventing their growth or stopping their effects (Simmons, 2013).

Models of systemic immunity vary depending on the researchers, their intellectual mindset, and their practical objectives. Leadership, integration, flexibility, participation, a problem-solving culture, empathy, energy distribution, and learning are the requirements for organizational immunity. According to Simmons (2013), it includes oversight and oversight committees, legal compliance, risk management systems, incentives, and rewards.

Huang (2013) said that it depends on organizational learning, memory, and knowledge, while Brown (1997) said that regulatory genes represent it. DeGeus (1997) returned to its roots, which can be seen in the organizational structure, information flow, power-sharing culture, the right to make decisions, and incentive and reward systems. Due to the differences and similarities in the above, our research was able to identify the dimensions of organizational immunity that came up more often than others because there was some agreement on them:

- Organizational learning:

It simulates the function of thymus cells (T) in the human immune system, which plays a crucial role in protecting humans from viruses, and organizational learning refers to the increased awareness of organizational problems and then recognizing and treating them, which is positively reflected on the performance of the institution and its outputs (Abdul Majeed, 2016). Organizational learning consists of (individual learning, group learning, and learning from others, i.e., competing organizations, and self-learning, i.e. within the organization (Smith and Chris, 2013; Neilson et al., 2004).

- Memory Regulatory:

It mimics the human immune system's Bone Marrow (B) memory cells. These cells can remember human diseases and produce appropriate antibodies to attack them. Organizational memory involves recalling the organization's prior archived knowledge through intelligently stored information and using it in decision-making Current and future building sustainable competitive advantages (Park and Bunn, 2003).
Organizational memory is similar to the human mind, where the organization recalls its past experiences in dealing effectively with current situations and planning for the future in light of previous knowledge (Croasdell, 2001). Intentionally generated by organizational culture, business environment, organizational structure, and external memory, including information about competitors, industry financial reports, and government records

- Regulatory genes:

It mimics the human genes deoxyribonucleic acid (DNA) essential for life. Organizational genes reflect the company's specific fingerprint that makes it different from others, enabling it to adapt aggressively to competition. An organization's DNA is defined by its core values, beliefs, culture, and personality that shape its identity, determine its destiny, and are reflected in its performance and activities in a way that limits or increases its capabilities and effectiveness (Ivanov, 2013).

Organizational DNA consists of the natural genetic imprint that belongs to a specific organization as natural defenses such as competitive position and market share, and the acquired genetic imprint resulting from the organization's disposal of environmental risks after which it recovered, such as immune cells resulting from exposure of a part of the body to environmental influence and was able to recover and became immune from this danger; organizational memory of previous treatments and stored solutions; organizational vaccine where outsourcing is used to deal with threats and risks; Benchmarking when using alternatives that have proven successful with the strongest competitors (Hovivyan, 2006)

According to the above literature review, the following hypotheses are presented:

- There is a high level of applying knowledge sharing in Jordanian industrial corporations
- Jordanian industrial corporations are attempting to improve their organizational immunity.
- The sharing of marketing knowledge influences building organizational immunity in Jordanian industrial corporations.
- Due to marketing managers' academic qualifications, there is a statistical difference in the effect of marketing knowledge sharing on obtaining organizational immunity in Jordanian industrial corporations.

3. Research Methodology

This study relies on the descriptive analytical approach by reviewing the theoretical literature related to the study variables, applying the study tool to collect data, and reaching results that contribute to presenting a set of recommendations.

4. Study Population and Sample

The study population consists of marketing managers in the 53 Jordanian industrial corporations. 40 questionnaires were found to be valid for analysis., representing 75.5 % of the sample size.

5. Data Collection Methods

The study relies on two types of data: primary and secondary data.

The secondary data is represented by previous theoretical and field studies, books and research related to the subject under study.

As for the primary data, it is represented in developing a questionnaire to measure the variables and their dimensions and to study the hypotheses.

6. Demographic Results

Frequency and percentage were calculated for the study sample. Following results (Table 1) are found:.

Table 1: **Descriptive Statistics of Demographics**

		f	%
Gender			
	Female	38	95%
	Male	2	5%
Age			
	Less than 30	12	30%
	40-31	20	50%
	50-41	8	20%
	50+	-	-
Qualifications			
	High school	1	2.5%
	Diploma	1	2.5%
	BA	31	77.5%
	High studies	7	17.5%
Experience			
	Less than 3 years	6	15.0%
	3-5 years	10	25.0%
	6-10 years	10	25.0%
	11-15 years	10	25.0%

		f	%
	16+	4	10.0%

We can see that 95% of the sample is male, and 5% is female. This suggests that Jordanian public shareholding industrial businesses are interested in recruiting guys to the role of marketing manager owing to the substantial loads needed by this job, which are consistent with male talents. 30% of the sample is between the ages of (30-40), and 20% is between the ages of (41-50). This demonstrates employers' desire to hire young people for the post of a marketing manager.

We can see that 5% of the sample has a diploma or less, 77.5% has a bachelor's degree, and 17.5% has a graduate degree. This demonstrates the high academic qualifications of the study sample concerning the tasks and work of the marketing manager position, as well as the public shareholding companies' awareness of the importance of the university degree in enhancing the capabilities of the marketing manager's incumbent to carry out his duties. We also notice that 15% of the sample has less than 3 years of experience, 25% have experience between (3-5), 25% have experience between (6-10) years, 25% have experienced between (11) -15) years and the remainder have more than 15 years of experience. This means that 65% of the sample has less than 10 years of experience. This might be owing to its members' young average age.

7. Reliability and Validity of the Scale

Many marketing arbitrators were given the questionnaire to complete, providing feedback on the scale's apparent validity.

The questionnaire was subjected to a Cronbach's alpha test, and the overall result of was 0.906, which is good because it is higher than the generally recognized value of 0.60. Malhotra (2004)

8. Hypotheses Testing

- There is a high level of applying knowledge sharing in Jordanian industrial corporations (see Table 2)

Table 2: H1 Test

One-Sample Statistics				
	N	Mean	Std. Deviation	Std. Error Mean
MKS	40	3.9225	.70219	.11103

One-Sample Test						
	Test Value = 3					
	t	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
MKS	8.309	39	.000	.92250	.6979	1.1471

Using a one-sample T-test, we find that the result of (t = 8.309) is statistically significant at the 0.05 level, indicating that there is a high level of applying knowledge sharing in Jordanian industrial corporations.

- There is a high level of organizational immunity in Jordanian industrial corporations (see Table 3)

Table 3: H2 Test

One-Sample Statistics				
	N	Mean	Std. Deviation	Std. Error Mean
Immunity	40	3.4050	.84821	.13411

One-Sample Test					
	Test Value = 3				
	t	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference

					Lower	Upper
Immunity	3.020	39	.004	.40500	.1337	.6763

Using a one-sample T-test, we find that the result of (t = 8.309) is statistically significant at the 0.05 level, indicating that Jordanian industrial corporations are attempting to improve their organizational immunity.

- The sharing of marketing knowledge influences building organizational immunity in Jordanian industrial corporations.

Table 4: H3 Test

Model	R	R Square	F	Sig.
1	.686[a]	.471	33.865	.000

Coefficients						
		Unstandardized Coefficients		Standardized Coefficients		
Model		B	Std. Error	Beta	t	Sig.
1	(Constant)	.152	.568		.269	.790
	MKS	.829	.142	.686	5.819	.000

Linear Regression was used to evaluate the hypothesis. Table (4) indicates that the value of F is statistically significant at the (0.01) level . This means that the hypothesis was correct, and that The sharing of marketing knowledge influences building organizational immunity in Jordanian industrial corporations. A correlation value of R=0.686 is considered high.

- There is no statistical difference in the effect of marketing knowledge sharing on obtaining organizational immunity in Jordanian industrial corporations due to marketing managers' academic qualifications.

Table 5: H4 Test

Tests of Between-Subjects Effects					
Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	21.226[a]	19	1.117	3.270	.006
Intercept	1.920	1	1.920	5.620	.028
academic qualifications	1.677	1	1.677	4.908	.039
MKS	14.880	18	.827	2.420	.029
Error	6.833	20	.342		
Total	491.820	40			
Corrected Total	28.059	39			

ANCOVA test is used to test above hypothesis. it is found that F value= 2.42 is significant at 0.05 . that means There is statistical difference in the effect of marketing knowledge sharing on obtaining organizational immunity in Jordanian industrial corporations due to marketing managers' academic qualifications

9. Results and Recommendations:

The purpose of this study was to assess the impact of sharing marketing knowledge on attaining organizational immunity in Jordanian industrial corporations by using a quantitative methodology. Marketing managers from Jordan's 53 industrial corporations made up the study's population. 40 questionnaires were found to be valid for analysis.

The following outcomes have been obtained: There is a high level of applying knowledge sharing in Jordanian industrial corporations This result is consistent with the study of (Connelly and Kevin Kelloway, 2003; Hashem and Suleiman, 2019; Pauline and Sunesson ,2012). Whereas, Jordanian industrial corporations are attempting to improve their organizational immunity. This result is consistent with the study of (Simmons ,2013; Huang ,2013; DeGeus,1997) .

Also, the sharing of marketing knowledge influences building organizational immunity in Jordanian industrial corporations. As well as, there is a statistical difference in the effect of marketing knowledge sharing on obtaining organizational immunity in Jordanian industrial corporations due to marketing managers' academic qualifications.

In light of the results thus far, the researcher suggests:

- The importance of creating unique procedures for assessing economic data relating to the company's operations in order to foresee any future marketing changes that may occur.
- The importance of creating specialized tools for monitoring business-related economic data in order to foresee potential marketing shifts.
- The need to tailor marketing research to the specific demands of a business to ascertain its place in the market and determine its relative strengths and weaknesses to adapt to a changing business climate.
- To cope with and adapt to any changes that may occur in the external environment, it is essential to teach marketing department employees in the art of gathering information about the external environment on a regular basis.
- To monitor potential shifts in client preferences, it's important to provide real-time reports to their profile database.
- In order to manage and deal with fluctuations in sales quantities, the marketing department must be eager to collect information and data about its goods on an ongoing basis.
- We are expanding the research's scope by analyzing its implications in other fields.
- Focusing on educating marketing department employees in the art of gathering information about the external environment on a regular basis, in order to confront and face any marketing changes that may arise in the surrounding environment.

10. Conclusion

In the twenty-first century, organizations face significant quantity and quality challenges, such as the rapid evolution of information and communication technology, the opening and liberalization of global markets, the expanding role of the knowledge economy, increased levels of competition, the movement towards mergers, and the formation of joint ventures between organizations.

Because of these challenges, businesses, in general, have to find a way to adapt to them by developing a clear vision that enables them to see into the future, find and seize opportunities, and recognize and steer clear of any risks and hazards. As a result of these possibilities, in the latter half of the twentieth century, the concept of concentrating on the knowledge resource of intangible knowledge assets emerged as a strategic resource that ought to be afforded the attention it deserves, no less than its interest in physical assets. This idea was developed as a strategic resource that should be accorded the attention it deserves.

Knowledge creation and dissemination are two essential aspects of knowledge management, and businesses should effectively develop their employees' knowledge and capabilities. The method highlights the critical role that the exchange of information plays in an organization. According to this research, marketing knowledge sharing is crucial for boosting organizational immunity.

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CLARK: Building Conversational Intelligence for Knowledge Management in the Space Domain

Marcel Henriquez[1], Paulius Danėnas[2], Darius Dilijonas[2], Jose Ontiveros[3] and Andrew Herd[4]
[1]Red Data, Almere, The Netherlands
[2]Intellerts, Kaunas, Lithuania
[3]Immedia IT Software, Madrid, Spain
[4]ESA - European Space Agency, Noordwijk, The Netherlands

marcel.henriquez@reddata.nl
p.danenas@intellerts.com
d.dilijonas@intellerts.com
jmontiveros@immediait.com
andrew.herd@esa.int

Abstract: This paper presents the case study of the CLARK (*Captured Lessons applied for the Reuse of Knowledge*) project which is an evolution of the Lessons Learned (LL) portal at the European Space Agency (ESA). The SCARLET research activity has been a key for-runner to this project on an academic research level. It has provided us with important insights into the architecture of the system design. A knowledge graph (KG) has been developed to (re)search (for) knowledge from different angles through the established relationships by combining and structuring data from many sources. Additionally, a chatbot is trained to provide a conversational intelligence experience on top of the data provided by the different Knowledge Management (KM) activities at ESA. Hence, CLARK project enables to retrieve, search, or provide knowledge for the employees across ESA through different interfaces connected to the core systems. In this paper, we also report some findings from the initial testing which indicate very promising results in terms of user engagement and usability of CLARK system and the overall approach. The paper also discusses current and future challenges.

Keywords: Conversational intelligence, Chatbot, Knowledge graphs, Natural language querying, Space, Knowledge re-use

1. Introduction

This paper is a case study of the European Space Agency development project to create a major evolution of the existing Lessons Learned capabilities currently in use at the Agency through their existing SharePoint-based webtool. Through considering the application of knowledge graphs and chatbot technologies to achieve this major “next step” in better addressing user needs, it has been possible to realise a radical shift in capabilities offered to users. This adoption of multiple novel technologies has in turn provided a higher level of relevance to user needs and hence benefit regarding user themselves. As a result it is suggested that these capabilities can now be more broadly applied and be available as Knowledge Management activities start to yield real solutions to everyday problems in a way that users want these to be offered and presented. In placing the user front and centre to the proposed solution, CLARK - Captured Lessons Applied for the Reuse of Knowledge, a diverse range of user interface options are being developed to provide knowledge through image and text-based interfaces, including providing interactions between CLARK and the user in a human like, conversational way, through the conversational agent (commonly known as a Chat Bot).

This project is a follow up on the research project SCARLET - Space Conversational Agent for Retrieving

Lessons learned and Expert Training - performed by the team of Strathclyde University led by Massimiliano Vasile (Mihaylov et al. 2022). The research has been done as a joint undertaking with the European Space Agency by Strathclyde University from a perspective “which technologies can be used to create a conversational agent” and “how to prove this technology imparts a higher quality of lesson capture and dissemination”. A minimum viable product has also been built by Strathclyde using static data and tested successfully. The CLARK project uses the experience from the Strathclyde University SCARLET research team to build a production system that collects and processes data continuously, robust enough for ESA engineers.

As to be expected from a large organization like the European Space Agency, particularly one that works on very complex problems and technological solutions, there is a lot of new techniques being generated and knowledge being acquired. Project teams working in the many different Directorates (of which ESA has eleven) focussing on different aspects of space missions are all working hard to get the (large) space programs aims realised (together with the space industry), operationalized and maintained.

For nearly two decades, ESA has had procedures in place to gather Lessons, captured and learned at the Space program level. For the last six years a centralized Lessons Learned (web-based) portal has been implemented that further helps ESA implement its process and to capture the important knowledge in a centralized system and in a common way. The lessons learned portal is the flagship of the knowledge management activities undertaken by ESA to safeguard its internal knowledge. The next step, and the main subject of this paper, is the implementation of CLARK on top of the centralized Lessons Learned repository. The main objective of CLARK is to directly address the identified use cases and user needs in order to allow the ESA workforce to access knowledge through different interfaces and through different approaches.

The technical setup of the CLARK system was configured in such a way to allow it to suit different types of situations users are looking for Knowledge. The simple search, for example, for a user who knows exactly what they are looking for and can find it with just a few keywords. The

Knowledge Graph is provided for the user who is visually inclined and knows how to navigate a number of data streams through their interrelationships (as presented in a knowledge graph). In turn, the chatbot being provided for the users that prefer to "interact" with the system, entering or extracting knowledge in an assisted manner, this particularly applies to the case where the user has an idea what he or she is looking for, but not how to look for it and wants a more "open" search environment.

For the end result of the CLARK project four components had to be developed.

- A data platform capability where data from different sources is held centrally and continuously updated from each source. The sources provide primarily structured data (content). At this point there are 9 sources that provide data to the CLARK data platform. The Lessons Learned portal being the primary source of configured information.
- A Knowledge Graph platform. In the Knowledge Graph platform different relations between the data (given in the graph as unique named nodes) are created and displayed to the user. Examples of a node and their relationships is a person and lessons, technology and a project and so on. This gives the user a possibility to browse through large, interconnected datasets through a completely visual interface where the node relations determine the outcome of the term being searched.
- A chatbot platform. The chatbot interface that is fed by the data platform and the Knowledge Graph platform, provides a conversational assistant to the user for both knowledge capture and retrieval. The chatbot also has a learning loop which allows it to learn from the interactions with ESA workforce. Additionally, the chatbot also has the capability to improve the quality of the capture a new lesson from a user, such as by identifying terms and acronyms not understood (i.e., not available) in the CLARK system.
- User Interfaces. For the user to use these new capabilities, two interfaces (offering the same capabilities) are built, a web interface (for desktop use) and a mobile app interface (for mobile device use). The key here is for the interfaces to be as simple and intuitive as possible, so the user does not have to focus on understanding what the interface does, but rather focussing on which capabilities she / he wants to start utilizing . In addition the user interfaces allow for a simple customisation by the user, to have the interface provide lessons matching the user interests, zas these lessons become available in the lessons learned portal.

2. Related Work

The fields of knowledge management and information processing historically have attracted a lot of attention from the scientific community; therefore, complete discussion of all the work which can be attributed to the success of this work is out of scope. However, there are several subfields which are considered more relevant in this context. Knowledge graph related research is one of these fields; in fact, knowledge graphs (also referred to as semantic networks) have been widely adopted in various domains. National Aeronautics and Space Administration (NASA) has also adopted KG technology for its Science Mission Directorate domains (Timmer et al. 2023); moreover, they have previously adopted it for scientific knowledge storage and organization (Zhang et al. 2020).

One of the most important recent developments in natural language processing (NLP) was the introduction of BERT transformer architecture (Devlin et al. 2018) and its successor RoBERTa (Liu et al. 2019). Transfer learning paradigm enables simplified reuse or adoption of previously pretrained models for different tasks or domains. Hence, these models are often applicable as parts of modern NLP systems, providing contextual embeddings with more relevance for particular domains. Several models exist for space related domains, namely SciBERT

(Beltagy et al. 2019), AstroBERT (Grèzes et al., 2021), SpaceBERT, SpaceRoBERTa and SpaceSciBERT (Berquand et al. 2021). In the context of CLARK project, they might be helpful to improve detection of named entities or concepts, as well as improve support for domain specific language or terminology.

Question answering (QA) is another influential topic; the most recent and well-known applications emerge from large generative language models (LLM), such as GPT-4 (OpenAI 2023), LaMDA (Thoppilan et al. 2022), LlaMA 2 (Touvron et al. 2023), combined with careful prompt engineering. This approach was first verified by creators of GPT-3 model showing that providing several examples can vastly improve generated output quality (Brown et al. 2020). However, although widely developed, such systems still struggle to provide precise answers. To overcome this issue, techniques like prompt chains or direct integration with external data sources or knowledge bases directly is generally considered. (Diefenbach et al. 2017) provide an extensive survey of traditional approaches for QA over knowledge bases; they show that a huge number of issues in question analysis, query construction, disambiguation and general natural language processing could be required to be solved to achieve high quality results.

Finally, natural language querying enables formulating queries in natural language which is more appropriate for human users. This is one of the core problems addressed by CLARK (and particularly chatbot) development. (Affolter et al. 2019) identified four types of NL database interfaces, particularly, keyword-based, pattern-based, parsing-based, grammar-based. Moreover, one can observe emerging trends of neural translation-based systems based on deep-learning approaches. Sequence-to-sequence (seq2seq) architecture, which was introduced for machine translation tasks, is also applicable for SQL-like query language generation (Zhong et al. 2017). (Bazaga et al. 2021) introduce Polyglotter translation approach based on Seq2Seq architecture which can be applied to generate queries for almost any database due to graph abstraction which is used to represent query candidates (in their work, MySQL and Neo4J are used as case studies).

3. The CLARK Approach

3.1 It all Starts with the Data

The primary target of the whole system is to let people learn from the experience(s) of their colleagues within ESA. For this target to be met, and the technology to be enabled, different types of data are required. Such data enables the user to perform contextual search for answers to his questions together with supporting objects or entities. In the context of CLARK, two categories of data are considered. The first category are primarily the lessons from the ESA Lessons Learned portal, associated with relevant documents. These lesson objects also contain information based on experience from all types of people (roles and functions) within the large projects. The second category of data is relevant to provide context in search, such as project list, technology tree and product tree. These all help the system to categorize the results and the user to put the input in perspective.

There are nine different sets of data sources in total which have been imported into the data platform. Some of them provide unstructured (e.g., text content) or partially structured data, hence they are processed using more advanced search technologies (such as Apache SOLR). Additionally, it is enriched with additional metadata to create cohesion between different data sources. As each source has its own schema for enrichment, this step can be performed automatically, resulting in structure within the unstructured data. Additionally, to enable change management (different metadata, change of sources, etc.) data is initially stored in data lake.

3.2 Knowledge Graphs

Knowledge graph (KG) technology enables organizing data as a set of entities and relations between them, thus forming a semantic network, which can be further traversed to mine more complex relationships (including complete hierarchies represented by *isPartOf* or *isParentOf* relations), filter them or visualize in a hierarchical way which is very convenient for such type of data. This inspired us to build a KG-based system based on two core components: a graph database (Neo4J) which stores all the relations and nodes, and a graph visualization component to render to representation of these nodes and their relationships. The core data comes from the data platform (described in Section 3.1), where it is further refined, preprocessed and a set of nodes are formed, together with their interrelations.

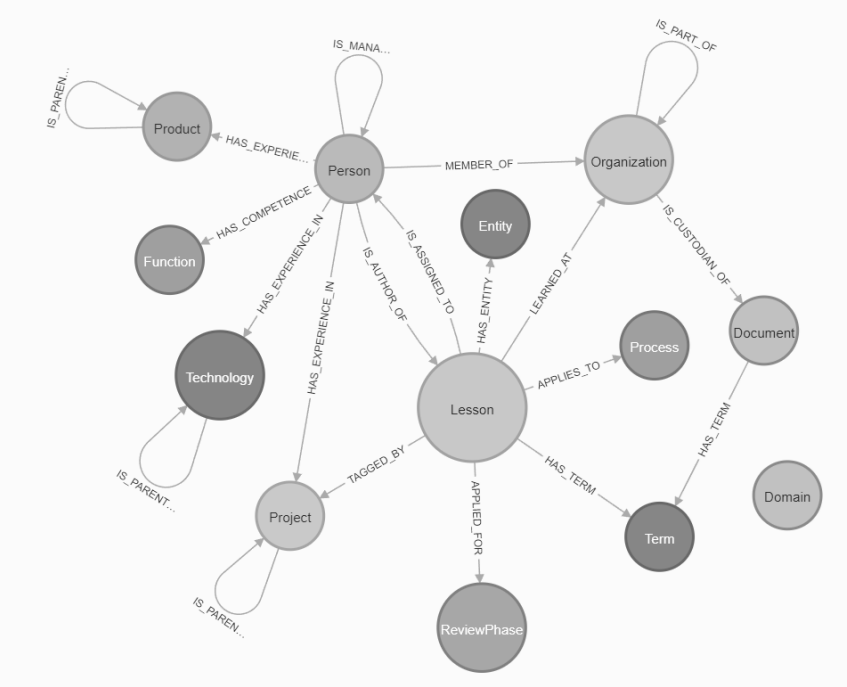


Figure 1: Knowledge Graph Structure

The KG system provides an interactive search tool for the users. This gives the user a possibility to browse through large datasets in a completely visual interface where the relations determine the outcome. Additionally, knowledge graph enables advanced search capabilities which can be employed by the chatbot to generate consistent and domain-focused answers to the system users, such as answering questions *Who is the author of this lesson?* or *List me lessons associated with project Sentinel*.

3.3 Conversational Intelligence with CLARK Chatbot

Arguably, the main and the most complex objective of CLARK project was to create a chatbot that can provide the user with the knowledge he or she is looking for through a conversation. Moreover, this is a domain-specific chatbot which should be capable to provide precise answers as available in the underlying KG database, which makes it more complex compared to recent trend of generative deep learning based chatbot technology (such as GPT) that tend to sometimes provide incorrect answers or even perform so-called “hallucinations”. Therefore, it also addresses several specific challenges as discussed further.

To communicate with the user and successfully assist him, CLARK chatbot implements a certain number of scenarios. They define how the user is expected to interact with the system. Currently, the following scenarios are implemented:

- List objects which can be searched: "Show me employees available in the database”, “Provide me the list of available technologies”
- Find number of objects in the database: "How many lessons learned are available in the database?”
- Find one or more objects by related term: "Show me information about Peter Peterson”, “Give me information related to Sentinel“
- Find objects that are related to other objects by some relation: “Show me people who worked in project Lunar Lander“, “Show me documents containing term flow control”
- Find property of some object: "Find me upper-level products for product Sensors", “Who is the supervisor of Peter Peterson?”
- Help on lessons learned similarity: “What is the similarity between lessons LL-0641 and LL-0650?”
- Submit new lessons learned: “I want to submit new lesson learned”
- Create specific recommendations to the user: “Could you give me some recommendations?”
- Add keywords and narrative to the lesson learned through the chatbot interface in the portal
- Provide help, sample queries and assistance to the user about the use of the chatbot: “How can I discover objects associated with a specific entity?”, “Show me how to search for properties of a specific object”

Additionally, it can provide recommendations for the user:

- Based on common terms from lessons in the previous user learning experience and lessons in the database
- Recommendations related to the working domain of the user
- Based by work of colleagues in the department of the user
- Based on similarity to a particular lesson

Recommendations are created using a specialized interactive menu-like scenario: the user is asked to select a recommendation type and, if required, provide additional input. The chatbot outputs several lessons learned according to the selected criteria. This scenario is illustrated in Figure 2.

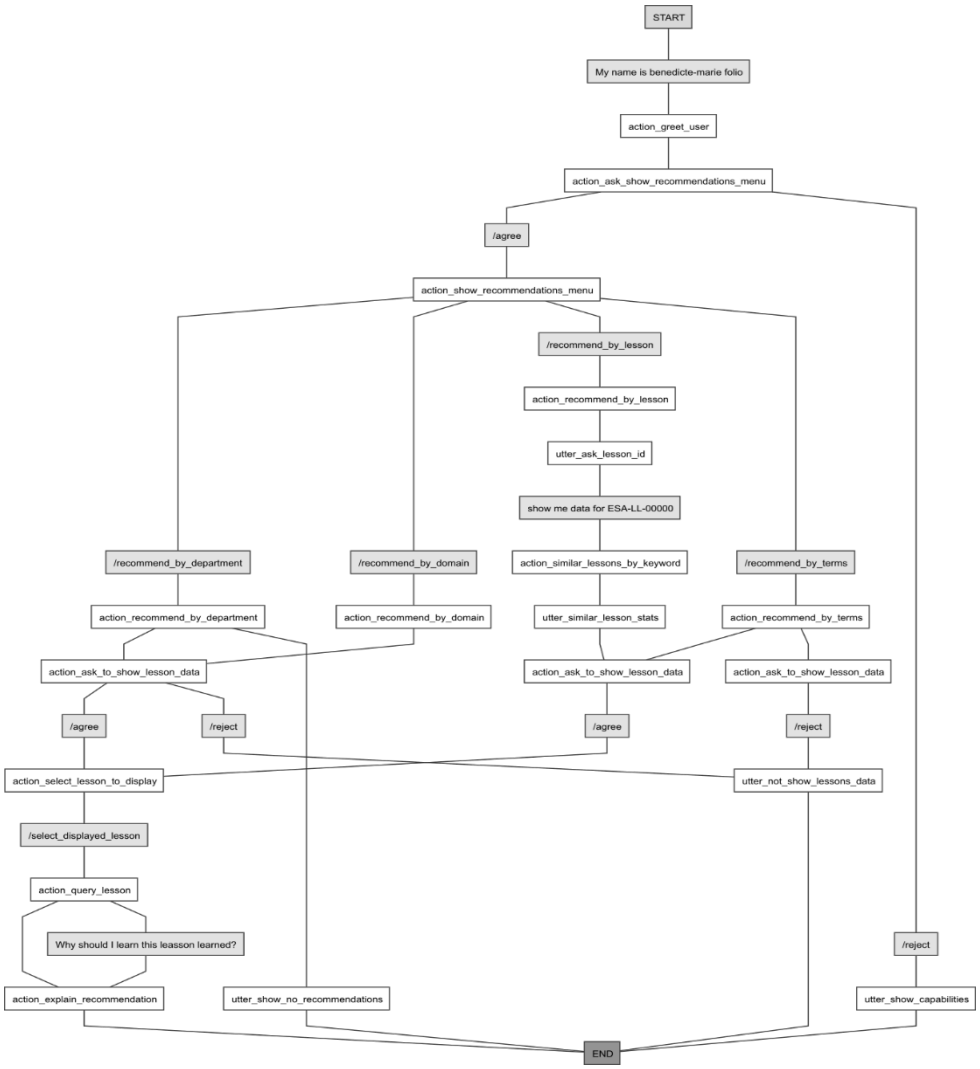


Figure 2: Recommendations Scenario

The final implementation is based on RASA framework which provides its own deep learning-based technology (DIET classifier) for training chatbot models and mapping them with specific knowledge-based actions. Moreover, it is also capable of integrating recent developments in language models, such as transformer models (BERT, RoBERTa) or generative GPT-like models, to provide their contextual embeddings as inputs. However, our experimental testing indicated that application of BERT or GPT-2 did not result in significant performance increase, hence, final model is based on RASA default DIET classifier with advanced processing pipeline setup.

3.4 The Complete View

For the user to use these new capabilities, two interfaces are built. From the usability perspective, interfaces should be as intuitive as possible, so the user does not have to focus on understanding what the interface does, but rather which capabilities are now available and can be used immediately.

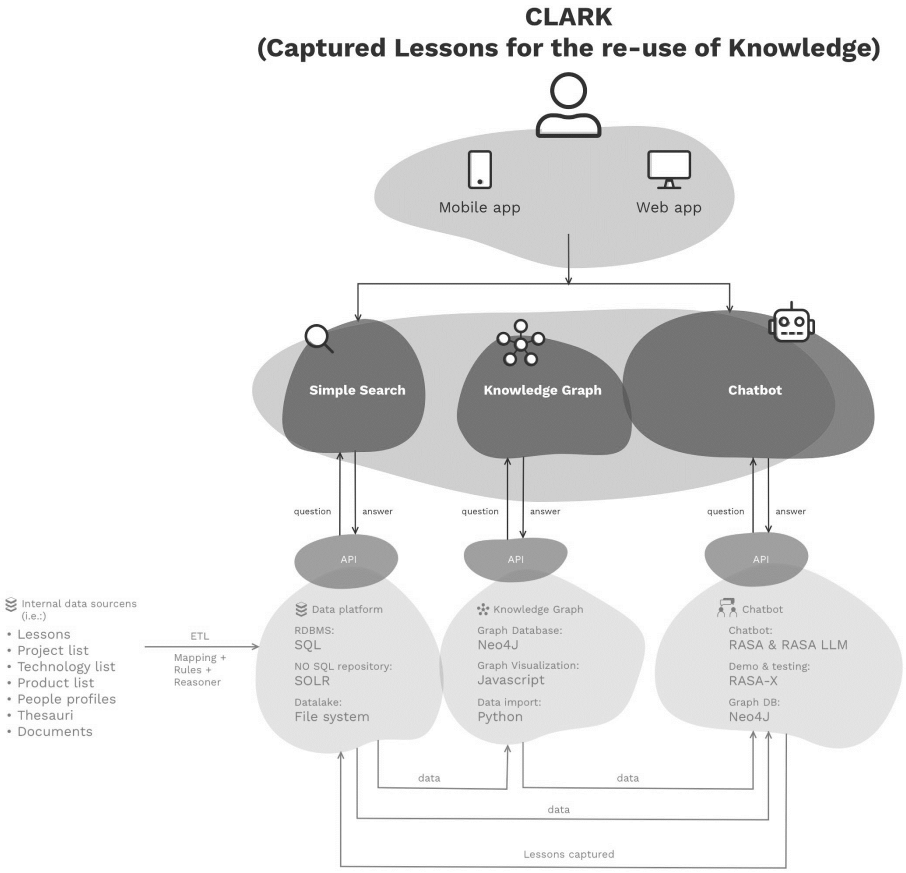


Figure 3: CLARK Architecture

Creating an elaborate system like CLARK does not mean the intended users will automatically start using the system. For the adoption of the CLARK system a webapp and mobile app (both compliant with ESA requirements) have been built. The webapp will by incorporated in the Lessons Learned portal and a mobile app will work only on ESA issued phones to comply to strict ESA security requirements. Both interfaces offer the user the chance to search for knowledge through the three possibilities.

4. Experimental Evaluation

To test the initial system, we ran an internal experimental evaluation at ESA. Eight users were selected to perform initial testing of the chatbot. They were provided with the documentation, including implemented scenarios, sample intents (questions for the chatbot). RASA-X, a visual frontend for conversation-driven development provided by RASA NLU framework, was used for interactive testing. We note that RASA-X does not represent the final user experience and should be viewed only as a temporary means for testing the overall approach; this is different actual usability testing performed for the CLARK webapp and mobile app.

The users were asked to provide their feedback in a free form. In this summary, we omitted feedback which was related to technical limitations which are to be solved after final integration of all components, minor technical inconsistencies (missing text, errors in text display, etc.) or out of scope functionality (mostly user interface related). While we consider them as less relevant at the initial stage, we admit that it could affect their first impression**.** Nevertheless, all these results proved to be beneficial for both the teams of chatbot and webapp/mobile development, as they clearly indicated the expectations from the end users and helped to solve some of them at initial stages of development.

Below we provide a summarized evaluation obtained from the feedback of the testers.

- *User feedback*. The main factors that users observed were related to the inconsistency of the output messages.

- *Conversation*. The overall chat experience seemed to be too formal or constrained for some of the users ("*the conversation had the feeling of being a set of commands input by the user..*"). This is not surprising since this is a chatbot focused on information retrieval, rather than communication; yet it provides hints for the future iterations. However, some of the users emphasized the intuitiveness but emphasized the limited feedback, especially when the chatbot failed to recognize intent and to continue scenario (*"unclear where you were at any on time and what process you were in..", "abrupt endings…"*). Clearly, this not only helped us to solve some unintended issues but provided clearer guidelines to handle such situations as fallback scenarios in the future.
- *Usability*. The feedback in this group is mostly related to the scenario. The key factors that users lacked were loss in conversation, absence of integrated chatbot help and user guidance, confirmation whether the chatbot understood their intents correctly, and inability to reset the chat.
- *Visualization*. This input is more relevant to the mobile app group, as it provided some expectancies for the user interface (bold field names, selection of black/white background, presence of reset section button), content layout or general output of the results.

Some important findings were observed after analyzing the obtained results:

- The feedback from the users who, according to their feedback, seemed to be familiar with the LL portal was more positive. This is not surprising as familiarity with the data present in the portal helped them to understand chatbot capabilities and formulate their requests to the chatbot more clearly.
- The actual expectations of the users were quite different – some of them were satisfied with the overall experience (although they had some comments) while the others seemed to have some skepticism about it. Such satisfiability distribution is not surprising at the initial stages, as it is expected to improve chatbot performance and usability in later iterations.
- From the system engineering viewpoint, the variability of user feedback clearly identified to need for multiple iterations of requirements re-elicitation and refinement, as well as application of agile development while developing conversational intelligence-based systems.

5. Current Challenges and Future Work

The initial testing has already provided us with valuable feedback from the users. However, there are multiple challenges or guidelines to be addressed in the future developments:

- *Integration of large language models (LLM).* LLMs, as the most recent developments in NLP, provide numerous application capabilities in solving various tasks. Despite their widely recognized issues, they can provide quite satisfactory solutions to various problems. In CLARK context, they could be applied as enhancements for multiple tasks, such as correcting mistypes or grammatical errors, improving general text quality, paraphrasing, summarizing text, extracting keywords or named entities, answering answers directly from LL text, and even generating structured representations such as visual diagrams or mind maps from text.
- *Longer chatbot memory context window*. This would enable more natural communication between user and chatbot. For instance, the chatbot could be able to extract various facts and store them in memory, while making use of them if asked. However, it might impose challenges related to advanced natural language processing and dialog management, such as co-reference resolution ("*it*" – which fact would it refer to?), word-sense disambiguation among others.
- *Better and more personalized recommendations for the user*. The user could get more personalized LL recommendations based on his preferences. This might be enabled by setting these preferences directly or by using integrated user feedback mechanisms (such as asking if the user liked this lesson, etc.). This requires the ability to set, store and manage these preferences. Moreover, lesson similarity and matching techniques could be improved as well, using novel semantic matching techniques.
- *(Semi) automated knowledge graph construction*. The knowledge graph could be automatically enriched with entities or relations extracted for LL text; this is also addressed in recent developments in the field of knowledge graph completion.
- *Dynamic alignment to changes in the underlying knowledge graph*. The chatbot should be capable of detecting new node types, entities or relationships. We note that the current implementation is already KG metadata-aware, yet, it still has some limitations, mostly due to restrictions or internal elements which must be excluded during search.

- *More advanced fallback implementation scenarios*. The proper implementation of fallback scenario, albeit seeming to be very simplistic, might not be trivial. Practical realizations may require handling different situations, such as: the text entered by the user, is garbage and should be skipped from further processing; the chatbot does not recognize any relevant entities or intents; handling and incomplete list various undefined exceptions.

6. Conclusion

The complete CLARK system is now in beta and will rapidly advance to production level. There are still a number of hurdles that need to be cleared as part of the planned integrated tests later in the year. An ESA team of testers with different backgrounds have used all three capabilities in their "stand-alone" form with positive and constructive feedback. The next step is to deliver the knowledge graph and Chatbot capabilities integrated in a single user interface and connect all platforms with the final "live" data (production).

The test results up until now are promising which are in line with the initial outcomes of the Strathclyde research that this technological solution (combining knowledge graph and chatbot in a single interface) is a unique and novel means to address user needs for quality knowledge capture and retrieval.. Some rapid progress has been made of the past months to realise this new capability and it should be acknowledged that none of the CLARK components existed 15 months ago when the project first started. Having said that, directly building upon the work of Strathclyde, and with the combination of the skills and capabilities of the knowledge graph and chatbots teams, the development project has been able to make great steps and a production version will be delivered within the next three months and deployed on the ESA corporate infrastructure as a standard capability.

The CLARK development is already creating a wave of interest within the Agency which is undergoing an internal transformation, and it is hoped that others (and other technology developments) can use this new exciting technology to achieve other significant advancements in lessons learned and any other application that might benefit from this capability..

Finally, it can be stated that CLARK basis is robust enough for further development, by extending it with additional entities (or nodes in KG), relations between them, concerning the chatbot – implementing new actions and scenarios. This can be in the form of additional sources and data, creating more context and scenarios. Moreover, as stated in the future work, there are numerous ways to improve it, making it even more accessible and personalized for the end user.

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Threshold Concept for Promoting Business Transformation

Yayoi Hirose
Toyo University, Japan

yayoi.hirose@iniad.org

Abstract: This qualitative study highlights the importance of considering the threshold concept for promoting the business transformation of large-sized enterprises. The wide range of business literature and experts has debated how traditional large-sized companies can transform conventional approaches and mindset to be competitive. For example, many global enterprises now focus on digital transformation (DX), aiming to disrupt their conventional routines and adopt new DX knowledge and approaches. The literature on leadership identifies how a business leader should behave for their staff to transform their conventional approach, including promoting crisis awareness, setting up a clear strategy vision, and creating a DX department. However, without considering how to transform employees' conventional way of thinking at the individual level, a leader's action will be a unilateral announcement, and the company cannot promote company-wide transformation. In order to get a clue for promoting the recent DX of large-sized traditional companies, this study is based on the past successful cases of two Japanese large-sized conservative companies that completed company-wide transformation and improved corporate business performance from financial haemorrhage in just a few years. The study suggests that, in order to promote corporate transformation, company leaders need to consider how their staff members and middle-managers overcome the threshold concept to learn transformative business knowledge at the individual level, instead of simply promoting crisis awareness and presenting a company goal. The study reveals the usefulness of the threshold concept for understanding transformative business knowledge, as it offers the ability to imagine a successful business scene by disrupting the conventional cognitive frame and adopting new values and approaches. The two cases suggest that by imagining a successful business scene, the employees were able to understand their concrete goal, learn transformative business knowledge, make huge efforts to attain their concrete goal, and ultimately improve their business performance. After overcoming the threshold concept, the employees, through a team effort, actively created their own business knowledge for transformation. This study thus suggests that business leaders who aim to promote DX in traditional companies should consider how company staff and middle-managers will be able to overcome the threshold concept for understanding transformative business knowledge.

Keywords: Threshold concept, Leadership, Business transformation, Business knowledge

1. Introduction

Nowadays, many global enterprises aim to implement transformational projects. For example, they focus on how to implement DX systems, as DX is necessary for many enterprises to survive severe global competition (Rogers, 2016; Wade, 2019). They expect DX to transform and deepen their relationship with their stakeholders – such as customers, suppliers, and employees – by leveraging advanced digital technologies, including artificial intelligence and robotics, for their competitive advantage (Wade et al., 2019). In order to promote DX, it is necessary to transform employees' mindsets from a conventional approach, disrupting their conventional way of thinking and creating new business (Rogers, 2016; Wade, 2019). This study aims to discuss the usefulness of threshold concept to transform employees' mindsets from a conventional way of thinking.

In many global companies, the CEO has taken the leadership role in implementing a transformational system. As for DX, the CEO announces a clear strategy vision, which includes the message of why DX is necessary, organizes the DX department, and assigns the chief digital officer (CDO). The DX department is required to frequently communicate with business departments under the CDO's initiative to implement the DX system to transform their conventional operations and practices and launch a new business (Rogers, 2016; Wade et al., 2019). The leadership literature claims that a business leader who aims to transform a conventional organization should enable his/her staff and middle-managers to understand the necessity of disrupting the conventional approach and present them with a new business direction (Heifetz et al., 2009; Rogers, 2016).

However, companies that implement transformative business knowledge – including how to conduct a new strategic vision and make profit through the new projects – have not necessarily successfully transformed their organizations. This means that a business leader needs to consider another factor in order to transform the company. This study emphasizes the overcoming of the threshold concept as a successful factor to understand transformative business knowledge. In order to transform a company, organizational people need to disrupt their conventional ways of thinking and implement a new approach. However, as large-sized firms struggle with bureaucratic structures that sap initiative, they tend to maintain a conventional way of thinking; it is hard for them to understand new transformative business knowledge (Hamel & Zanini, 2018). This study discusses two key questions. First, what are threshold concepts to understand transformative business knowledge?

Second, how can an organizational leader generate new business knowledge by collaborating with various stakeholders through an understanding of the threshold concept?

2. Literature Review

2.1 Leadership for Transformation

Past literature on leadership describes how a business leader should promote transformation. Heifetz et al. (2009) emphasizes that an executive leader should present the threat by continuing conventional business and evaluating challenges for adapting to a new environment. Kotter (1996) identifies the importance of promoting staff's crisis awareness, organizing collaborative teams for transformation, presenting a strategic vision, and encouraging staff initiative. The DX literature claims the importance of clarifying a strategic vision and organizing a new division for transformation (Rogers, 2016; Wade, 2019). Mintzberg (2004) stresses that a leader should first reflect on him/herself and frequently communicate with his/ her front-line staff to take effective action for transformation.

Although this literature on leadership for transformation focuses on how a business leader ought to be and what a business leader should do (Heifetz, 2009; Hughes, 2016; Kotter, 1996; McKnight, 2013; Mitzberg, 2004; Rogers, 2016; Wade, 2019), it does not discuss how employees can transform their way of thinking or how they understand transformative business knowledge to the degree of actualizing the knowledge from an employee perspective. The leadership literature identifies the importance of communication with staff (Mintzberg, 2004), but it does not discuss what a business leader should consider in their communication with staff members to promote their understanding.

2.2 The Threshold Concept

The threshold concept was more developed in the field of school education rather than business solution (Barradell, 2013; Meyer & Land, 2003, 2005, 2006). Past discussion on threshold concepts focuses on how learners understand more complex knowledge that is not accessible to a novice, such as using a statistical lens to understand statistics (Beitelmal, et. al., 2022; Luoma, 2006; Meyer & Land, 2005). The discussion mainly addresses students learning technical, mathematical, and business material rather than learning organizational knowledge generated in a different culture (Bajada &Taylor, 2016; Chrispin, 2016; Hoatly, 2016).

The literature emphasizes that threshold concepts have five characteristics. They are gateway functions that prove troublesome for the learner to integrate with what they already know but, once learned, they are both transformative and irreversible. 'Transformative' refers to a complete and radical change in a learner's understanding, interpretation, and view of a phenomenon, topic, and/or practice (Meyer & Land, 2003; Meyer & Land, 2005). Threshold concepts completely alter the learner's view of the world and their way of thinking and behaving (Meyer & Land, 2005; Trafford, 2008). They change a learner's internal mental structures with respect to the way they perceive and interact with external reality (Yip & Raelin, 2011).

The concept is also irreversible. Once a learner has deeply embedded knowledge into their mindset, it is hard to unlearn because the conceptual framework used to interpret experiences has been reconfigured as a result of a novel integration of new thinking that applies to many phenomena (Davies & Mangan 2007; Meyer & Land, 2005). A threshold concept is also integrative in that it makes sense of and combines past knowledge through a different logic so that a learner can relate factors that have been previously hidden or separated (Meyer & Land, 2005). In this way, a threshold concept can enable learners to grasp and re-interpret the implications of previously tacit assumptions. Davies and Mangan (2007) argue that a threshold concept integrates past dimensions in complex ways by transforming conventional perception so that a learner cannot unlearn. When applying it to transformative business knowledge, it is important for employees to understand the threshold concept, as they are required to deal with tacit assumptions that they have already obtained.

Another characteristic of a threshold concept is that it acts as a gateway. It can be a portal or a step progression that enables a person to understand more complex knowledge that is inaccessible to a novice (Luoma, 2006; Meyer & Land, 2005). For example, Beitelmal, et. al (2022) argues that when a learner aims to understand statistics, he needs to have a statistical lens rather than a mathematical one; otherwise, the statistical concepts will not make sense. When an organizational leader aims to promote a transformational project, he/she needs to consider the gateway function, because they are novices in the field of transformation.

Finally, a threshold concept is troublesome because learners are being offered knowledge but cannot intuitively understand what it means in experience; it feels uncomfortable because it contradicts what they are

familiar with and, at the initial stage, there is no sense of how to relate it to what they do know well (Meyer & Land, 2005; Perkins, 2006). Basically, it looks unfamiliar and alien, generating feelings of anxiety or tension as learners wrestle with the complexity of how to integrate it with knowledge that has worked well for them up until now (Cousins, 2006; McCormick, 2008; Perkins, 1999; Yip & Raelin, 2011). While the previous four points refer to cognitive dimensions, this difficulty is most connected to the emotional dimension of learning. Lucas and Mladenovic (2007) discuss how to make students understand new knowledge in pedagogical practice. They stress that a teacher needs to address the fundamental principles or assumptions for students to transform their conventional framework (Lucasa & Mladenovic, 2007). Students' preconceptions of new knowledge can be a barrier; for example, they tend to avoid understanding statistics because they think they cannot understand mathematics. Therefore, they first feel it to be troublesome before they even reach the gateway for understanding statistical knowledge (Lucas & Mladenovic, 2007). When learners think the concept is troublesome, they present emotions such as fear, concern for rejection, anxiety, tension, resentment, and worry (Lucas & Mladenovic, 2007).

For organizational people, it is troublesome to transform their worldviews by challenging prior knowledge and information, as their organizational cultural context affects the recognition of business knowledge (Carlile, 2004). Nahavandi (2016) claims that a mindset that recognizes and accepts many cultures can be a threshold concept for management and leadership. He identifies the significance of self-assessment, reflection, and experience regarding global diversity to understand their own culture and the diversity of other cultures. However, although recognition of cultural diversity can be an important factor in understanding global management, organizational people will not intend to transform their mindsets to learn a new approach, as it is uncomfortable for the staff who have followed conservative norms and rules, and they do not recognize its necessity and value for improving their organizational performance (Hirose, 2022; Khoja & Maranville, 2010; Todorova & Durisin, 2007). Thus, it is necessary to explore another threshold concept to understand transformative business knowledge.

For employees who have been involved with conventional values and approaches for a long time, understanding the threshold concept can be effective for understanding transformative business knowledge. This is because, in order to promote organizational transformation, the learners (i.e., the employees) need to disrupt their conventional knowledge, completely transform their way of thinking, and create their own new business knowledge that integrates with the knowledge that has worked well for them up until now (Kotter, 1996; Heifetsz, 2009; Wade, 2019). Thus, a business leader needs to provide a gateway function for transformative business knowledge from an employee's perspective.

3. Case Study

This study discusses the threshold concept for Japanese business people to understand transformative business knowledge. In order to promote the recent DX, analysis on the past transformation projects can be helpful because transformation of employees' mindset is one of the most important factors for any types of transformation projects. It examines two traditional companies, Hitachi, Ltd. and Japan Air Lines (JAL), which showed a heavy deficit starting with the Lehman Shock in 2008. Hitachi, Ltd. recorded the largest deficit of Japanese manufacturing companies in 2009, and JAL filed for bankruptcy protection in January 2010. The business leaders of both companies implemented transformation projects and successfully turned business around within a short period (Inamori, 2015; Kawamura, 2015; Koitabashi, 2014). Table 1 summarized the two cases.

Table 1: Transformation of the two Cases

	Number of employees before the transformation	**Year of foundation**	**Circumstances**	**Goal of the transformation project (in terms of employees' mindset)**
Japan Air Line	Around 47,600	1951	Filed for bankruptcy protection in January 2010	Impress the importance of making a profit and customer first principle
Hitachi	Around 330,000	1920	Recorded the largest deficit of Japanese manufacturing companies in 2009	Impress the importance of making a profit for each small unit of business.

The reason this study examines Japanese traditional companies is because the norms and routines of Japanese companies are completely opposite of the direction in which transformation projects develop. Generally, Japanese traditional companies are based on conservative values, and their cultural values do not require clear goal setting which the leadership literature requires (Davis & Ikeno, 2002; Hirose, 2022). Historically, Japanese companies have struggled with disrupting conventional bureaucratic culture in order to be competitive. Business experts refer to *big company disease*: bureaucratic structures do not consider their customers and are unable to create new ideas because they have conventional and fixed ways of thinking (Tateishi, 2008). As Japanese traditional companies have been based on a bureaucratic seniority system, it takes a long time to make a decision, resulting in missed business opportunities (Kawamura, 2015; Parkinson, 1962, Tateishi, 2008; Yutani, 2008).

Although many Japanese business journals and books have criticized Japanese bureaucratic systems, including those of JAL and Hitachi, Ltd., it is hard for organizational people in Japanese companies to understand transformative business knowledge (Kaneko, 2017; Kawamura, 2015; Ogasawara, 2016). Both Hitachi, Ltd. and JAL are said to be successful cases of overcoming big company disease and implementing transformational business knowledge (Kaneko, 2017; Kawamura, 2015). There are various books and documents regarding how Hitachi, Ltd. and JAL successfully transformed, including statements by the CEOs at the time, middle managers, and staff members (Inamori, 2013; Kaneko, 2017; Kawamura, 2015; Shinko, 2020)

Many global enterprises are still struggling with transforming their conventional business thinking. Business departments resist transforming their conventional operations and practices. For example, in many companies, only one or two departments implement a DX system on a trial basis now, and the CEO cannot decide to launch a new DX business at the level of the entire company. Under these circumstances, the companies need an approach that enables the promotion of a transformational project. Such an approach requires organizational people to understand transformative business knowledge.

4. Findings

The cases of Hitachi, Ltd. and JAL suggest that the threshold concept for understanding transformational business knowledge can be the ability to imagine a successful business scene by disrupting the conventional cognitive frame and adopting new values and approaches. Organizational people tend to take actions based on their cognitive frames, which have been collectively generated in their organizations (Kaplan, 2008; Witt, 1998). As a result, in long-established organizations, many employees who have simply followed the conventional approach tend to focus on working based on conventional values (Tateishi, 2008). This is because following conventional norms and operations have made their business successful and their evaluations high. For example, the ex-CEO of JAL, Mr. Inamori (2015, p. 114), described the organizational situation when he became CEO in 2010: 'JAL staff did not recognize that JAL went bankruptcy as the airline continued regular operation even after JAL filed for bankruptcy protection'.

The ex-CEO of Hitachi Ltd., Mr. Kawamura (2015, pp. 89–90), referenced the difficulty of transforming employees' business when their business performance was going well: 'Even if I explain, "Because overseas companies become competitive, we will not be able to compete with them," the employees claim "we should not withdraw from this business because our business go well"'. He suggested that employees had difficulty in imagining the threat of a well-performing mature business being surpassed by new entrants. He stated that this is the most difficult issue when he aims to transform a company (Kawamura, 2015).

Past literature on leadership claims the importance of presenting the threat in continuing conventional business and evaluating challenging spirits for adapting to a new environment (Kotter, 1996; Wade, 2016). However, the two cases suggest that a leader unilaterally promoting crisis awareness does not necessarily mean that the employees can clearly imagine the urgent situation. Kaplan (2008) argues for the process of transforming cognitive frames through collective actions. However, organizational people who are used to conventional frames have a hard time understanding why it is necessary. They cannot understand why they need to disrupt their present approach. If they think they can still be successful using their conventional approach rather than a new one, they will not be able to disrupt the present business approach because they do not understand why they need to disrupt it and because it is stressful for business people to negate a successful way of thinking that had worked up to that point (Heifetz et al., 2009)

Marton et al. (2000) distinguish learning knowledge related to context from surface learning, where external knowledge is simply acquired and memorized, and the capacity to repeat what is known to others. In order to learn knowledge generated from a different value, learners need to understand the meaning of that

knowledge in relation to their context, change their perspective of the world, and, as a result, change or transform the self (Marton et al., 2000). Thus, it is important to argue for the threshold concept, which considers how learners change their view of the world and their way of thinking (Meyer & Land, 2005; Trafford, 2008). Considering this situation, Mr. Inamori (2013) raised the awareness of employees by continuously and directly talking to them about deeply recognizing that JAL went into bankruptcy, reflecting on the reason, and addressing the reform.

The ability to imagine a successful business scene includes entrepreneurial imaginings about the business to be conducted and how to conduct it (Witt, 1998). For example, Mr. Kawamura stated:

> *When I became a president of Hitachi company, I required the business unit leaders to set a benchmark, their competitors and present counteracts to their competitors. That is, they were required to explain their plan regarding how to increase their sales, such as the amount of increase in facility investment. Previously, the only executive management team members explain the company performance. So it was like a somebody's else's problem at that time. After I became a president, they were required to present their future successful business scene based on their concrete business data. Since then, they had a different look in their eyes and some business unit leader asked staff members to check the price of even small equipment. (Kawamura, 2016, pp. 52–53)*

Mr. Inamori also claimed the importance of a concrete goal (Inamori, 2013; Shinko, 2020)

> *Since we belonged to private company, we were required to make decision based on concrete data on our business performance. However, our staff rarely presented concrete data and they just presented very rough figure on our business a few months ago. Furthermore, it was not clear who own responsibility for what business. (Inamori, 2013, pp. 114).*

He also required the employees and middle-managers to have a sense of ownership over their business, set a concrete goal, and make efforts to achieve the goal, no matter how the business environment changed (Inamori, 2013).

These successful cases suggest how organizational members should have a concrete image about their business performance. For successful business, organizational staff need to collectively share entrepreneurial business concepts rather than conventional business procedures and routines (Witt, 1998). Inamori (2012) claimed that JAL needed to change from bureaucratic norms and values to customer-first values and Amoeba management. Inamori created the Amoeba management system, in which small financially independent branches take responsibility for making their business profit. By implementing Amoeba management, the staff clearly imagined their goals and what they should improve in order to successfully achieve this goal (Shinko, 2020).

Through the reforms, JAL's middle managers' eyes sparkled and generated a sense of unity among the staff: 'We should have learned how we should act as a leader for customer-first and profit-oriented business much earlier to prevent JAL's bankruptcy. I would like to transfer this knowledge to my staff' (Inamori, 2013, p. 115).

The two cases illustrate how, when a leader focuses on carefully transferring the transformation's successful business image, the staff will be able to understand the image and take the transformative actions that the leader expects. For example, JAL middle managers collectively and actively created JAL's norms and business approach based on the successful image and shared them among all staff members (Inamori, 2013). The reason that new business knowledge was created was that most of the middle managers clearly understood their goal, so they were able to collectively create an approach for how to achieve this goal. As a result, JAL transformed into a customer-first company and in 2012 recorded a 17% profit ratio, which is miraculously high in the airline industry. Hitachi, Ltd. also achieved a record net profit in 23 years.

Table 2 summarizes the threshold concept for the transformative business knowledge of Hitachi, Ltd. and JAL and the business knowledge for transformation collectively created by employees and middle managers when the companies recovered from huge deficits.

Table 2: Threshold Concept and New Business Knowledge in Japanese Cases

	Transformative business knowledge	**Threshold concept: The ability to imagine a successful business scene**	**New business knowledge collectively created by the middle managers and staff members**
Hitachi, Ltd.	How to conduct a new strategic vision and make profit through the new transformative projects to reach the goal	Understand the goal, a concrete figure of profit at the business unit level	Report on business performance based on the new strategic discipline by each business unit
JAL	How to conduct a new strategic vision and make profit through the new transformative projects to reach the goal	Understand the goal, (1) a concrete figure of profit at the level of small independent branches and (2) customer-first service, which is highly evaluated	The 'JAL philosophy' regarding customer engagement and business strategy

5. Discussion, Conclusion, and Limitation

While past literature on leadership tends to emphasize what actions aa business leader should take, this study presents the importance of considering employees' and middle managers' perspectives in corporate-wide transformative projects. By analysing the two cases of the past transformation project, this study presents the effectiveness of adopting threshold concept for transforming employees' mindset.

The findings show that employees who have belonged to traditional organizations have a hard time understanding transformative business knowledge, as they are used to bureaucratic organizational rules and norms. The threshold concept for business transformation can be the ability to imagine their successful business scene through transformation. By understanding the threshold concept, they become able to collaborate with colleagues who similarly overcame the challenge and thus generate transformative business knowledge that supports their business transformation.

This study highlights the importance of considering the threshold concept in the context of past discussions on business leadership, which emphasize the steps and actions a business leader should take from the viewpoint of a C-level leader. While the past discussions on threshold concept mainly focus on school education, this study contribute to extend the discussion to practical business projects. In order to promote transformation, a business leader needs to consider the individual level of employees and middle managers in overcoming the impediment to understanding transformative business knowledge.

When business leaders aim to promote DX, they need to define a successful business scene more clearly. In the two cases of this study, where the purposes were to recover from the huge deficit, the successful business scene was easy to be imagined for employees based on a concrete profit figure. However, the DX goal can be more conceptual and not simply to achieve short-term profit, as DX strategy is related to company-wide long-term platform strategy (Rogers, 2016). This is the limitation of this study. Thus, further research is expected to clarifying threshold concept for employees' understanding of DX strategy

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Use of Knowledge Management Strategies to Prevent Knowledge Loss in a Government Agency

Ike Hlongwane[1] and Kamogelo Molekwa[2]
[1]The department of Information science, University of South Africa (UNISA), Pretoria, South Africa
[2]City of Tshwane (CoT) Metropolitan municipality, Pretoria, South Africa

Hlongik@unisa.ac.za
Kamogelom@tshwane.gov.za

Abstract: There is increasing evidence that tacit knowledge is "the important strategic resource that assists in accomplishing a task (Woo, 2004)." According to Haughton (2021), Knowledge is a valuable asset, and managing that knowledge is now recognised as a significant contributor to organizations in the current business climate'. When people with expertise leave a job, the organization often loses critical tacit knowledge because the person did not pass it on to others. This knowledge gap can be costly and time-consuming or impossible to replace (Leonard, 2014). However, government institutions and agencies are known to be not good when it comes to knowledge management (KM) implementation and thus often suffer knowledge loss when employees/people with expertise leave a job, retire, or pass away. A qualitative study was conducted in one of the government agencies which has recently embarked on KM initiatives to find out what their strategies and challenges are in preventing knowledge loss. The study used the Knowledge Management Capability Assessment Tool (KM CAT) theory to assess KM initiatives in the agency. The data was collected by purposefully interviewing senior officials/managers in the agency's KM directorate. Despite the results of the study revealing that there are several challenges experienced by the agency in its endeavour to implement an effective and efficient KM process and strategy to help stem the tight against loss of knowledge, there are signs of good improvement. However, the agency needs to be resolute in its adoption of a systematic approach to KM to ensure the full utilisation of the organisation's knowledge base, coupled with the potential of individual skills, competencies, thoughts, innovations, and ideas to create a more efficient and effective organisation.

Keywords: Knowledge management, Tacit and explicit knowledge, Loss of knowledge, Government agency, Knowledge sharing, Knowledge retention

1. Introduction

There is increasing evidence that tacit knowledge is an important strategic resource that assists in accomplishing a task (Woo, Clayton, Johnson, Flores & Ellis, 2004). According to Haughton (2021), knowledge is a valuable asset, and managing that knowledge is now recognized as a significant contributor to organisations in the current business climate. When people with expertise leave a job, the organisation often loses critical tacit knowledge because the person did not pass it on to others. This knowledge gap can be costly and time-consuming or impossible to replace (Leonard & Swap, 2014).

Knowledge is recognised as the most significant asset for those companies that focus on capabilities and intangible resources as tools to compete in the marketplace; however, it is not managed easily (Whelan & Carcary, 2011). The management of knowledge is becoming more important now as most organisational, economic, and social activities are knowledge driven (Muslim, Indra, Lystiardi & Anggiani, 2021). Furthermore, using knowledge resources effectively gives organisations the ability to be innovative, quickly respond to customer demands, and support operational activities (Daghfous, Belkhodja & Angell, 2013). This shows that organisations are realising that knowledge is becoming the most important asset they can leverage to achieve a competitive advantage. Massingham and Massingham (2014) state that companies in the United States invest in knowledge management by spending $73 billion annually on software related to the concept alone; however, they also lose approximately $31.5 billion a year by failing to share knowledge.

As a developing country, South Africa is witnessing fast population growth, which drives up the travel demand. Many of the country's citizens continue to rely on public transport to get to work, school, healthcare, recreation, and tourism sites. To manage an innovative rapid rail transport system in the country, an agency was formed as a public-private partnership (PPP) project to provide a more affordable and accessible transport system to alleviate traffic congestion, while also providing a reliable and quick mode of public transport. In the intervening process, a wealth of skills and technical knowledge, particularly in the management of the protracted design and construction review process and the legal and environmental compliance processes, are organically produced. Therefore, if this tacit knowledge residing in the minds of the organisation's employees is not captured and preserved, it could be easily lost when an employee exits the organisation at the end of the project.

Government institutions and agencies are known to be not good when it comes to knowledge management (KM) implementation and thus often suffer knowledge loss when employees/people with expertise leave a job,

retire, or pass away. A qualitative study was conducted with the objective of providing an overview of the knowledge management processes in one of the government agencies. This would help determine if there are any gaps in the implementation of KM in the organisation. Furthermore, the other objectives of the study were to examine the strategies used to capture tacit knowledge in the agency and the difficulties encountered in the knowledge capturing process, and to suggest effective strategies to prevent tacit knowledge loss in the agency.

The study used the Knowledge Management Capability Assessment Tool (KM CAT) theory to assess KM initiatives in the agency to provide an overview of the KM implementation process in the agency, examine the strategies and difficulties encountered, and suggest effective strategies to deal with the challenges encountered in the agency's KM processes

The data were collected by purposefully interviewing senior officials/managers involved in the agency's KM directorate. A thematic approach was used to analyse the data to obtain the results.

2. An Overview of the Current KM Strategy at the Government Agency

The agency's KM strategy (2016) was firmly established by the South African transport Act, Act 5 of 2006. Section 5 (e) and (f) of the Act requires the agency to establish and operate information and management systems for transport projects in Gauteng province, and liaise and exchange information with institutions, authorities, or professional bodies regarding rail matters in South Africa or in other countries. The agency as part of the Gauteng province is required to support and contribute to the implementation of the Gauteng 25-year Integrated Transport Master Plan (ITMP25). Given the mandate of the agency and public transport development imperatives for the province a KM strategy is critical for the organisation. There have been tremendous efforts put in place on the electronic document control and management particularly during the development phase of the transport projects in Gauteng province.

KM enjoys strategic leadership support in the organisation. KM communication initiatives need to be cognisant of this strength and leverage on the support for maximum benefit. Harvesting knowledge from employees and consultants is critical for the preservation of knowledge and corporate memory, this may be the most difficult yet critical of interventions for the successful implementation of the strategy.

However, the SWOT analysis conducted by the agency in 2015 identified several gaps in the agency that the needed to be addressed by the KM strategy implemented in 2016 which included:

- Loss of institutional memory
- Knowledge not captured during the crucial project stages
- Loss of skills due to retirement or resignation
- Lack of knowledge transfer
- KM not embedded in
- business processes
- Lack of KM resources

The vision for the agency's KM Strategy is to develop agency as a learning organisation with the ability to share and disseminate information to relevant stakeholders. The strategy can be achieved through active participation in the knowledge economy by prioritising; preservation of existing knowledge, sharing of existing knowledge and gathering of external knowledge or information to create new knowledge.

3. Problem Statement

Organisations are increasingly concerned about loss of knowledge due to unprecedented employee turnover. Noting the positive spin-off of KM trends, Lamont (2021) asserts that "at a time in which few organizations have been able to conduct business as usual, knowledge management solutions have sustained momentum and even accelerated their growth. Increased use of collaboration, cloud technology, AI, language processing solutions, and graph databases has all contributed to a robust environment for knowledge management". This shows that the harmful effects of knowledge loss from employee turnover can easily spill into other areas of the business.

In their position paper (2018), Knowledge Management South Africa claims that KM is still a black box in South Africa, understood only by KM practitioners and not valued as a corporate value-add. This is despite the inclusion of KM as a requirement in ISO 9001: 2015, clause 7.1.6, which is a step change towards formalising the discipline in organisations in South Africa. The concern raised by the Knowledge Management South African Position Paper (2018) is that KM in business is often concealed within other disciplines such as research and development, strategy, IT, and human capital (resources).

According to the agency's annual report (2021), the agency experienced a turnover rate of 2%. Although it has been consistently below the industry average norm of 10% in this financial year, this loss of talent equates to a loss of knowledge that could be difficult and costly to replace. This is because the agency operates in an industry where scarce and specialised skills are in great demand and it faces a high risk of knowledge loss which could significantly affect the agency's ability to carry out its mandate.

Through the agency's strategic workforce planning, the agency endeavours to continue to attract, engage, develop, and retain the best calibre talent needed to deliver on the agency's strategic outcomes (Annual Report, 2021). However, it is unclear whether the agency is doing enough to prevent knowledge loss. The risk of knowledge loss can significantly affect the agency's ability to carry out its mandate. This study, therefore, sought to investigate KM practices at one of the government agencies in South Africa to provide new insights into how KM is implemented in public institutions in developing countries. The assessment of challenges experienced by KM officials will be identified for proper remedial action to enable the agency to achieve a competitive edge.

4. Study Objectives

- To provide an overview of the KM implementation process in the government agency
- To examine the strategies used to capture knowledge in the in the government agency
- To examine the challenges encountered in the knowledge capture process in the government agency
- To suggest effective strategies to deal with the challenges encountered in the agency's KM processes

5. Knowledge Management Capability Assessment Tool (KM CAT)

To assess knowledge management maturity in the organisation, the study used the Knowledge Management Capability Assessment Tool (KM CAT). The KM CAT is best suited for reviewing procedures, recognising intellectual assets in an organisation, and developing KM solutions that enhance organisational performance such as improved efficiency, increased productivity, and knowledge retention (Kapofu (2014).

According to APQC (2022) the KM-CAT helps an organisation assess its capabilities and maturity in knowledge management (KM) and focus its KM investments to produce the highest return on value. This assessment maps the current "as-is" state of KM and the knowledge flow processes within an organization to:

- measure the current maturity of the enablers and infrastructures employed,
- evaluate the status of knowledge flow processes and supporting approaches,
- set an objective for the improvement of business processes through the flow of knowledge,
- guide the evolution of organizational change, and
- compare or benchmark with similar efforts of other internal units or external organizations.

The KM CAT is divided into four major sections and each section is also subdivided into subcategories assess as follows:

- Strategy (objectives, business case, and budgets)
- People (resources, governance structure and roles, change management, and communication)
- Process (knowledge flow process, KM approaches, and measurement)
- Content and Information Technology (content management and IT processes and tools)

The focus of the current study was limited to the KM process category. However, the objectives stretch across the subcategories of the four major sections mentioned above. Although this seems like the adaptation of the KM CAT, the results of this study provided a clear sense of strengths, gaps, and opportunities for improvement, as well as appropriate steps to enhance the KM process and strategies in the agency.

6. Literature Review

Knowledge is a key component providing organizations a competitive advantage in the current business environment (Fong & Kwok, 2009; Lin, Lai & Yang, 2016). Arsenijević, Trivan, Podbregar and Šprajc (2017) assert that knowledge is now a key source of wealth for many organisations.

There are various ways of categorising knowledge that exists in an organisation, namely explicit knowledge and tacit knowledge.

Explicit knowledge is tacit knowledge that is codified, documented, and shared, making it readily available to either a single person or a group of people at a minimal cost (Jasimuddin & Zhang, 2014). Some examples of

explicit knowledge are policy manuals, technical documentation, and reference guides (Terzieva & Morabito, 2016).

Tacit knowledge, also known as implicit knowledge, is present in the individual but cannot be expressed easily by the individual in either spoken or written form (Turner, Zimmerman & Allen, 2012).

According to Davenport and Prusak (1998), KM is defined as the process of developing, documenting, and applying knowledge to improve the performance of an institution. However, KM is also seen as an essential process for enterprises to determine where they are going and for organisational survival in the long run, given that knowledge creation is the core competency of any organisation (Leonard-Barton, 1995). The aforementioned definition provided the setting for the paper to discuss the various strategies that can be used to capture tacit knowledge in order to prevent knowledge loss in the organisation.

7. Knowledge Management Processes

Knowledge management is defined as a "process that enables an organisation to improve its performance by enabling learning and innovation whilst solving its problems, acknowledging, and resolving gaps in organisations, and recognising knowledge (comprising people and information) as an organisational asset which has to be managed through enabling policies and institutional tools." (Mavodza & Ngulube, 2012:2).

However, there is no single commonly accepted definition of KM in the literature, consequently, there are various models that can be followed to transform knowledge into a valuable strategic asset for the organisation. The Wiig model consists of four dimensions, namely completeness, connectedness, congruency, and perspective and purpose. The Meyer and Zack model (1996) proposes the following stages for refining knowledge: acquisition, refinement, storage and retrieval, distribution, and presentation or use. The Bukowitz and Williams model (2000) consists of six stages that support the strategy of the organisation. According to the Nonaka and Takeuchi model (1995), knowledge creation is a continuous process that follows four methods in terms of how knowledge is converted. These methods are socialisation, externalisation, combination, and internalisation. The McElroy (1999) model posits that organisational knowledge is held both subjectively in the minds of individuals and groups to produce knowledge and that four high-level processes must be followed, which are individual and group learning, knowledge claim formulation, information acquisition, and knowledge validation.

8. Barriers to Successful KM Implementation

When carrying out KM activities, several barriers or bottlenecks could be encountered. According to Wiig (1995:9), these include knowledge not being managed as a valuable asset; insufficient knowledge at point-of-action; and missed learning opportunities such as situations in which the feedback is not always given by those who performed earlier work, as this eliminates chances for knowledge workers to learn about the implications of their actions. Wiig (1995:12) also argues that "different entities (knowledge workers, departments) possess part of the knowledge required to perform the whole task", which may lead to unnecessary "divided knowledge".

In addition, Trivedi (2007) believes that effective KM can be or is hampered by, among other things, failure to document intellectual capital; the culture of not sharing knowledge in the organisation; obsolete information, which leads to overload if not removed; and rapid changes in technology that pose serious problems, especially in its adaptability and application in KM manipulation processes.

9. Knowledge Management Strategies

Knowledge loss is the result of a more mobile workforce, employees nearing retirement, employee turnover, and disability (Bratianu, 2018; Massingham, 2018). Collective knowledge resides in the minds of the organisation's employees, customers, and vendors. Tacit knowledge is often shared through face-to-face interactions, such as community of practice, storytelling, mentorship, or on-the-job training, which allow individuals to learn through direct observation and experience. Explicit knowledge is knowledge that can be easily documented and shared, such as facts, procedures, and processes. It is often shared through written documents, presentations, and formal training programmes. On the other hand, implicit knowledge is knowledge that is embedded in the practices, processes, and culture of an organisation. It is often difficult to identify and capture, but it can be shared through shared experiences, traditions, and cultural practices.

10. Methodology

To address the main research question, this qualitative study used a case study research design because a case study enabled the researcher to conduct an in-depth study of the KM process in the agency. The case study research design enabled the researcher to explain the complex situations where important factors could be lost or not described completely enough in a generalised method. This study used semi-structured interviews to gain an understanding of how the loss of knowledge (tacit) affected this South African government agency, rather than acquiring a more superficial overview.

The researcher purposefully selected senior management involved in the agency's KM directorate. The interview guide was prepared to help the researcher to comprehensively cover identified topics relevant to the study objectives. Each participant was allocated one and a half hours for the interview.

The interviews were conducted using the Microsoft Teams app, which is a virtual platform the researcher deemed fit to use due to the COVID-19 pandemic. The interviews were recorded with the consent of the participants.

Owing to the semi-structured nature of the interviews, participants were encouraged to elaborate on the subject and provide as much information as they could. Apart from the interviews, internal documents of the agency such as the KM policy and strategy plan were used to achieve data triangulation to enrich the data collected.

The collected data were analysed using ATLAS.ti version 9 according to a thematic approach, in which the data were aligned to the study themes, and a coding procedure was followed.

11. Profile of the Participants

The study initially targeted 10 senior managers in the KM directorate who are actively involved in the agency's KM projects and processes. These included the executive manager of KM, five KM specialist, a senior records officer, a registry officer, a senior manager for reputation, and a senior manager in stakeholder relations. Owing to the COVID-19 pandemic, four employees were unavailable because of ill health and death.

In the end, six senior managers in the KM directorate with the relevant knowledge and experience in KM programmes and processes of the agency were interviewed.

12. Discussion of the Findings

- Overview of the knowledge management implementation process

The study results revealed attempts have been made to develop a KM process that is anchored on four pillars of the KM life cycle, namely knowledge creation, acquisition, storage, sharing and application, and a high level of knowledge culture among employees which is a necessary condition for the development of an effective KM programme in the agency. To expand the potential capability of the current KM system to produce knowledge that can be used for productivity enhancement, a coherent and practical framework for how KM processes should be carried out or managed in the organisation, must be developed.

- Strategies used to capture knowledge in the in the agency

Most participants noted the use of technology to support knowledge initiatives in the agency such as knowledge portals, podcasts, intranet, LinkedIn, case studies, project wikis, corporate blogs, fact sheets, presentation repositories, exit interviews, taxonomies, and more. However, some participants shared that there was a pressing need to find or create new ways of capturing and preserving knowledge amid increasing staff turnover and shrinking budgets. Therefore, the availability of funding for IT infrastructure will encourage employees to use a variety of techniques to share lessons learnt, insights, and experiences to mitigate organisational knowledge loss.

- Challenges in the knowledge capture process

The study revealed that due to budgets cuts, the existing technologies are not sufficient to provide support for processes of acquisition, preservation, and dissemination of knowledge. A lack of trust, rewards and incentives, and little collaboration among employees hampers the organisation's knowledge capture and sharing efforts. Top management needs to intervene decisively, as this situation can result in high employee turnover rates, which can lead to knowledge loss if individuals with decision-making authority continue to exit the organisation.

13. Conclusion

This study showed that despite KM implementation being a black box in South African public and private sectors, there are islands of good practice in the implementation of KM in some government agencies in South Africa. Despite the current challenges experienced by the agency in its endeavour to implement an effective and efficient KM process and strategy to help stem the tight against loss of knowledge, there are signs of good improvement. However, the agency needs to be resolute in its adoption of a systematic approach to KM to ensure the full utilisation of the organisation's knowledge base, coupled with the potential of individual skills, competencies, thoughts, innovations, and ideas to create a more efficient and effective organisation.

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Moneyball of X

Henri Hussinki[1] and Harri Laihonen[2]
[1]LUT University, Business School, Lahti, Finland
[2]University of Eastern Finland, Faculty of Social Sciences and Business Studies, Department of Health and Social Management, Kuopio, Finland

henri.hussinki@lut.fi
harri.laihonen@uef.fi

Abstract: "Moneyball" (Lewis, 2003) is one of the most influential non-fictional books of the 21st century. It is a story of how a financially constrained baseball team, the Oakland Athletics, managed to turn around its fortunes and become competitive by exploiting an inefficient labor market with an extensive use of data analytics. Moneyball has had a great influence on how professional sports teams conduct their operations these days, it has spread from professional sports to several other realms, and its hypothesis has been a subject of academic studies. In the areas of business and economics, Moneyball has become a profound slogan for a firm's data-driven revolution and the resulting new ways of conducting business. However, Michael Lewis, the author of Moneyball, accordingly thinks that the core message of Moneyball has been misinterpreted or misused to some extent (Dubner, 2022). It seems that adopting such a context-specific framework to other realms is neither easy nor simple, as the business logics and extra-organizational contingencies are different. The objective of this study is to better understand how Moneyball has been applied and discussed within academic research literature. This is done by systematically reviewing the Moneyball related literature that has been published in academic journals from 2003 to 2022. For both academic and managerial audiences, this study points out that sustained competitive advantage does not sprout from knowledge resources that are commonly available in the market. This study also serves as a reminder that a contemporary business and management buzzwords, such as Moneyball, Big Data, and Artificial Intelligence, may become elusive and misleading and the related research evidence scattered, if the academic research community cannot find ways to agree upon the definitions of the key concepts.

Keywords: Moneyball, Data analytics, Data-driven culture, Performance management, Literature review

1. Introduction

Moneyball offers a data-driven perspective to firms that may achieve competitive advantage. Firms that follow Moneyball philosophy are typically capable of identifying better data sources than their rivals and/or applying superior methods and models to analyze the data that is commonly available. Moneyball involves identification of new data or new ways of approaching the existing data, development of new insights based on data and rigorous analytics, and ultimately data-driven decision making (Hakes and Sauer, 2006). Moneyball is similar to business analytics that is defined as the extensive use of data acquired from diverse internal and external sources, statistical and quantitative analysis techniques, explanatory and predictive analytics models, and fact-based management to drive decisions and actions to proper stakeholders (Davenport & Harris, 2017; Soltanpoor & Sellis, 2016). However, the difference is that in the original Moneyball case example, competitive advantage was based on commonly available data and the first mover advantage: the Oakland Athletics was able to outperform their rivals by being the first one to identify baseball labor market inefficiencies through baseball match data and back then novel data analytics approaches. The market inefficiencies were caused by the rival teams' misjudgment of some employee attributes and performance statistics that were believed to translate as team performance. For example, batting average and stolen bases were widely seen as among the most important statistics to assess players, but the Oakland Athletics were able to gain competitive advantage by looking at other statistics, such as on-base percentage (OBP, see Lewis, 2003).

In broader business management context, Moneyball can be defined as an extensive use of data-analytics to capitalize new business opportunities and to invent new ways of conducting business. Conversely, the increased use of data-analytics is not Moneyball if it does not lead to the capitalization of new business opportunities or new ways of conducting business. Neither is a new way of doing business Moneyball if it does not involve extensive use of data-analytics. Building on the knowledge-based view of the firm (KBV, see Grant, 1996; Spender, 1996), the benefits gained from the use of commonly available data in competitive markets are mainly short-term information benefits that are quite easily imitated by the rival firms. Commonly available data as such possesses almost zero intrinsic value, but when it is approached in an original way, analyzed rigorously, and its hidden insights are used in decision making, a firm may achieve competitive advantage. KBV posits that knowledge embedded in people is the firm's most important strategic resource, and the firm's task is to combine and coordinate knowledge to create value and sustained competitive advantage (Grant, 1996; Spender, 1996). In the original Moneyball case example the use of commonly available data was not the key to

the Oakland Athletics' competitive advantage, but it was rather the people and knowledge on how to use the data in a way that was never done before: 1) the new General Manager, a context expert, had the vision and courage to make drastic changes to how employee performance was evaluated, 2) the data analytics expert (hired by the new General Manager) had the suitable knowledge to view the baseball data in a new way that produced information on undervalued employee performance statistics, and 3) the data-analytics knowledge and methods that were adopted from other realms proved to work well in the professional sports context. When these three different types of knowledge were combined, refined, and applied, it disrupted the Major League Baseball's labor market.

Moneyball hypothesis has been a subject of several academic studies, such as econometric evaluations (Hakes and Sauer, 2006; 2007). However, according to the author of the original Moneyball book, Michael Lewis, most of the Moneyball applications fail at their attempts to adopt the Moneyball philosophy to new realms, as they try "to make some boring business much more entertaining to yourself than it actually is." (Dubner, 2022) The objective of this study is to review the academic Moneyball literature to understand whether and to what extent the original idea of Moneyball has been correctly applied. By doing that, we show the merits of the extensive use of data-analytics in transforming how business and operations are conducted and discuss why firms need also other knowledge-related resources than data to gain sustained competitive advantage.

2. Methodology

Literature for this study were searched on January 30th, 2023, from citation and abstract databases Scopus and Web of Science Core Collection. A single keyword "moneyball" was used and the search was targeted to document titles, abstracts, and keywords, and limited to journal articles. The search in Scopus yielded 57 document results while the search in Web of Science returned 65 document results – altogether 122 results. The citations and abstracts were then exported to a reference management service RefWorks. In RefWorks, the 122 returned documents were checked for duplicates, which reduced the number of potentially relevant documents to 88.

In the next step, the full texts of the 88 remaining documents were searched and downloaded. Full texts of 8 documents were not found, which reduced the number of potentially relevant documents to 80. Full texts of the remaining documents revealed that 19 documents were not academic journal articles, which reduced the document count to 61. Finally, out of 61 remaining documents, 24 were successful interpretations of the Moneyball philosophy, while 37 were lacking some aspects of Moneyball. We will discuss both categories in the results section.

3. Results

We analyzed 61 academic journal articles that were based, to a varying extent, on the Moneyball philosophy. Our objective was to find out whether the various academic Moneyball studies were really about Moneyball or something else. To determine whether a study was regarded as a successful interpretation of Moneyball, we utilized the following qualification criteria:

- In the original baseball context: Moneyball is a combination of extensive use of data analytics and exploitation of an inefficient labor market.
- In a broader management context: Moneyball refers to an extensive use of data-analytics to capitalize new business opportunities and to invent new ways to conduct business.

By utilizing these definitions as qualification criteria, we identified 24 "Moneyball studies" and 37 "non-Moneyball studies". In the next sub-sections, we will describe our findings regarding these categories.

3.1 Moneyball Studies

Our analysis suggests that there were 24 such studies within the reviewed literature, which have successfully adapted or adopted the Moneyball philosophy. These studies fall into three subsets regarding their contexts: professional baseball (the original context), other sports, and non-sport realms.

3.1.1 Baseball context

Plethora of other Moneyball studies have been conducted in its original context, the MLB's inefficient labor market. In one of the most influential academic Moneyball studies, Hakes and Sauer (2006) focus on a case of mispricing in the MLB labor market: the hitters' (baseball player position) salaries in the change of the millennium did not accurately reflect how different batting skills contributed to winning games, which allowed

one team, the Oakland Athletics, to gain sustained competitive advantage over their rivals. The competitive advantage evaporated many years later, as the other teams were able to close this knowledge gap. The same authors published another study a year later where they conducted a more refined analysis which suggested that this pricing anomaly existed well before the MLB's "Moneyball period" and that the post-Moneyball market correction persisted (Hakes and Sauer, 2007).

Deli (2013) addresses the limitations of the earlier Moneyball studies and demonstrates how a methodological choice may improve understanding of the relative importance of the key predictors of baseball team performance. Brown et al. (2017) provides updated evidence that the post-Moneyball correction has persisted: the study demonstrates this persistence by showing that the OBP salary premium has risen for the class of baseball players known as "free agents" (i.e., players whose contracts have expired). With the expiration of their contracts, free agents are, in theory, involved in actively marketing their services to all MLB teams. Also, Congdon-Hohman and Lanning (2018) assess whether a broad range of production indicators (i.e., aggregate or rate statistics) translate into better salaries in the MLB's free agency market and find that the Moneyball's production indicators have accurately predicted the salaries in the 2000s. Conversely, Gin (2018) shows that the increasing reliance on the lower-paid baseball players has not translated as salary increase for the lower paid players. Interestingly, the analysis shows that the salary share for lower-paid players has even decreased in the Moneyball era. Holmes et al. (2018) builds upon Hakes and Sauer (2006; 2007), refines their earlier models, and finds new insights based on cleaner dataset: they find that the labor market for hitters/batters in baseball was efficient both before and after the appearance of Moneyball, thus providing new type of evidence. Pinheiro and Szymanski (2022) arrive to the same conclusion about the efficient labor market for batters before and after the publication of Moneyball.

Moreover, Duquette et al. (2019) seeks to test the analytics underlying Moneyball by modelling MLB teams' regular-season won-loss records over a long period (45 full seasons) and confirm the hypothesis of the significance of the previously overlooked predictors of team performance. They also find that some of these aspects are still undervalued by MLB teams in terms of the player-payrolls. With a slightly different focus, Caporale and Collier (2013) approach the Moneyball subject through the efficiency of the player draft in professional sports by evaluating a key implication of the Moneyball hypothesis, the superiority of college baseball players over high school players, which does not receive empirical backing. Finally, Abisaid and Cassidy (2017) investigate whether journalists have adopted sabermetrics, the use of advanced baseball statistics for making player projections and objectively measuring player performance, in their reporting of MLB stories since the print and theatrical release of Moneyball. They conclude that despite the increase of Moneyball statistics reporting, the traditional baseball statistics still dominate the reporting.

3.1.2 Other sports

Moneyball has been adopted in other sports contexts, and association football is clearly the second most popular context for Moneyball studies. For instance, Gerrard (2007) evaluates the transferability of Moneyball philosophy to professional association football context and finds that there are technological, conceptual, and cultural barriers that make in rather difficult. Weimar and Wicker (2017) study whether certain association football players' skills are undervalued, and they find that the labor market undervalues the player's running distance. However, McHale and Relton (2018) find in their study that the amount of running is not positively related to team success. Gavião et al. (2020) develops a Moneyball model that is applied to evaluate the efficiency of association football player market, whereas Aydemir et al. (2021) provides a generic framework for estimating player performance and performing player-fit-to-criteria assessment, under different objectives, for left and right backs (association football player positions) from competitions worldwide. In addition, Zaytseva and Shaposhnikov (2022) conclude that there is a Moneyball effect in professional association football: defensive actions contribute positively to the team's winning probability, but they are undervalued by the player market. Lastly, McHale and Holmes (2023) utilize advanced player rating systems to develop models for estimating the transfer fees of professional associate football players.

Stewart et al. (2007) apply Moneyball approach to study elite Australian Football. They use regression models to identify and quantify the relationship between important player statistics and match outcomes, suggesting that the Moneyball approach can be adopted to other team sport contexts, too. Millington and Millington (2015) argue that Moneyball is part of a highly important trend in sports: the utilization and impact of Big Data. Lastly, Plant and Stowe (2019) study horse racing and find an undervalued predictor of a racehorse's late racing development and a measure that is valued by the auction market but predicts only early racing development (not career earnings).

3.1.3 Non-sport realms

Based on the reviewed literature, researchers have struggled to successfully adopt Moneyball to other realms than professional sports. There are, though, three instances where it seems to have worked. First, McHugh (2009) analyzes the applicability of the Moneyball book in management education. The study concludes that Moneyball is a useful complementary resource "to a traditional textbook when addressing topics such as organizational change and innovation, leadership, recruiting and selection, performance management, employee development, and negotiations" (McHugh, 2009, p. 219). Second, Mauboussin (2012) arguments for the applicability of Moneyball in various other realms but highlights that using the right statistics is prerequisite to compete and identifying and exploiting them before rivals do will be the key to seizing competitive advantage. Third, from the medicine industry's point of view, Gayvert et al. (2016) proposes a model for clinical trials that goes beyond the drug-likeness methods that consider only the chemical properties of a molecule by including previously overlooked features related to the properties of the drug's target.

3.2 Non-Moneyball Studies

37 of the reviewed articles did not qualify as successful applications of the Moneyball philosophy. These studies can be assigned to the following categories based on what they lacked: lack of data-analytics insight, and lack of new ways of conducting business.

3.2.1 Lack of data-analytics insight

As stated earlier in this study, Moneyball involves extensive use of data-analytics. However, it seems that a large proportion of the extant research that claims to be Moneyball has overlooked the role of extensive use of data-analytics. From the viewpoint of non-Moneyball studies in the sports context, Mason and Foster (2007) discuss the potential of applying Moneyball in a professional ice hockey league (National Hockey League). They highlight several issues that my hinder a widespread adoption of the Moneyball practices, but do not go as far as demonstrating how Moneyball would change the business operations of the National Hockey League teams. Moreover, Hughes et al. (2012) lists skill requirements for association football players, including seven different playing positions, but does not describe the data related to these "KPIs" and whether they statistically matter for team performance outcomes. Regan (2012) analyzes how different payroll efficiency strategies affect the baseball teams' average game attendance but does not explain how extensive use of data analytics is linked to payroll efficiency. Elitzur (2018) analyzes the temporary and longer-term competitive advantage gained from establishing an analytics department within a baseball club, thus oversimplifying the Moneyball philosophy just as the existence of analytics department in a baseball club. Cassilo and Sanderson (2017) finds that media reports about analytics as the opposite of the conventional operational practices in the National Football League (American football) but does not explain how the National Football League teams could benefit from using data analytics. Wang and Cotton (2018) examine how strategic and support teams' experience is related to MLB team performance, and highlights the roles of social capital and human resource management. However, the study does not fully grasp the original idea of Moneyball. Kovalchik and Reid (2019) present a framework for sports-academia collaboration but does not present evidence of how it actually works. Roach (2022) study the impact of organizational decision-makers' career concerns on their spending in the baseball player market and find that underperforming expectations decreases spending on signing bonuses. The role of an extensive use of data analytics is, however, very small.

In non-sports contexts, Wolfe et al. (2006) suggest that data has become a cornerstone of effective human capital management and therefore this should reflect also as changing competence requirements for human resource professionals. However, they do not show evidence of how extensive use of data-analytics improves the human resource operations. Wolfe et al. (2007) investigate the applicability of Moneyball in other realms outside baseball and conclude that the analytics-based performance assessment approaches might not be useful in those organizations with relatively low interdependence, but some of the Moneyball lessons, for instance, managing radical organizational change can be generalizable in broader context. In addition, Cullen (2009) takes 8 lessons learned from Moneyball to propose improvements for correctional agencies' operations. However, the study makes a comparison between Moneyball and evidence-based management, which are two quite different things. Antoun's (2011) essay on the shifting forms of competition and changing political and cultural economies explains why poor teams and cities need to figure out something new to stay competitive. However, the connection to Moneyball philosophy is quite minimal. Evans (2011) suggests that Moneyball can and should be adopted in the healthcare sector to decrease the money spent on hospital readmissions, but the study does not provide any empirical backing for this idea. Kelly's (2011; 2013) anthropology studies refer to Moneyball but only as a generic metaphor for change. Cohan (2012) suggests

that science would benefit from utilization of advanced analytics methods, but there is no evidence of how these ideas work in practice.

Vito and Vito (2013) study the views of police managers on the applicability of Moneyball in policing. The findings suggest that statistical analyses are a promising lever to steer operations, to challenge the status quo, and to enable doing more with less. However, the elaboration on the use of data-analytics remains rather anecdotal. Butterworth (2014) tells a story about Nate Silver, who was able to predict the outcome of the 2012 US presidential election. Butterworth's essay describes Nate Silver's background, which involves some baseball analyst experience, but otherwise the study has nothing to do with Moneyball. Furthermore, Coe and Best (2014) proposes a model for the American Dental Association membership renewal but does not really show how the model improves the membership renewal in practice. Kaiser and Pratt (2016) uses data-analytics to show that pre-PhD publication activity predicts the researcher's career publication activity. However, the novelty of this finding is questionable, as publication productivity is a commonly utilized criterion in academic recruiting.

Valerdi (2017) applies Moneyball to software project context and elaborates how it might help software teams to operate more efficiently and effectively through untapping their hidden value. However, the discussion remains on a rather hypothetical level. Norton et al. (2018) assess the extent of the marginal future payments for hospital payments but refers to Moneyball only in the introduction. Harewood (2019) tries to adopt the Moneyball philosophy to healthcare context, but the study focuses on basic data-analytics and established performance measures. Houck (2019) uses Moneyball metaphor to lay foundations to improve the performance of public forensic service providers but gives no empirical evidence. Howard and Mayes (2020) relate the employee credentials to their performance, with Moneyball mentioned only as a keyword. Szymanski (2020) connects dots between alchemy and sport analytics as they are both characterized by opacity and secrecy: evidence of success is limited according to the scientific criteria. Liu (2021) illustrates how social limits prevent mispriced human resources from being arbitraged away sooner, with implications for engaging cognitive diversity that go beyond sports. Mori et al. (2022) finds similarities between the sport and pharmaceutical industry: quantitative modelling could be useful for a broad set of stakeholders in the drug development technology ecosystem.

3.2.2 Lack of new ways of conducting business

Some of the non-Moneyball studies seemed to lack the insight of new ways of conducting business or operations. For instance, Tingling et al. (2011) study the National Hockey League player draft and find that earlier choice leads to better outcomes, but the effect becomes insignificant after the first 100 selections. However, this is common knowledge in the National Hockey League and based on talent scarcity. Bonomo et al. (2014) provides evidence that algorithms can be used to optimize management of a fantasy football team. Kringstad and Olsen (2016) study the effect of budgeted revenues to sporting outcomes, which is not a new way to analyze the input-output paradigm in professional sports. Kryscynski et al. (2018) study the individual level analytical abilities of HR professionals to their job performance, which is not related to Moneyball philosophy. Soland (2014) connect dots between Moneyball and predictive analytics in education — schools' use of early warning systems to predict student dropouts. While this is an important research topic, its connection to Moneyball is rather vague. Ehrlich et al. (2021) mentions Moneyball but does not provide any definition or base its analysis on the Moneyball philosophy. Finally, Simmons (2022) recaps the influence of Moneyball on the rise of sports analytics on the input–output (pay-performance) relationship.

4. Discussion and Conclusion

The objective of this study was to review the academic Moneyball literature to understand whether and to what extent the original idea of Moneyball has been correctly applied. We find that Hakes and Sauer (2006¸2007) have had a great influence on the Moneyball studies conducted in the original baseball context. Some of the follow-up studies (e.g., Brown et al., 2017) confirm the inefficient labor market of the MLB and thus are aligned with Hakes and Sauer's findings, while some other studies that utilize refined models and more (detailed) data show evidence of an efficient labor market (e.g., Holmes et al., 2018). Therefore, the research output is far from conclusive on the Moneyball's mispricing hypothesis, which could be partially explained by Deli's (2013) suggestion of the effect of the methodological choices on the research output. Those studies that point out to the post-Moneyball correction of the Major League Baseball labor market (e.g., Hakes and Sauer, 2007; Brown et al., 2017) receive backing from the KBV (e.g., Grant, 1996; Spender, 1996): when the key resources are commonly available (baseball match data) or easily transferred between firms

(baseball data analyst leaves the organization and is employed by a rival), a firm cannot gain a sustained competitive advantage with those resources. In order to attain sustained competitive advantage, a firm should be dynamic in its data analytics by utilizing new and better data sources, combining new and existing data, renewing the data analytics skills and methods (e.g., machine learning), and developing new "research questions" to set objectives for data analytics.

Regarding the successful Moneyball adoptions in other sports contexts, it seems that association football (soccer) has been the most fertile soil for the Moneyball philosophy (e.g., McHale and Holmes, 2023). However, "flow team sports" such as association football are quite challenging contexts for Moneyball, as they are characterized with high interdependence between players, and it is difficult to isolate a single player's effect on team performance. In non-sports contexts, we find that successful adoption of such a context-specific philosophy has been rare.

From the non-Moneyball findings, we can conclude that Moneyball as a concept has been used liberally. In some instances, it means just the existence of analytics department in organization (Elitzur, 2018), figuring out something new (Antoun, 2011), or just a metaphor to describe the increased opportunities related to data utilization (e.g., Vito and Vito, 2013). Some studies argue that Moneyball could be a good option to change how things are done in some contexts (e.g., Valerdi, 2017) but they do not provide evidence on how the extensive use of data-analytics provides benefits in practice.

All in all, those studies that have stayed true to the original idea of the Moneyball philosophy have been done in the baseball context or other sports context. At the other end of the spectrum, there are studies that have used Moneyball only as a metaphor without contributing to the Moneyball literature.

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Identification of Knowledge Workers and Analysis of Methods for Managing their Competencies in Baltic Sea Region Enterprises

Michał Igielski
Gdynia Maritime University, Poland

m.igielski@wznj.umg.edu.pl

Abstract: This article is a continuation of the 2017 research process on the identification of key employees in the companies participating in the research process. Now the main objective of the research is to identify knowledge workers and analyze the methods of managing the competencies of this group of employees in the studied companies. Of course, at the outset, the author attempted to identify knowledge workers and described their main competencies . In the following part of the article, the author tried to evaluate the measures taken by companies to optimally manage and use this capital to build a competitive advantage. These objectives determined the further course and nature of the research - the author used the following set of research methods: an analysis of the literature on the subject, a comparison of defined concepts and an interview with executives of the surveyed companies. The survey was conducted in 2021 in 100 randomly selected large companies based in the Baltic Sea Region (BSR) - a total of 261 people participated in the study. As literature analysis and empirical studies show, the degree of utilization of knowledge workers' potential is at different levels - there is a distance between developing countries and the richest and most developed countries. This is all the more surprising because company executives are aware of the importance of this capital to the future of their organizations. They also know what barriers they would have to overcome to better manage it. Therefore, according to the author of the article, it is necessary to remove all barriers that prevent the optimal use of the potential of this group of employees. For the organization, this will mean greater efficiency, greater innovation and flexibility in adapting to change. And for employees, intelligently organized work will be easier, more useful, more satisfying and meet a wider range of needs.

Keywords: Knowledge workers, Key competence, Human capital management

1. Introduction

One of the most important metatrends accompanying the evolution of our civilization is the continuous increase in the overall mass of information in human society. It is the result of a feedback loop between our cognitive activity and our ability to influence reality. Wider knowledge increases the scope of our ability to shape reality. How does this affect economic processes? We are seeing the development of the concept of the personnel function towards the study of the growing role of knowledge at work, knowledge management and intellectual capital. Organizational managers are realizing that in such economic conditions, the proper use of the competencies of identified knowledge workers will increase the chance of success in the market.

Changes and accompanying turbulence in the modern economy have led companies to modify the rules of building competitive advantage on the market. This resulted in the necessity to introduce changes in the approach to management. The era in which we live is completely different from the previous ones. Now, the main form of economic activity (social activity too) is the creation and transfer of information and services. All this, combined with new management models and a higher pace of work and life, makes it necessary for entrepreneurs to focus on competences that are important for the type of work. Flexibility, mobility and adaptability to changing conditions are becoming increasingly important. Nowadays, many enterprises need developed interpersonal skills and practical competences.

This means that globalisation, technological innovations and the rapid growth of knowledge and information have forced changes in the structure of employment and a change in the approach to competences that are needed to perform a specific job. In today's world without knowledge we will not build an optimal model of competition and we will not be able to manage the enterprise. It is human capital that has become the most valuable resource in an enterprise. It is the only capital that can obtain, collect and select the necessary information. It has the knowledge that we use to make decisions and solve problems at every level of management.

The purpose of the article is to identify knowledge workers and analyze the methods of managing the competencies of this group of employees in the surveyed companies. In addition, the author presented basic issues in the context of knowledge workers, their competencies and methods of managing them - based on the analysis of the literature and the research process.

2. Method and Description of the Research

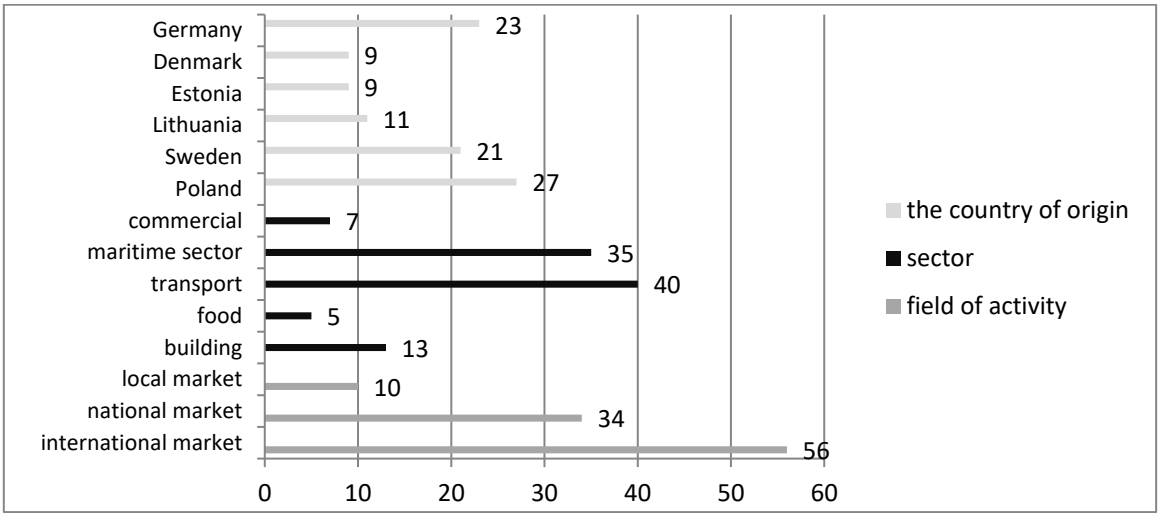
This survey is a continuation of the 2018 survey on the identification of key employees in companies. Now the main objective of the research is to identify knowledge workers and analyze the methods of managing the competencies of this group of employees in the studied companies. The author used 3 research methods: analysis of the literature on the subject - systematization of the language of terms; comparison - the author wanted to indicate characteristic features and defined terms; structured interview with senior managers in the surveyed entities.

The survey was conducted in 2021 in 100 randomly selected large enterprises with the seat in the BSR) - a total of 261 people took part in the survey. At the stage of planning the research process, the author intended to apply a targeted and random selection of the sample on the basis of information on enterprises in this sector contained in statistical data for the BSR. Unfortunately, the author did not have such large resources and he adopted the principle of selection on the basis of his own declaration of participation (questions were sent to 250 entities whether they are interested in participating in such an undertaking). Unfortunately, the research sample does not have the characteristics of the whole group for this region - the presented research results are not a complete set. It is the basis for extending the research process to the whole BSR in the future - for the time being it is a pilot study.

The author used the method of individual interview. A paper questionnaire was a research tool. The selection for the sample was purposeful on the basis of the following criteria: the status of a large company, having its registered office in the BSR, having a Human Resources (HR) department. The HR department was to help the author to obtain information about employees who can meet the criteria of belonging to the group of "knowledge employees".

Why did the author choose the method of individual interview? He believes that it is the managers who have the greatest knowledge of the nature of the work of their employees in each position. The basic technique of researching the methods of managing the competences of key employees may be an interview. Other techniques provide partial data that are less reliable.

The respondents were managers due to their daily contact with employees. Calculations and statistical analyses of empirical material, which was collected in the research process, were made using the Statistica statistical program and Microsoft Excel spreadsheet. The author used the following structure indicators and descriptive statistics: average, median, standard deviation, quartile range, measures of Spearman's rank correlation. They allowed to determine which of the surveyed phenomena are the most important in the opinion of respondents and what the diversity of their opinions looked like. They were also used to measure the interdependence between particular features of the variables.



Source: Own study.

Figure 1: Characteristics of Companies That Participated in the Research Process

The author could not find companies from other BSR countries, i.e. Russia, Finland and Latvia, to participate in the research (Russia was not considered from the beginning). Unfortunately, none of the companies from these

countries wanted to participate in the research. Therefore, the larger group of companies is from Poland, Germany and Sweden. As we can also see, more than half of the companies operate on the international market, in the transport and maritime sectors.

3. The Essence of Knowledge Workers

However, before we begin to discuss and consider increasing the productivity of today's knowledge workers, it is important to define what productivity and knowledge workers themselves actually are. It was P. Drucker who first described the knowledge worker in a meaningful way in his 1959 book Landmarks of Tomorrow, and in 1969 he posited that the productivity of knowledge work would be the great management challenge of this century, just as the productivity of manual labor was the great management challenge of the previous century. Continuing his reflections, in 1997 he went even further in, paying special attention to knowledge workers themselves by claiming that the productivity of knowledge and knowledge workers will not be the only source of competitive advantage in the global economy. Obviously, it will be a decisive factor, at least for most industries in developed countries. Therefore, the question arises: why is knowledge worker productivity such a significant challenge and who are knowledge workers?

A knowledge-based economy must create new organizations, hitherto unheard of, in which the essential ingredient for success is the worker. The new enterprise models are the people with personalized knowledge who make optimal use of other resources. They occupy a central place in their organization, they constitute its competitive advantage - they are its driving force.

Knowledge itself is a body of knowledge acquired through learning, a body of information in some field, knowledge of something or awareness of something (Dubisz 2003). From the point of view of a modern enterprise, knowledge is an economic good that can be privately owned and, as a commodity, can be traded on the market. In this case, knowledge is treated as an asset of the enterprise (Lobesko 2004). But looking from a human perspective, it is a key internal capital of each of us, each employee.

Returning to employees, however, the focus on people with high professional potential increased significantly as early as the late 1990s in the United States, where the talent search began to notice and focus on additional employee attributes, which included, first and foremost: distinctive abilities in a particular field - called specific; elevated intellectual potential; originality; openness to ambiguity; risk-taking; commitment to work; internal discipline; diligence.

Thus, if we associate a category of workers with knowledge, we are already dealing with a group of so-called knowledge workers, who, according to T. H. Devenport (2007), have a high degree of specialized education or experience, and the work they do requires the creation, distribution and use of knowledge. They earn their living by thinking, their working tool is the mind, and any effort involved in their profession is intellectual, not physical.

In a similar vein about knowledge workers is expressed by F. Horibe (1999), who believes that it is a worker who uses his mind in creating new value, through innovative ideas, analysis, evaluation, synthesis and design. This is confirmed by the theory of C. Winslow and W. Bramer (1994), which states that a knowledge worker interprets and uses information to create and deliver new value and validate information. On the other hand, M. Morawski (2009) in the layered management model presented categorizes employees according to their importance and value to the company, listing the following categories of knowledge workers: key employee, knowledge process manager, mature specialist, promising talent. Equally interestingly, knowledge workers are characterized by A.K. Koźminski (2004), stating that they are people with: personal intellectual capital (experiences, thoughts, intellectual prowess), personal social capital (acquaintances, contacts, social position), documented qualifications and achievements, and a stable financial situation (an indicator of independence and the value of their services).

Knowledge workers can be found in almost all organizations in developed economies, regardless of the type of business. It is difficult to determine exactly what percentage of the total workforce is made up of knowledge workers, as we do not have a one-size-fits-all definition at the global level - this issue will be discussed further in the next subsection. Arguably, the majority of knowledge workers can be located in organizations engaged in new or advanced technologies, among those in the professions of doctors of certain specialties, scientists, engineers, among professions requiring creativity, non-standard thinking and innovation, as well as among those in certain managerial positions.

The main dilemma, however, remains how to define workers who are not knowledge workers. This issue raises a lot of controversy, because since the productivity of knowledge workers is to constitute the competitive advantage of enterprises in the modern economy, it is necessary to correctly identify the specific characteristics of both the object of their work (knowledge work) and a certain set of characteristics and personal predispositions of knowledge workers as a group. On this basis, it is only possible to develop and implement measures - to create the right work environment - that will bring out the potential in this group of workers and make their knowledge as productive as possible.

Of course, in the era of the new economy, most professions require a certain level of knowledge - but this was also the case at the time when F. W. Taylor implemented the principles of scientific organization of work. External conditions at the turn of the century have changed due to unprecedented economic, technological and social development. Therefore, the minimum level of knowledge necessary to perform any work has increased. Revolutions in technology, telecommunications, automation, productivity impose a certain minimum level of knowledge and the ability to apply it, whether for direct production workers (e.g., automation of production), service workers (knowledge of customer needs, product offerings, etc.) or farmers (mechanization and computerization of farming). However, they do not become knowledge workers by doing so. To be a knowledge worker, one must (i) do knowledge work and (i) have certain specific competencies.

However, it is the productivity of knowledge workers that poses one of the greatest challenges for organizations in the 21st century. The most valuable resource of 20th-century enterprises was production equipment. The most valuable resource of 21st-century institutions, business or not, will be knowledge workers and their productivity (Ducker 2009).

T. H. Davenport (2005), in keeping with the trend of considering knowledge work and the productivity of knowledge workers, created a classification of workers based on the quantity, quality, application and creation of knowledge that accompanies the operations performed by each group of workers. The classification he presented reflects very well what Drucker advocated and brings us closer to a consensus on differentiating workers by the share of knowledge in their work. In short, the idea is that certain types of work require more knowledge, experience, expertise, autonomy, independent, out-of-the-box thinking than others.

On the other hand, today most tasks require at least a minimum level of thinking and knowledge, but not all of the same type and scale. It is important for employers to recognize these differences and act accordingly.

On the one hand, it is important to raise the productivity of those groups of employees who are the most numerous in the organization (such measures most often in practice boil down to the traditional management of industrial era employees - cyclical evaluation and planning of employee development and structure management). On the other hand, if companies want to compete in the global market, they need to attract and adequately motivate employees who, through the use of their knowledge, determine the lasting market success of the company - and these are knowledge workers.

4. Identifying Knowledge Workers in Theory and in Practice

It is already known that the productivity of knowledge workers is a challenge, but how the very distinction between a knowledge worker and a manual worker *vel an industrial era worker*, remains unresolved. Neither managers, workers nor professors at universities have reached consensus on defining these differences clearly, and it is often the case that the existence of such a division is questioned at all. It seems that the main challenge in the coming decade will be to identify knowledge workers themselves, classify them internally, define their tasks and the quality of their performance, and only then, work on their productivity. However, in the literature on the subject, among recognized research authorities, the author has encountered rather harsh criticism of the introduction of the above division.

However, disregarding the different opinions on the subject, the author for the purpose of this article, after synthesizing the definitions of knowledge workers proposed by other researchers, has made a kind of summary and believes that:

- the main purpose of their work is to create, distribute and apply knowledge (taking into account manual operations, which require highly sophisticated and theoretical knowledge);
- thinking occupies most of the time they spend on their work;
- the results of their work are mainly ideas and knowledge, which most often contribute to the work of others;
- the basis of their work performance is knowledge, expertise, experience, education;

- the problems they solve and the opportunities they seize are most often new, unprecedented, non-routine;
- they seek, process and produce information or data from which they are able to draw meaning and take necessary actions based on it;
- their work requires innovation, creativity, problem-solving skills, systemic thinking, high concentration and focus.

To sum up, a necessary but not sufficient condition for a person to be referred to as a knowledge worker is the performance of knowledge work. People with the above-mentioned knowledge worker competencies, but who do not perform knowledge work, will not be referred to as knowledge workers. However, the main dilemma still remains how to find employees who are or are not knowledge workers. This issue raises a lot of controversy, because if they are to be included in this group and constitute a competitive advantage for companies in the modern economy, it is necessary to correctly identify the specific characteristics of both the object of their work (knowledge work) and a certain set of their personal characteristics and predispositions as a group.

In the author's opinion, this is not so simple and of course. Usually, the simplest measures that are available in measuring the number of knowledge workers go to the "first fire":

- ISCED-97 classification - the number of economically active people with full tertiary education.
- ISCO-88 classification - the number of economically active people in an occupation that requires a significant body of knowledge at the tertiary level.
- HRST measure - the number of economically active people with higher education occupying positions that require a significant body of knowledge at a higher level.

Of course, we can assume that higher education is one of the characteristics that I can distinguish a knowledge worker from other workers. But are we sure? On the one hand, it seems that a knowledge worker must, not at all, have an extensive body of theoretical knowledge that will help him understand the essence of the work he is doing and allow him to gain knowledge of how to do it well - methods. At the same time, he must also possess the ability to use such already acquired knowledge in business practice to carry out the tasks assigned to him independently. Of course, such knowledge in the 21st century is acquired primarily during higher education, as evidenced by programs prepared by universities around the world, along with competence matrices that have been in force for almost two decades.

However, on the other hand, the empirical experience of each person who has or has had contact with the higher education system causes them to treat these measures with great caution and distance. The reason for this situation can be attributed to the significant growth of this group of workers (people with full higher education) in the labor market over the second decade of the 21st century. The trump card in the labor market in the form of higher education is slowly becoming a requirement in most of the jobs that are arriving. These booming industries are reporting demand for new professions and are looking for specific specialists to work through, thus greatly expanding educational offerings. In addition, there has been a need to retrain or diversify the competencies already held by a large number of those already working, which also increases the demand for studies.

Besides, can we not be surprised by the fact that the previously described criteria determining the membership of a given employee in the group of knowledge workers, often among many researchers of the subject (not only about the author of the work), did not include this determinant. We can find many more such uncertainties, but some assumptions must be made to make at least an attempt to determine the size of this group of employees in the population under study.

Therefore, the identification of knowledge workers turned out, for the author of the article, to be one of the major challenges during the conducted research, which is described in detail in Chapter 5 of this article.

The first objective of the study was to identify knowledge workers in the surveyed entities - of course, the beginning was the most difficult, as the concept of knowledge worker did not function in any of the surveyed entities (100 large companies in the Baltic Sea Region). Fortunately, having previous experience in this area (the author of the study conducted similar research in 2013-2015) and the characteristics of this group of employees established for the needs of other countries, the author created criteria and conditions affecting the membership of a given employee in the group of knowledge workers, which worked well.

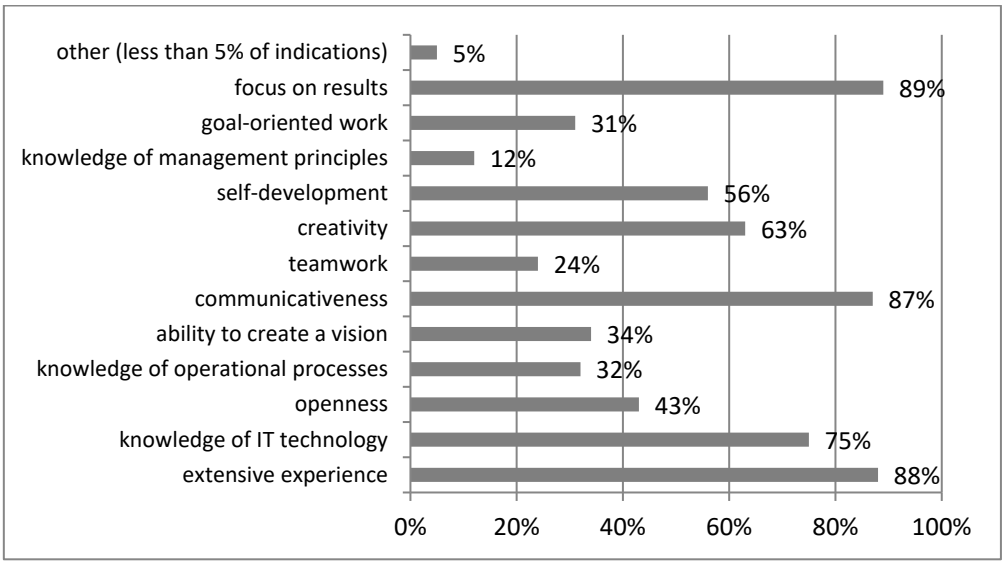
Table 1: Kryteria i warunki przynależności do grupy pracowników wiedzy

	Criterion/condition
1.	Expertise
2.	Creativity in daily work
3.	Courage to implement innovative solutions
4.	Independence and responsibility in action
5.	Expanding and developing existing knowledge
6.	Combining technical and managerial skills
7.	High professional culture
8.	Ability to properly organize work
9.	Dedication to the work performed
10.	Ability to work with others
11.	Possessing the confidence of co-workers
12.	Sharing knowledge with others

Source: Own study.

5. Analysis and Interpretation of Research Results

The entire research process was inspired by the words of.H. Davenport (2005), who put forward some time ago, a rather bold thesis that one of the strategic goals of a company nowadays is to provide a high level of satisfaction to its best employees - this was certainly confirmed in the research process conducted among companies in the new economic conditions. With the above statements in mind and in order to start the research process at all, it was necessary to identify knowledge workers. Therefore, in the first step of the first stage of the research, since the functioning of the concept of knowledge worker was not found in any of the companies selected for the study, the author planned to obtain the opinion of a group of respondents on the qualities which, in their opinion, a knowledge worker should have (Figure 2.).



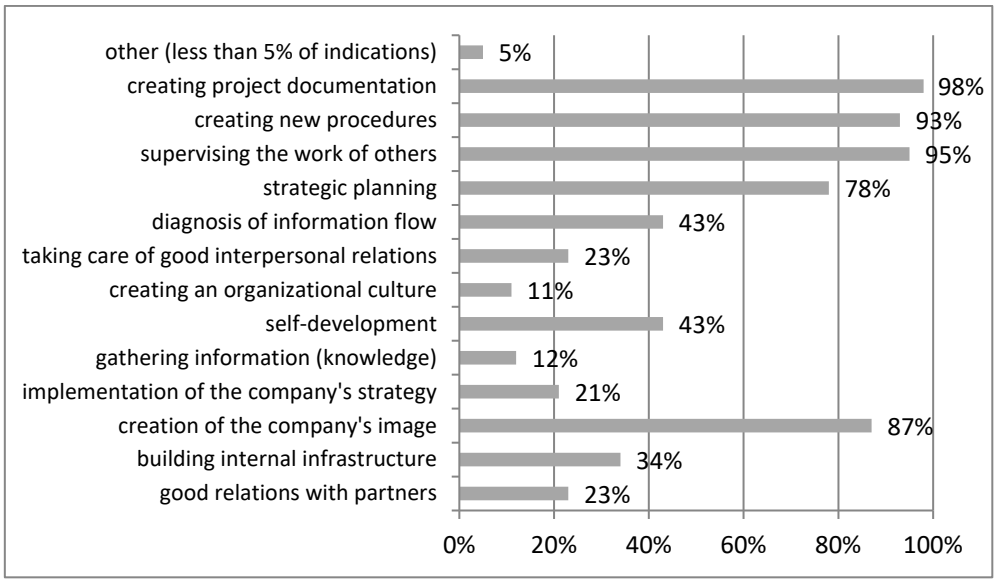
Source: Own study.

Figure 2: Features of Knowledge Workers Identified by Respondents (Managers)

As it can be seen, managers, when defining the qualities of a knowledge worker, attach particular importance to their experience, achieved results or specific competencies (in this case, IT), which may prove the thesis that they expect results from their employees above all - this is the main barrier to creating a vision for managing their competencies and knowledge. Interestingly, respondents placed great emphasis on leadership qualities,

which included, first and foremost, systems thinking, a shared vision, a friendly attitude toward others (even altruism), courageous commitment, or knowledge of the business.

Equally interesting opinions of the respondents appeared when they were asked what tasks they set for the people they would include in the group of knowledge workers (Figure 3.) - of course, the condition for fulfilling these tasks, is to have, first of all, the appropriate qualities identified earlier.

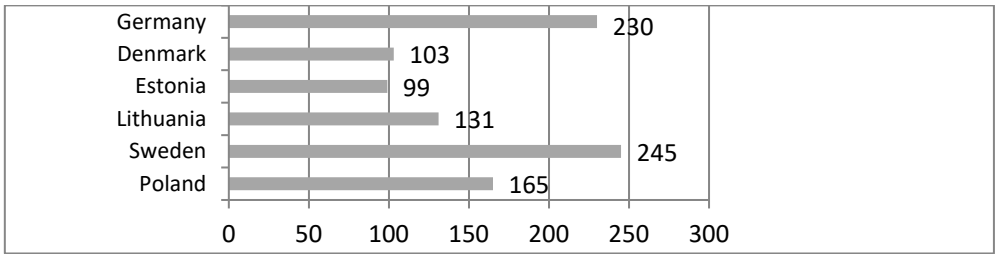


Source: Own study.

Figure 3: Tasks set for Knowledge Workers in the Opinion of Each Manager

In this case, the respondents focused primarily, once again, on day-to-day work (preparation of documents or procedures), although, in the author's opinion, issues related to the use of knowledge, i.e.: its collection, processing and use, should prevail. This is undoubtedly the result of the lack of identification and in general the presence of the concept of a knowledge worker in the surveyed companies - it seems that the management is not aware of the potential of such people and their impact on the overall functioning of the company (at this point it was known that the level of difficulty in achieving the set research objectives increased significantly).

Reassuming. thanks to the analysis of the above data and on the basis of the experience of the research process in previous years, it was possible to identify knowledge workers (Figure 4) in all the companies participating in the study - in 973 employees.



Source: Own study.

Figure 4: Number of Identified Knowledge Workers by Country of Origin of Enterprise

Analyzing the above data, it may seem strange to us that the number of identified knowledge workers was distributed almost evenly across all the surveyed companies - in proportion to their number from a given country (Scandinavian countries minimally lead the way). This is probably a result of the fact that in no enterprise such a concept was functioning, and the process of identifying them, created and implemented for this purpose, may have been imperfect - it was perhaps too unified a picture. In summary, however, it can be assumed that the first stage of the research process has been completed - the established sub-goals have been achieved - the author moved on to the next stage of the research.

In the next part, in accordance with the research plan, respondents were asked about their opinions on the conditions that the companies created for knowledge workers. Respondents were given a rating scale from 1 to 5 - where one was very poor conditions and 5 was very good. The answers given nevertheless add up to a fairly positive picture of this area in the surveyed entities - the main mistakes most often made by companies are: lack of agreement to act independently, lack of experienced among managers (this causes lack of recognition among employees), excessive bureaucracy or lack of expected training, These are the biggest problems and at the same time challenges faced by the managements of the surveyed entities. It is difficult to talk about building relationships with knowledge workers in the case of poor evaluation of the working conditions created for them.

Table 2: Assessment of the Conditions Created for Knowledge Workers and Identification of the Biggest Problems of Managing Them

Evaluation of the created working conditions				
very weak	weak	medium	good	very good
11%	19%	20%	33%	17%
Mistakes made by enterprises in the process of managing knowledge workers				
lack of acceptance of self-reliance				88%
little experience of managers				78%
excessive bureaucracy				77%
lack of expected training				76%
poor relations between manager and subordinate				67%
favoritism of individual employees				65%
lack of opportunities for promotion				64%
poorly constructed evaluation system				61%
one-sided communication				59%
too much control				56%
authoritarian management style				54%
too many ritualistic activities				52%
low level of remuneration				49%

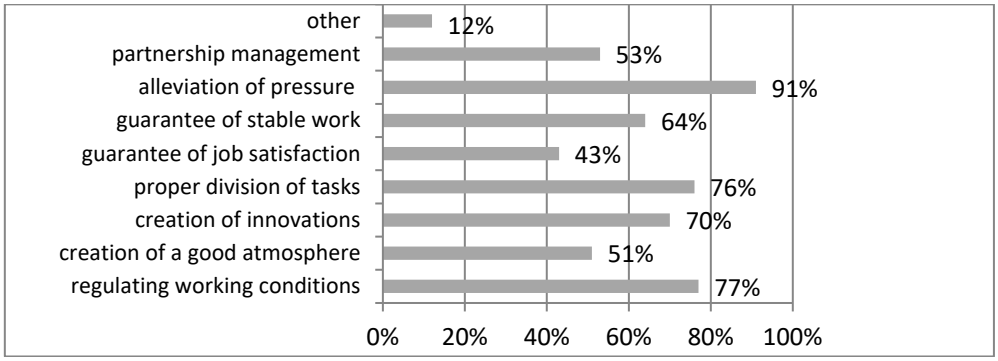
Source: Own study.

At this point, it should be noted that, on the one hand, the respondents are aware of the challenges they face due to the new determinants of the economy - this was shown by their opinions on knowledge workers and "competencies of the future" and the role I these people to play in the process of building a competitive advantage for their companies in the market. They also understand that their companies will become organizations of the digital age, producing physical products and providing innovative services based on data analytics - there will be a radical transformation in the way they operate and the dynamics of the processes in the market will also increase. They also know that data and information are central to the coming changes, and they have a long and difficult road ahead of them leading to advanced analytical capabilities.

5.1 Tools and Principles of Cooperation with Knowledge Workers in the Enterprise

Unfortunately, the problems / barriers or challenges are quite numerous - this confirms the need to set directions for improvement and implement corrective actions. This shows not only a gap in the research and scientific treatment of the problem, but also a gap in business practice. Therefore, decisive steps should be taken to eliminate the barriers that have arisen, which contribute to the escalation of further dysfunctions and will help (initially at least to a small extent) to better manage knowledge workers. In the next stage of the research, it was possible to observe and, importantly, identify, from the opinions of respondents, new areas / directions of activities implemented in the surveyed companies in the field of knowledge worker management strategies: the creation of systems to prevent psychosocial risks at work, strengthening of already existing and implementation of new tools, improvement of the quality of relations and working conditions.

This is the result of the understanding of the needs of employees by the responsible boards, conversations with managers, as in the next step of this stage of the research, the respondents themselves indicated the need for specific actions and changes in management systems, in line with the above-mentioned areas, which would affect the effectiveness and efficiency of work (Figure 5).

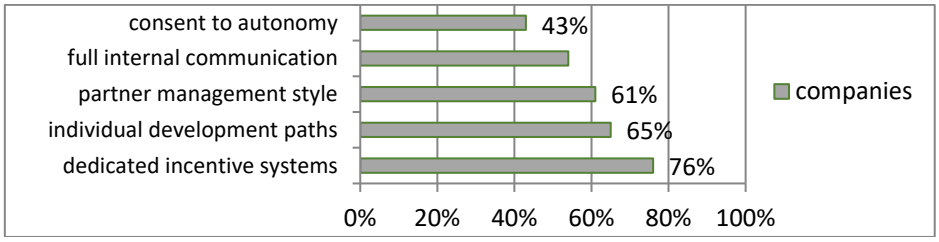


Source: Own study.

Figure 5: Changes Needed to be Made in Knowledge Worker Management Strategy

All of the above plans must, of course, be translated into concrete actions that will gradually modify the management systems already in place. Interestingly, at this stage of the research, based on the analysis of all the data, we can see the analogy with the earlier theoretical argument about contemporary working conditions resulting from the economic changes taking place and the specific characteristics of knowledge workers, who do not attach as much importance to a permanent place of employment, and put their independence first. The most important thing, however, is that employees, together with their managers, at least in the companies surveyed, are aware of this.

Summarizing all the above considerations, while moving on to the essentials of changes in personnel policies in the context of knowledge worker management, it was possible to identify in the surveyed companies, the initial directions of activities aimed at achieving the highest possible productivity of this group of employees and creating optimal conditions conducive to the effective use of their potential and competencies (Figure 6).



Source: Own study.

Figure 6: Measures for Knowledge Workers in Surveyed Companies

An equally important condition that an organization must meet to enable knowledge workers to act as innovators is the issue of building employee commitment. When planning to fully utilize the potential of this group of employees, it is necessary to cause them to be sincerely interested and preoccupied with their work and willing to take on additional activities that go beyond their formal duties. However, it is often possible, as the research has shown, to encounter barriers that hinder the optimal use of the potential of knowledge workers (and not only this group of employees) for the development of the enterprise: haphazard recruitment of team members, the lack of specialists on the market, the lack of mechanisms developed by companies to function in the new economic conditions, the lack of awareness of the role of intellectual capital in the knowledge economy.

Of course, when analyzing the data, we can come across measures to effectively manage this group of employees - according to the author, they can be directed to 4 main areas - acquisition of new knowledge, use of knowledge by the largest possible group of employees, knowledge management, encouraging employees to continuously acquire new knowledge.

Below, in Table 3, the author has matched, in his opinion, the main actions taken by the surveyed companies to optimally utilize the potential of knowledge workers and assigned them to the 4 areas plotted earlier.

Table 3: Actions Taken to Optimally Utilize the Potential of Knowledge Workers

Areas	Actions seeking to realize the potential of knowledge workers
Area No. 1	Clarifying the role of management
	Determining the influence of strategic goals on each employee's work
	Careful listening
	Eliminating ventures that do not benefit the company
	Encouraging the creation of new ideas
	No punishment for mistakes - only he who does nothing is not wrong
	Promoting attitudes related to admitting mistakes
Area No. 2	Informing employees about organizational conditions
	Consent to corporate actions
	Joint decision-making / consultation on changes
	Preferowanie pracy zespołowej Preferring teamwork
Area No. 3	Delegating decision-making authority to knowledge workers
	Changing the role of managers: coordinator, coach (helps strengthen commitment), leader/authority (represents the interests of their employees), mentor (reminds them of the organization's mission)
Area No. 4	Training that takes into account the strategic goals of the company
	Training that takes into account employee development goals
	Zachęcanie do uczenia się nieformalnego Encouraging informal learning
	Rewarding learning outcomes

Source: Own study

This means that in the new economic reality created by globalization, technological advances or the rise of intellectual capital, at the dawn of a 5.0 society, there will be changes in the perception of employees in every workplace. In every industry - in the factory and in the law firm. Knowledge workers will need new competencies in the face of the dominance of digital tools. They will expect completely different treatment and support from their employer. Daily experiences with Artificial Intelligence, Internet of Things, robotics and automation will imprint on them and evoke unprecedented feelings and needs, and HR departments around the world must be prepared for this.

In addition, the above measures are all the more important because knowledge worker productivity is one of the biggest challenges facing organizations in the 21st century. However, before even discussing and considering how to increase knowledge worker productivity, it is important to define what productivity is and how we distinguish between the productivity of industrial era workers and knowledge workers. Therefore, it seems that this will be another very important research problem that the author plans to address in the near future.

6. In Conclusion

In summary, no matter what method or strategy an organization chooses to support (or even build) its business goals through optimal management of knowledge workers, it must base this sphere of activity on specific rules:

- All people employed in the company, not just knowledge workers, must be treated as an asset of the organization - not a cost or resource.
- The organization must have a concrete and flexible business model, from which the applicable personnel strategy is derived.
- Organizational culture is the basis for managing knowledge workers - primarily a system of values and norms, as well as people's attitudes and behavior.
- Combining the goals of the employer with the interests of knowledge workers.
- Breaking down the responsibility for managing all human capital to several centers in the organization: starting with the top management and ending with each manager.

- The top management in an organization must realize that the expertise of the people they employ largely determines its competitiveness - they must trust them and motivate them properly.
- Properly define the tasks for the HR Department, which should include helping to solve social problems in the organization. Managers of these departments should have at their disposal HR solutions and tools that are easy to apply and tailored to the specifics and needs of the company.
- In building and managing teams of employees, techniques should be used that will enable, on the one hand, proper organization of work and effective problem-solving, and on the other hand, take into account the interests of the company and its employees.

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Changes in the Labor Market in the era of the COVID-19 Pandemic: Occupations Desired by Employers in the Polish Labor Market

Waldemar Jędrzejczyk
Czestochowa University of Technology, Poland

waldemar.jedrzejczyk@pcz.pl

Abstract: The contemporary business environment is very dynamic. Only two years ago, the factor that determined changes in organizations the most was the technological progress – mass digitization of processes combined with progressive automation and robotization. Currently, the situation has changed a lot. Today's economy has to cope with another crisis caused by the COVID-19 pandemic and exacerbated by Russia's military aggression against Ukraine. The pandemic caused worldwide social and economic disruption, including the deepest global recession since the Great Depression. The pandemic also brought changes to the labor market and work environment. The most visible impact of the COVID-19 pandemic on the work environment was the spread of remote work. In this article, the main subject of consideration will be the issues of occupations in the context of the COVID-19 pandemic. The main objective is to assess the overall impact of the COVID-19 pandemic on the labor market. The analysis covered 2019-2023 and was based on secondary and primary research. The unemployment rate and the Occupational Barometer were analyzed. In-depth interviews with employment agents and career advisors were conducted. The conducted analyses and research showed that the changes in the labor market caused by the COVID-19 pandemic were temporary. The most significant changes occurred during the first year of the pandemic. Today, after the cessation of the epidemic threat and the revocation of the pandemic, the situation in the labor market has returned to normal - to the pre-pandemic state. The only change in the labor market that has not returned to the pre-pandemic state is the number of people working remotely.

Keywords: COVID-19 pandemic, Labor market, Remote work, Occupations, Poland

1. Introduction

On March 11, 2020, the World Health Organization (WHO) declared a COVID-19 pandemic caused by the SARS-COV-2 virus – as a consequence of the rapid increase in the number of people infected with the virus, which first appeared in Wuhan, China. Due to the spread of the pandemic, most countries, including Poland, introduced various types of restrictions to prevent the spread of the coronavirus at the turn of the first and second quarter of 2020, i.e., ordering people to stay indoors, closing schools and workplaces, banning mass events and public gatherings, restricting movement and crossing borders, or using public transportation. In many countries, the state of epidemic emergency was introduced first, and then the state of epidemic. After three years, on May 5, 2023, the WHO declared the COVID-19 pandemic revoked.

The coronavirus pandemic has affected the economic climate worldwide. Global GDP in 2020 fell by 4.3% compared to 2019. The pandemic has also brought significant changes to the labor market - the demand for occupations and competencies changed, and forms of work organization evolved. Changes in the labor market were not identical for all entities, both at the macro and micro levels. The pandemic had a varying impact on different countries and regions of the world, both in terms of the object of change and the period of change. The same applies to industries and professions. For some, the impact was favorable, while for others, it was neutral or unfavorable.

The main purpose of the article is to assess the overall impact of the COVID-19 pandemic on the labor market. According to the definition, the labor market is a type of economic market that consists of, on the one hand, job seekers and their offers and, on the other hand, entrepreneurs who create new jobs and need a workforce. Within the main objective, the following research questions were posed to elucidate the research problem:

- Has the COVID-19 pandemic caused an increase in the level of unemployment?
- Has the COVID-19 pandemic affected the demand for occupations in the labor market?
- Has the COVID-19 pandemic caused significant changes in work organization?

With regard to the main objective and the posed research questions, the primary hypothesis was formulated: The changes in the labor market caused by the COVID-19 pandemic were temporary and were not perpetuated after the cessation of the epidemic threat and the revocation of the pandemic.

Against the background of global changes in the labor market, detailed analyses in terms of the most important indicators of the labor market, i.e., unemployment rate, number of job offers, employment conditions, and scarce occupations, were carried out for Poland, a country ranked 69th in the world in terms of administrative area, and 9th in Europe.

2. Work Changes Caused by the COVID-19 Pandemic

The most visible impact of the COVID-19 pandemic on labor was the spread of remote work (Marcus, 2023). The threat posed by the coronavirus and the introduction of the lockdown forced the market to shift some of the work activity of employees from workplaces to their homes (*Impact of Pandemic …*). In Poland, according to the Central Statistical Office, in the fourth quarter of 2020, the number of people usually doing their work at home was 1,609,000 (which accounted for 9.7% of all working people). It constituted a significant increase – the number of people working remotely increased by 128% compared to the end of 2019, before the pandemic. The trend was intensifying, and during the so-called "Third Wave of the Pandemic" in March 2021, 14.2% of the employed were already working remotely (GUS, 2020, p. 10).

Another visible effect of the pandemic was a change in expectations regarding the competencies employees should possess. Employers began to pay more attention to competencies related to the use of new technologies, as well as time management, organizational skills, and resilience to stress, which is closely connected with the spread of remote work.

The pandemic has made employers and employees realize the importance of flexibility and responding quickly to change. It is also vital to have the ability to make decisions in uncertain conditions and adapt to new realities. As a result, companies are more likely to hire people characterized by so-called learning agility, i.e., the ability to learn quickly and adapt to change.

3. State action to Protect Jobs

The crisis caused by the COVID-19 pandemic detrimentally affected the labor market, which has contributed to a decline in people's living standards and created socioeconomic problems (Hupkau et al., 2023). To counteract these adverse developments, governments in many countries have undertaken a series of countermeasures (Köhler et al., 2023). The Polish government introduced the first package of support for businesses and employees, known as the Anti-Crisis Shield, as early as April 1, 2020. Within the framework of the Anti-Crisis Shield, an assistance program was launched targeting businesses affected by the pandemic. Its purpose was to protect the labor market and provide companies with liquidity during a period of severe economic disruption. Support granted to employers aimed at maintaining jobs and consisted of (*Life and Work …*, 2020, pp. 194-195):

- Subsidizing micro, small, and medium-sized entrepreneurs for part of the cost of employee salaries and social security contributions;
- Subsidizing entrepreneurs who are natural persons not employing workers to conduct business activities;
- Granting low-interest loans to micro-entrepreneurs;
- Subsidizing salaries with funds from the Guaranteed Employee Benefits Fund during the period of economic downtime or reduced working hours imposed by employers.

In addition, small businesses could receive support through an exemption from Social Security contributions for three months. Medium-sized companies were able to apply for more funds from the Export Insurance Policy Committee for insuring trade turnover at home and abroad. Large enterprises could obtain state support by, among other things, being subject to more flexible labor market regulations.

4. Working During the Pandemic

With the economy grinding to a halt, many employers have suspended hiring processes and cut back on hiring people in order to survive the challenging times. They dismissed a significant portion of their staff, leaving employees without jobs and income (Nunes et al., 2023). It affected the service sector in particular. Industries such as tourism, hospitality management, catering, hairdressing, culture, and entertainment suffered the most. Customer service departments in companies also showed a downward trend. Many employers reduced working hours for their employees.

The Covid-19 pandemic and the resulting lockdown have led to significant changes in the perception of performing work. Employers and employees alike had to adapt to the new conditions in a rapid manner. Initially, the lockdown caused panic and complete paralysis of most industries in the market. However, when the public realized that the shutdown of the economy would last over a dozen days, it became necessary to develop new solutions that would enable the continuity of the work of individual entities. As a result, a significant part of the professional activity was transferred from the company to the home. It was a milestone in working conditions,

as under regular conditions, the application of remote work on such a scale would certainly not have happened sooner than in a few or a dozen years (*Impact of Pandemic …*).

The epidemiological crisis has fundamentally changed the organizational reality. In many industries, remote work has become a requirement and the only option. It posed a significant organizational challenge, especially for those companies that had never had experience with this form of work organization. The pandemic, therefore, caused remote work to become widespread in organizations (Marcus, 2023). This form of work was a safe choice for many companies and provided them with an opportunity to maintain work continuity. In this circumstance, the ability to work remotely, good work organization, and soft skills were becoming vital qualities of employees.

Remote work should rely on cooperation between supervisors and employees and a sense of responsibility for the work performed. The pandemic has forced employees and employers to adapt to a new way of working. To this end, new technologies and information techniques have been used, enabling the digitization of all forms of work. The manner of communicating at work, including the mode of meetings between employees or meetings with the employer, has changed. These have become possible through the use of video and teleconferencing (Stanciu et al., 2023).

The pandemic has intensified the demand for IT professionals and specialists in finance and economics-related occupations. Demand for blue-collar workers in positions such as warehouseman and courier has also increased. It is related to the shift of sales to the Internet and the development of e-commerce platforms and services for delivering products directly to the customer's home.

The ability to work in home office mode should occur in accordance with the following rules (*Working remotely …*):

- Adequate management support – especially a results-focused approach that requires precise identification of tasks and main goals and proper monitoring of work performance without excessive reporting.
- Provision of work tools (including laptops and apps), platforms for communication with management and colleagues, and the necessary training.
- Explicit rules and transparent expectations regarding telework performance, its hours, the method of reporting, and the contact ability and availability of employees.
- Allowing employees time flexibility so that they can perform their work at the most convenient time for them, balancing their home responsibilities and at the same time remaining in contact during the company's working hours.
- Mutual trust, which determines the effectiveness of remote work.

After an initial period of complete stagnation, organizations gradually began to initiate recruitment processes. However, they offered much less favorable employment conditions in comparison with the pre-pandemic period. It was caused mainly by the desire to reduce labor costs. The number of provided non-wage benefits declined, such as subsidies for learning foreign languages, private medical care, or sports cards. Instead, companies offered in-house training, which generates lower costs.

The COVID-19 pandemic has undoubtedly brought changes in the way work is organized and in demand for particular job positions. However, it did not lead to the collapse of the labor market but only to its transformation. The pandemic showed that companies, regardless of size, have become efficient organizations, quickly adapting to the new reality.

5. Research Method

The main purpose of the article is to assess the overall impact of the COVID-19 pandemic on the labor market. With regard to the main objective, three research questions were posed:

- Has the COVID-19 pandemic caused an increase in the level of unemployment?
- Has the COVID-19 pandemic affected the demand for occupations in the labor market?
- Has the COVID-19 pandemic caused significant changes in work organization?

The primary hypothesis was formulated: The changes in the labor market caused by the COVID-19 pandemic were temporary and were not perpetuated after the cessation of the epidemic threat and the revocation of the pandemic. The trends of changes in the labor market were analyzed in two dimensions: macroeconomic and microeconomic. The phenomenon was considered on the scale of a single country – Poland, in 2019-2022.

In the macroeconomic dimension, the unemployment rate and the Occupational Barometer were analyzed. The unemployment rate is one of the primary macroeconomic indicators. It is a statistical quantity that describes the severity of unemployment in a given population. It is most often defined as the ratio of the number of unemployed people to the economically active population. The fundamental premise for selecting this indicator, which characterizes the state of the labor market, was its unified nature. This feature makes it possible to conduct comparative analyses between regions, countries, and industries. Furthermore, the level of unemployment determines the level of economic growth and translates into the living standards of the population.

The "Occupational Barometer," on the other hand, is a one-year forecast of the state of occupations. The barometer divides professions into three groups: deficit, balanced, and surplus, and the results apply to districts, voivodeships, and the country as a whole. It is a qualitative study based on so-called expert panels. Participants in the study, recruited from among employees of labor offices and other institutions statutory involved in the labor market, as well as companies that operate in the HR industry, provide answers to the following questions in the course of the discussion:

- How will the demand for employees in a given occupation change in the upcoming year? Will it increase, decrease, or remain the same?
- How will the relationship between the available workforce and the demand for employees in a given occupation shape? Will there be a deficit or a surplus of work seekers, or will demand and supply balance out?

Changes in the classification of occupations into a deficit, balanced, or surplus group illustrate well the changes occurring in the local, regional, and national labor market, including the expectations of employers.

In the microeconomic dimension, the research subjects were labor offices[1]. Labor offices are institutions that study and analyze the labor market, provide information to the unemployed, and engage in job placement for work seekers. The research was conducted in the form of interviews. It was an in-depth study to clarify the changes that have occurred in employers' expectations of job candidates due to the COVID-19 pandemic. The interview questionnaire consisted of two sections: header and substantive section. The header section recorded such information as the date of the interview, the start and end time of the interview, the form of the interview, the name of the respondent, the held position, and the respondent's seniority. The substantive section consisted of ten questions, which are presented in the aggregated form in the last main point of this article. The validity of the posed questions was also verified during the interview.

The research was carried out between October and December 2022. Prior to conducting an interview, the secretariats of the labor offices were contacted by phone and asked to speak with the director or deputy director. Interviews were carried out in offices where the directors agreed to conduct such a survey. A total of 10 interviews were conducted. The average duration of an interview was 1 hour. The respondents were eight employment agents and two career counselors from various labor offices in the Silesian voivodeship.

6. Changes in the Labor Market in Poland in 2019-2022 in the Light of Macroeconomic Indicators

The announced and implemented state of the epidemic in Poland in March 2020 caused changes in the labor market. Companies reduced their employees' working hours, sent workers on furlough, or dismissed them. In the initial and following stages, the labor market in Poland was in a worse condition than in previous years. In December 2019, the unemployment rate in Poland stood at 5.2% (Table 1). In March 2020, at the outbreak of the pandemic, the unemployment rate was 5.4%. The unfolding pandemic caused a significant increase in the number of unemployed people. At the end of 2020, the unemployment rate was 6.8%. Such a level of unemployment persisted until April 2021. In the following months, the level of unemployment in Poland decreased slightly – at the end of 2021, it was 1 percentage point lower compared to the same period in 2020. After the pandemic slowed down, the level of unemployment in Poland decreased and stabilized – from May 2022 to April 2023, it remained within the range of 5.2-5.5%.

[1]The research was conducted by a research team led by Waldemar Jędrzejczyk. The main research stream concerns the issue of competencies, both currently desired and prospective, regarding sectors and types of organizations, occupational groups, and key positions in organizations. In the area of labor market changes caused by the COVID-19 pandemic, the head researcher was Agnieszka Mańka-Goncerz.

Table 1: The Registered Unemployment Rate in Poland in 2019-2023 (data in percentage)

Month/Year	2019	2020	2021	2022	2023
January	6,1	5,5	7,0	5,9	5,5
December	5,2	6,8	5,8	5,2	-

Source: Compiled based on current GUS data (https://stat.gov.pl/obszary-tematyczne/rynek-pracy/bezrobocie-rejestrowane/stopa-bezrobocia-rejestrowanego-w-latach-1990-2023,4,1.html)

The highest increase in the unemployment rate was recorded in the first year of the pandemic in March 2020–March 2021. Over the course of 1 year, the unemployment rate increased by 1.5 percentage points. The increase in unemployment halted in April 2021, and a downward trend could be observed from May onward.

With regard to the increase in the unemployment rate caused by the outbreak of the COVID-19 pandemic, the question must be asked: has the decline in employment affected all industries and occupations to the same extent? The occupational barometer was used to find the answer to this question. Occupation barometers for the years 2020-2023 (developed respectively in 2019 and 2022) were analyzed. The main focus was on deficit and surplus occupations.

In these two categories, the number of deficit occupations, that is, professions in which the number of vacancies is greater than the number of people interested in taking a job or meeting the requirements of employers, predominated each year on a national scale. By contrast, there were virtually no surplus occupations – in which the number of vacancies is lower than the number of people interested in taking a job or meeting the requirements of employers. Surplus occupations were indicated only in the 2020 and 2021 barometers – in both cases, these were economists.

Deficit occupations pose a far more significant problem. There are occupations in which it has been difficult for employers to find job candidates for many years. These include such professions as (these appear on the lists of deficit occupations in the occupational barometers in all analyzed years): woodworkers and construction carpenters, roofers and sheet metal workers, electricians, electromechanics and electrical fitters, physiotherapists and massage therapists, bus drivers, truck and tractor drivers, cooks, doctors, warehouse workers, motor vehicle mechanics, construction fitters, bricklayers and plasterers, practical vocational training teachers, vocational subject teachers, earth-moving equipment operators and mechanics, machine tool operators, caregivers of the older people and people with disabilities, nurses and midwives, construction finishers, construction laborers, independent accountants, welders, and locksmiths.

The pandemic has caused a shift in demand for some occupations. In the 2021 occupational barometer, unlike in 2020, hairdressers and accounting and bookkeeping workers were absent from the group of deficit occupations (due to the lockdown and closure of hairdressing establishments and other service establishments in many industries, which reduced, among other things, the scale of outsourcing in financial and accounting services), while tailors, garment production workers (due to a change or expansion of the business profile - many entities began sewing protective masks, suits, and aprons for health care), and paramedics (as a result of a very high increase in severe illnesses caused by the SARS-CoV-2 virus) appeared. The second year of the pandemic also brought changes in the group of deficit occupations. In the 2022 occupational barometer, tailors and garment production workers disappeared from the group of deficit occupations, while psychologists and psychotherapists appeared (as a result of widespread isolation, especially among children and adolescents - education in most schools was provided remotely), and accounting and bookkeeping workers reappeared.

The slowdown of the pandemic has again brought some changes in the group of deficit occupations. In the 2023 occupational barometer, bakers, woodworkers, carpenters, and paramedics disappeared from the group of deficit occupations, while general education teachers and teachers of special schools and inclusive departments appeared – a trend unrelated to the pandemic phenomenon.

The COVID-19 pandemic exacerbated the deficit crisis for certain professions. In particular, there was a shortage of medical, construction, and IT workers – programmers and database administrators, as well as workers in the transportation industry – drivers and warehouse workers. The pandemic also caused a crisis of demand for some occupations. The crisis particularly affected professions in the industries subject to restrictions, namely catering, trade, tourism, and hospitality management, and the mining, manufacturing, and automotive sectors. There was a deficit of job listings in the Labor Offices for occupations in these industries. Only since May 2021 has there been an increase in job offers and occupational activation, while the number of unemployed people has fallen.

In 2021, despite the ongoing pandemic, employers were more open to new hiring processes than 12 months earlier. The caution from the beginning of the pandemic was replaced by a rational personnel strategy. There was an increase in the number of employers seeking employees in the sectors most affected at the beginning of the pandemic and in the second wave – catering, hospitality management, and the HR industry (*OLX labor* …, 2022). Businesses have opened up to home offices due to the pandemic. As early as 2021, there was an increase in the number of job offers with remote work options compared to the beginning of the pandemic. It proves that the remote work form found many enthusiasts. It was also a safe choice that allowed work continuity, at least in some sectors. Remote work became widespread in industries such as marketing, PR and media, accounting, telephone customer service, and IT (*OLX labor* …, 2022). Not every trade could afford to switch from onsite to remote work. Certain businesses do not allow remote work, i.e., the construction or manufacturing industries.

7. Changes in the Labor Market in Poland in 2019-2022 in the Light of Labor Offices

Interviews conducted with employees of labor offices aimed to find answers to the following problem questions:

- Which industries, occupations, and positions have been most affected by the COVID-19 pandemic?
- What impact has the COVID-19 pandemic had on employers' requirements for candidates for recruited positions?
- What changes have occurred in the processes implemented by labor offices as a result of the COVID-19 pandemic?
- What impact has the COVID-19 pandemic had on the situation of the unemployed?
- Has the COVID-19 pandemic caused an increase in interest in remote or hybrid work?

Respondents included hairdressers, catering assistants, cooks, waitpersons, bartenders, beauticians, nail stylists, bus drivers, truck and tractor-trailer drivers, travel agents, and tour guides among the occupations most severely affected by the pandemic in the labor market. The prolonged lockdown has primarily caused great caution in the employment of people in industries exposed to restrictions. Temporary and contingent workers and employees with short job seniority were the first to suffer the fallout of the lockdown. They were the first to receive notices of termination, were not offered another contract, or had no job offers in their occupations. Employers who received state assistance, such as the Anti-Crisis Shield, did not dismiss workers for whom they obtained support, but the majority did not increase employment.

The worst period in the number of job offers on the market was the early months of the pandemic – from March to June 2020. By the same period in 2021, most occupations had already returned to relative balance. Job offers were plentiful, and employers' interest in subsidized employment increased. The phenomenon of rebranding has also intensified. Many people dismissed from industries impacted by restrictions declared a desire to retrain – they were leaving their professions and looking for work in more stable industries.

Among the occupations positively affected by the pandemic (as a result of the pandemic, the supply of these occupations in the labor market increased), respondents included: couriers, food delivery drivers, IT specialists, warehouse workers, logistics specialists, salespeople, and cashiers. Due to the increased interest in online sales and the transition of some restaurants to selling food with home delivery, interest in food delivery drivers and couriers was particularly pronounced.

The pandemic has highlighted and exacerbated staff deficits in the healthcare sector the most. It has been difficult for medical facilities to find candidates for medical and nursing vacancies. Interest in medical registrars, caregivers for older people, and health carers has also increased.

Since the loosening of restrictions, demand has begun to increase for low-skilled occupations, such as cashier, salesperson, and warehouse worker. Employers requirefrom such candidates only the willingness to work and availability, understood as the willingness to work shifts and the ability to start working "immediately." The high supply on the labor market for such employees stemmed from high rotation. Employers also forwent requiring work experience for such positions. Depending on the industry, employers requireprimary or secondary education.

In the case of more complex products or sales processes involving middle-skilled occupations, i.e., sales representative, customer services advisor at a bank or insurance institution, or salesperson of specialized equipment or high-tech products, employers' requirements increased and, apart from a willingness to work, professional education and experience were required.

For high-skilled occupations, such as positions requiring credentials, licenses, and a certain level of professional education, the COVID-19 pandemic did not affect employers' requirements for job applicants. They remained the same before, during, and after the pandemic.

During the pandemic, job seekers usually contacted labor offices by phone or email. Many treated such contact as confirmation of their willingness to work. Only a few inquired about job offers that were lacking in the market. The unemployed reported on suspended recruitment processes and the lack of vacancies.

The pandemic highlighted the phenomenon of digital exclusion. A high percentage of people were unable to adapt to the new pandemic reality due to their living situation (difficult financial conditions, homelessness, illness, addictions) or lack of digital competencies. The implemented lockdown and recommendations for the administration to work remotely caused many services to be available only in the remote form. The pandemic further aggravated the problem of exclusion of certain groups of the unemployed. The situation has particularly worsened for the long-term unemployed, who entered the pandemic already with severely limited social contacts. The pandemic has caused even further isolation. A phone call or email contact with the unemployed did not create convenient conditions for frank conversations about professional issues.

The trend, observed in Poland and abroad, of employers offering remote or hybrid work opportunities was not clearly confirmed in the intermediation provided by the surveyed labor offices. Employees did not notice significant interest from employers cooperating with labor offices in such forms of work.

8. Conclusions

The COVID-19 pandemic has had a profound impact on the labor market in Poland and caused many changes. As it was presumed, the demand for particular occupations and forms of work organization changed, with the strength of the impact varying from highly negative to highly positive. The adopted main objective was therefore achieved.

The answers to the posed research questions were also found. The COVID-19 pandemic has had a negative impact on the labor market. In its initial period, it caused an increase in the unemployment level and a decrease in the overall number of job offers reported to labor offices, which was influenced by the centrally introduced restrictions aimed at limiting the transmission of the virus (restrictions on the use of services, restrictions on leaving homes and on traveling, restrictions on the ability to gather in closed spaces, mandatory quarantines for people infected with the SARS-CoV-2 virus and their families) and changes in how work is performed (remote work was practiced more frequently; some sectors, such as education, outsourcing of financial and accounting services, and outsourcing of IT, switched entirely or to a large extent to remote work), and also by the uncertain scenario of the pandemic, which may have translated into personnel decisions in organizations.

The labor market crisis has particularly affected occupations in the industries subject to restrictions, namely catering, trade, hairdressing and beauty services, tourism, and hospitality management. Professions in these industries have become surplus. Some people left their occupations, retrained, and sought work in more stable industries.

The pandemic also contributed to the emergence of deficit occupations. Such occupations, both immediately after the outbreak and during the pandemic, were IT specialist, logistics specialist, salesperson, cashier, and courier. Personnel deficits worsened the most in the medical sector.

Above all, the pandemic contributed to the proliferation of remote work and recruitment. In these cases, the company's location was not an issue for candidates. The new pandemic reality has forced a change in the previous habits of companies and employees at all levels. The hybrid work model, which combines working from a company's headquarters and performing work duties remotely in a home office, became the most common work style during the pandemic.

After the initial stagnation, the labor market has returned to normal – the unemployment level has fallen to the pre-pandemic level, and employment dynamics have increased. In job offers, employers often reported their willingness to train employees for a specific position. The availability and willingness of candidates to take the job mattered the most. If the candidate agreed to be trained for a job, the level of professional education mattered less to employers, especially in deficit occupations. The exception was recruiting for specialized positions which required specific competencies, such as in the IT or medical sectors.

The conducted analyses and research showed that the changes in the labor market caused by the COVID-19 pandemic were temporary. The most significant changes occurred during the first year of the pandemic. Today,

after the cessation of the epidemic threat and the revocation of the pandemic, the situation in the labor market has returned to normal - to the pre-pandemic state. The only change in the labor market that has not returned to the pre-pandemic state is the number of people working remotely. Also, in many organizations, administrative and office work in particular, the hybrid work model remains in use. The adopted hypothesis is therefore confirmed.

The considerations presented in the article do not exhaust the issue and require further research. The limitation of the study is the narrowing of the analysis of macroeconomic indicators to one country and the size of the research population – the study was conducted on a small research sample. Verification of the adequacy of specific changes in the labor market should be carried out on the basis of a higher number of countries and a larger group of respondents.

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Reimaging Power and Micro-Politics in Project Organizations

Birgit Helene Jevnaker and Johan Olaisen
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 on project management in an organization? 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 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. Power is significantly underrated as a tool to control and govern projects. Micropolitics is a part of that tool to get the decisions the project leader wants, maybe with future promises. 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 both increase and reduce the effectiveness and efficiency of an organization. The higher complexity, the higher returns on using Power and micro-politics to get the expected project results.

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 & 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 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 four investigated companies' role descriptions. 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 need to learn 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 need to know. The practical usefulness of micropolitics and Power for project management is evident, and the theoretical need for knowledge about the concepts is thus also overdue.

The problem with the paper is:

What impact do micropolitics and Power have on 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, a discussion, a 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 on project management.

The methodological approach has been conducting a survey study as fundamental knowledge for interviewing twelve project managers in four Norwegian hydro, oil, and gas companies. We need more 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 evaluate the perceived importance of formal 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 evaluate whether the interviewees are happy with their answers to questions 4 and 6 or would like to learn more. Questions 8 and 9 are phrased as open questions and ask for their experience. Question 10 concerns personal incentives and reward mechanisms for participating in the power and micropolitics game. We conducted a 90-minute follow-up meeting with all twelve managers to discuss the findings.

The questionnaire and interviews were combined to secure 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 three billion NOK (i.e., 250 million EURO). The interviews were done in 2016 as a spin-off through an executive education offer in project management by BI Norwegian Business School. Access to the project managers was secured through the executive program. The empirical investigation represents the best-conducted investigation of the importance of Power and micro-politics in project management.

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 (1979) 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 be outside the organization's goals since Power and micro-politics are informal processes (Kieser & Walgenbach, 2007, p. 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, p. 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 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 governs all human relations, including all organizations" (Foucault, 2005, p. 103).*
> *“Power is the potential to allocate resources and to make and enforce decisions” (HBSP 2005: xi).”*

> *"Power dressed as a cognitive authority delivers all the results you need (Olaisen, 1984, p. 47)." The more bullshit you deal with as a manager, the more you need to bend the processes your way" (Olaisen & Revang, 2017, p. 149).*
>
> *" When you are standing to the shoulders in the 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)." You do what you must to get the results needed, and using your Power is the only way to deliver on time (Interviewed manager)." Power implies keeping your position and getting better positions and projects (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 is often regarded as the 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, p. 154). Several individual power bases lead 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 & Revang, 2017). Jevnaker and Olaisen (2022) reimagined the organizational world and found that traveling less traveled roads for success involved handling relationships and role clarifications through Power.

According to Foucault (2005), relationship power influences 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 must do to come there" (Interviewed manager). Foucault (2005) defines Power as the essential tool in all relationships, especially in all leadership and management forms. 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 as 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. Any leadership position involves Power, and not using Power in a leadership job is not the essential tool you have. Without Power no leadership.

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 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 must to achieve decisions and results (Nonaka, 1985; Foucault, 2005; Olaisen & 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, p. 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 audience understanding, rhetorical 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 aligns with the theory; Kotter (2012:181) evaluates 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 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 internationally, 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. For a long time, it seems to lie within persons in the same organization 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. That outcome judges a project manager and must do what is necessary to achieve the outcome if that is accepted in the corporate culture. All interviewees believed consensus does not finally drive decisions but is often 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 the team will appreciate his results. He must keep his career in mind and cannot act 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 always remember who gave them a reward and a position and will keep together throughout their careers and protect each other. There needs to be more conservatism in how to handle the project business. However, there is a possibility for change and innovation simultaneously since managers protect each other from risk and punishment. Balancing stability and

creativity might be the reason for high effectiveness and efficiency in Norwegian oil and gas production. All the managers mentioned the fast-track projects that aim to finish a project in half of the planned and required time. Firstly, all these managers denied managing fast-track projects, and 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 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 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 needs more 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. 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. It can take considerable time for a new person in the organization 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. The manager's agenda is often consensus and team harmony, giving him informal Power to proceed even though he does not fully comply with his team's opinions. It is fascinating 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 or delay a process and get the decisions the manager wants. The process might be time-consuming and challenging to understand since hidden agendas exist. The institutional project manager muddle through formal and informal Power and micropolitics.

> *"Power for me is friendliness and the explanation of expected results and the contributions to get the results. There is a reward for a contribution and a penalty for not contributing. If you want to grow and to get new possibilities, you will be contributing and you will do your outmost to get the project to deliver on time for cost and quality."*

4.4 How are the findings Related to Answering the Remaining Research Questions?

- How do Power and micropolitics appear in projects?

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 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 critical success factors 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, 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. All project managers accepted Power and micropolitics as critical success factors. 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 true. Strong informal power bases exist within all four investigated companies, positively affecting the efficiency and effectiveness of a project. The main reasons are a need for more 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 is 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 undoubtedly a cultural and branch bias. Temporary project organization is vital 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.

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Mapping Scientific Production on Organizational Knowledge Flow

Jaime Miranda Junior, Lídia Neumann Potrich, José Leomar Todesco and Paulo Mauricio Selig
Universidade Federal de Santa Catarina, Florianópolis/SC, Brasil

jaimemjunior@gmail.com
lidia.potrich@gmail.com
titetodesco@gmail.com
pauloselig@gmail.com

Abstract: For several years now, we have been living in a society called the knowledge society, in which the primary resource is knowledge. It is no longer just a personal input but also a strategic asset in the development of organizations. In this context, we have an area dedicated to studying and analyzing organizational knowledge flow (KF), which is defined as the process of transferring knowledge between people and/or knowledge processing mechanisms. A lack of studies compiling the most recent scientific production on KF has been identified in the literature analysis. This makes it difficult to understand the current context of the field, identify the main knowledge gaps and trends in this area of study. Thus, the research objective was to map the characteristics of scientific production on the knowledge flow construct by analyzing bibliometric and sociometric indicators to discover the state of the art and suggest future research in the field. An analysis was performed based on over 3,000 articles and reviews extracted from Scopus, Web of Science, and IEEE Xplore databases. The results indicate that (i) research on the flow of knowledge has been stable since 2013, with a constant number of studies and publications in recent years; (ii) the main authors are from the Asian, European, and American continents without having a hegemony; (iii) prominent approaches are the relationship of knowledge flow within knowledge management processes and within the innovation ecosystem; and (iv) the analysis of the flow of knowledge gains potential importance, mainly in guiding action plans in knowledge management (KM) and in the search for better results in organizations.

Keywords: Knowledge flow, Scientific production, Bibliometrics, Sociometry

1. Introduction

Knowledge is not only essential for the survival of organizations but also for their competitive advantage (Meher and Mishra 2022; Marjerison, Andrews and Kuan 2022; Ferreira et al. 2022). Technological advancements have resulted in the accumulation of information, making knowledge a crucial organizational resource (Dalfovo et al. 2010). Since knowledge has an interdisciplinary characteristic, the term has different interpretations, depending on the adopted epistemology (view). Hence, there is no universal definition among different areas of interest. Venzin, Von Krogh, and Ross (1998) have identified three main epistemological perspectives for the term "knowledge": the autopoietic, connectionist, and cognitivist approaches.

In the autopoietic view, the term "knowledge" is believed to reside within people and groups, as it arises from the transformation of information that individuals gain from their experiences and observations. On the other hand, the cognitive approach holds that knowledge is obtained through the identification, gathering, and dissemination of information. As information can be stored in databases, files, manuals, and also within individuals, knowledge is not exclusively confined to people's minds. Finally, in the connectionist perspective, knowledge creation arises through the interaction (connection) between actors (Venzin, Von Krogh and Ross, 1998).

Regardless of epistemology, knowledge management supports all processes related to knowledge as an organizational resource. According to the Asian Productivity Organization (APO 2010), knowledge management is based on "an integrated approach to identifying, creating, storing, sharing, and applying knowledge to increase organizational productivity, profitability, and growth" (p. 43). Within this context, Kurtz, Sierra, and Varvakis (2013) emphasize that the flow of knowledge is a stage within the knowledge-sharing process, which is an important phenomenon to be mapped and researched. However, given the lack of studies in the literature that compile research on knowledge flow (KF), this study aims to identify the current scenario and indicate possible paths to follow in the field of KF, using bibliometric and sociometric analysis.

The following section will present the definitions of the knowledge flow construct, as well as the bibliometric studies that have been previously conducted.

2. Concepts

2.1 Knowledge Flow

There is no consensus in the literature on the definition of KF, but it essentially revolves around the exchange, diffusion, or movement of ideas, knowledge, and concepts within an organizational setting (An, Han, and Park, 2017). Within this perspective, Zhuge (2002) defines KF as the process of passing knowledge between people or knowledge processing mechanisms. With a similar approach, Nissen (2006) considers it to be dynamic knowledge. That is, the flow works in an activity of knowledge conversion, transfer, sharing, integration, reuse, movement, and application over time. Laihonen (2006) points out that KF refers to knowledge that is transferred from one person or place to another, where the receiver relates it to their own mental model and creates their interpretation of the original knowledge they received.

2.2 Bibliometric Analysis

The emergence date of the term "bibliometrics" is a controversial issue, as there are debates regarding who coined it and when it was first used. However, one of the studies that contributed to introducing the theme was the work by Cole and Eales (1917). In the 1960s, Pritchard (1969) defined bibliometrics as the application of mathematical and statistical methods to books and other communication media. Therefore, when applied to science, bibliometric analysis is referred to as scientometric analysis and is a scientifically recognized methodological approach. It is a mapping technique of the primary authors, countries, and keywords on a given topic, developed through statistical methods capable of presenting these data and information, which are extracted from scientific databases (Santos, Maldonado, and Santos, 2011).

There are several bibliometric indicators that can be employed to measure the scientific production of a particular research field. Among them, three are commonly used: Lotka's Law, Bradford's Law, and Zipf's Law. Lotka's Law pertains to the productivity of researchers, Bradford's Law refers to the distribution of scientific production, and finally, Zipf's Law is related to the occurrence of terms in the text (Machado Junior, 2016).

In this study, the three aforementioned laws were employed with a secondary objective: to assess whether the research findings were in line with the principles espoused by these laws, thereby serving as a complementary approach.

2.3 Bibliometric studies on Knowledge Flow

The first step of the current research was to verify and confirm in the literature the existence of other bibliometric reviews about KF. Therefore, a search was conducted in several databases including Scopus, Web of Science, and IEEE Xplore using the protocol ("knowledge flow*" OR "knowledge passage*" OR "knowledge movement*") AND (bibliometric* OR scientometric*).

The results indicated a lack of reviews. However, six studies were identified, two of which were directly related to the KF construct and bibliometric analysis, but in very specific contexts. These studies did not aim to map and verify the field of study and the state of the art of the construct. Table 1 presents some of these findings.

Table 1: Bibliometric Studies on KF

Authors (year)	Title	Goal
Ming-Yueh Tsay (2015)	*Knowledge flow out of the domain of information science: a bibliometric and citation analysis study*	To analyze, through bibliometrics and citation analysis, the knowledge flow construct outside the discipline of information science. The survey data were gathered between 1998 and 2010.
Ponomariov and Toivanen. (2011)	*Research and development: Bibliometric analysis of knowledge flows of Brazilian research 2005-2009*	To analyze, through bibliometrics, the dynamics of knowledge creation in order to discover how knowledge flows. The survey data were gathered between 2005 and 2009.

Source: Authors 2023.

Given the above, the importance and, at the same time, the need to carry out a scientific mapping about KF was verified.

3. Method

In order to identify the state of the art of the KF construct with scientific rigor, this literature review was developed through four steps. Figure 1 presents each of them.



Figure 1: Research Method Used

Next, each of the developed steps is detailed.

3.1 Review Planning

In the initial phase of the research, known as literature review planning, several essential elements were formally defined. These included the research objective, the selected electronic database, the descriptors, data management tools, search locations within articles, and eligibility criteria, as presented in Table 2. It is worth noting that the research methodology employed drew on various established works in the literature, including significant contributions from authors such as Arksey and O'Malley (2005) and Patil and Kant (2014). Therefore, specific stages and phases from these sources were selectively integrated, rather than being adopted entirely.

Table 2: Review Planning

Criterion	Description
Purpose of the literature search	Map the characteristics of scientific production on the KF construct.
Source of information	Scopus, Web of Science and IEEE Xplore
Search strategy	"knowledge flow*" or "knowledge passage*" or "knowledge movement*"
Data management	*EndNote©, Google docs©* and *VOSViewer©*
Search locations in articles	Title, keywords and abstract
Eligibility criteria, exclusion criteria and inclusion criteria	Research involving and/or synonyms. Any language. Any publication period. Any type of study. Research published in papers or reviews. Research in the final stage, that is, completed

Source: Authors 2023.

3.2 Database Search and Portfolio Definition

Once the strategies had been established, the next step, known as database search, aimed to locate publications that met the predetermined criteria on Scopus, Web of Science, and IEEE Xplore. This research phase was conducted from December 2022 to February 2023. In the third stage, publications were selected to form the research portfolio, which would provide support for the final stage. In the initial search, 4,192 studies were retrieved, but after applying filters and removing duplicates using the EndNote© tool, the research portfolio was reduced to 3,352 studies. Table 2 provides a more detailed breakdown of the filtering process.

Table 3: Planning of Literature Review

Activity	Databases		
	Scopus	Web of Science	IEEE Xplore
Initial query with defined search string	3.317	2.667	366

Activity	Databases		
	Scopus	Web of Science	IEEE Xplore
Research published in the form of papers or reviews, magazines or conference proceedings	1.995	1.834	363
Elimination of duplicate searches			840
Total studies selected for the job (portfolio)			3.352

Source: Authors 2023.

3.3 Bibliometric and Sociometric Analysis

The last stage of the research, called bibliometric and sociometric analysis, was supported by the VOSViewer© software, version 1.6.15. This tool provides graphs of bibliometric and sociometric networks (Van Eck and Waltman 2010) through the importation of CSV files extracted from scientific databases (e.g., Scopus).

4. Findings and Discussion

In this section, the research results will be presented along with discussions. Initially, we will discuss general results such as the evolution of the number of articles since the first publication that mentions the knowledge flow construct, as well as the authors and journals with the highest number of publications. Following that, we will present the sociometric analysis, including co-citation networks and co-occurrence of keywords.

4.1 Evolution of the Field

The 3,352 studies identified were published in 881 journals. The number of publications per year is shown in Figure 2.

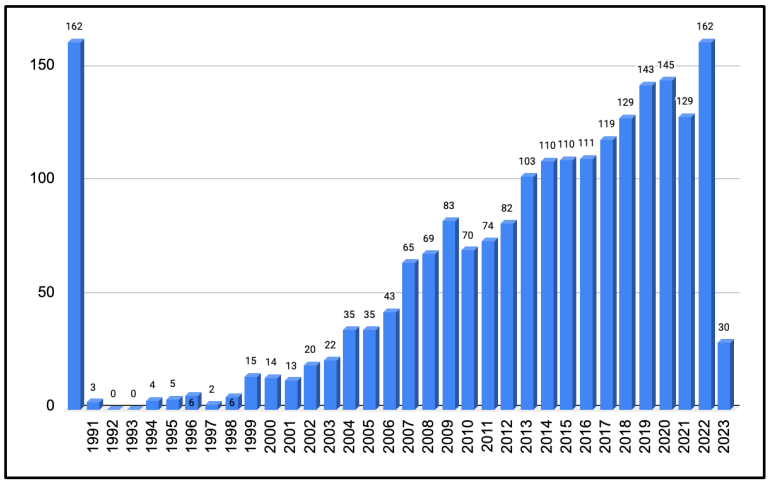


Figure 2: Number of Publications per Year

The first article to address the KF construct was published in 1953 by Harvey S. Perloff, titled "Planning Concepts and Regional Research." In this article, the author analyzed the flow of knowledge between academia and public policy. Until 1990, there was discrete production of studies about KF, with several periods without any publications. The construct started to gain momentum in 1991, when three studies were published, coinciding with the advancement of organizational theories such as the Knowledge-Based View of the Firm (KBV - Grant, 1996), which considers knowledge as an organizational resource and expanded studies on organizational knowledge. After that, there was strong growth in publications, reaching its peak in 2022 with 162 publications. It is worth noting that stabilization in the number of publications about the construct has been observed since 2013. The year 1999 represented the inflection point in the production growth curve of the subject, with a 150% increase compared to the previous year. It is worth mentioning that in the 1990s, the process of digital

transformation began with the digitization of documents, which, in some way, contributed to significant advances in research.

4.2 Authors With More Publications

The author with the highest number of publications is Yongtae Park from Seoul National University in South Korea, with 10 published studies. Two Canadian researchers followed: Ajay K. Agrawal, who is affiliated with the Rotman School of Management, and Harald Bathelt, who is affiliated with the University of Toronto. The list is completed by researchers from Europe (Netherlands and Italy) and the United States. Table 4 presents the authors ranked by the number of publications.

Table 4: Authors Ranked by the Number of Publications

Author	Number of articles	Affiliation	Country
Park, Y.	10	Seoul National University	South Korea
Agrawal, A.	9	Rotman School of Management	Canada
Bathelt, Harald	9	University of Toronto	Canada
Cantwell, John	9	Rutgers Business School	United States
Bathelt, H.	8	University of Toronto	Canada
Nissen, M.E.	8	Naval Postgraduate School	United States
Verspagen, B.	8	Universiteit Maastricht	Netherlands
Montobbio, F.	7	Università Cattolica del Sacro Cuore	Italy

Source: Authors 2023.

4.3 Journals With More Publications

The 3,352 articles identified were published in 881 journals, representing an average of 3.8 articles per journal. Table 5 presents the top 10 journals.

Table 5: Main Periodicals

Journal	Number of articles
Journal of Knowledge Management	61
Scientometrics	61
Research Policy	59
Regional Studies	25
European Planning Studies	24
Technological Forecasting and Social Change	23

Journal	Number of articles
Knowledge Management Research and Practice	21
Strategic Management Journal	20
Journal of International Business Studies	19
Journal of Business Research	19

Source: Authors, 2023.

4.4 Highest Impact Article

With 2.303 citations, the article that has had the greatest impact is "Knowledge Flows within Multinational Corporations" authored by Anil K. Gupta and Vijay Govindarajan, which was published in the Strategic Management Journal in 2000. The research describes the application and evolution of a framework that refers to intra-corporate knowledge transfer within multinational corporations.

The next article, also published in the Strategic Management Journal, is titled "Creating and Managing a High-Performance Knowledge-Sharing Network: The Toyota Case," authored by Jeffrey H. Dyer and Kentaro Nobeoka, which has almost the same number of citations as the first.

Following these impactful works in the field of knowledge flow, there are two works with approximately 1,000 citations each: "Motivation and Barriers to Participation in Virtual Knowledge-Sharing Communities of Practice" published in the Journal of Knowledge Management, and "Overcoming Local Search through Alliances and Mobility" published in Management Science. Table 6 presents the ten most referenced works in the field.

Table 6: Highest Impact Articles

Author (year)	Title	Journal	Number of quotes
Gupta and Govindarajan (2000)	Knowledge flows within multinational corporations	Strategic Management Journal	2303
Dyer and Nobeoka (2000)	Creating and managing a high-performance knowledge-sharing network: The Toyota case	Strategic Management Journal	2254
Ardichvili, Page and Wentling (2003)	Motivation and barriers to participation in virtual knowledge-sharing communities of practice	Journal of Knowledge Management	1036
Rosenkopf and Almeida (2003)	Overcoming local search through alliances and mobility	Management Science	905
Decarolis and Deeds (1999)	The impact of stocks and flows of organizational knowledge on firm performance: An empirical investigation of the biotechnology industry	Strategic Management Journal	863
Meyer, Mudambi and Narula (2011).	Multinational Enterprises and Local Contexts: The Opportunities and Challenges of Multiple Embeddedness	Journal of Management Studies	716

Author (year)	Title	Journal	Number of quotes
Singh (2005)	Collaborative networks as determinants of knowledge diffusion patterns	Management Science	667
Grossman and Helpman (1991)	Trade, knowledge spillovers, and growth	European Economic	632
Caloghirou, Kastelli and Tsakanikas (2004)	Internal capabilities and external knowledge sources: Complements or substitutes for innovative performance?	Technovation	617
Oxley and Sampson (2004)	The scope and governance of international R&D alliances	Strategic Management Journal	570

Source: Authors 2023.

4.5 Knowledge Areas

As shown in Figure 3, it is evident that the topic of KF is researched with greater emphasis in areas such as Administration, Management, Social Sciences, and Computer Science, which together account for almost 50% of all publications. However, in several areas, the scientific interest in the construct is still in its infancy, as indicated in the same figure by the percentage of 7.4%.

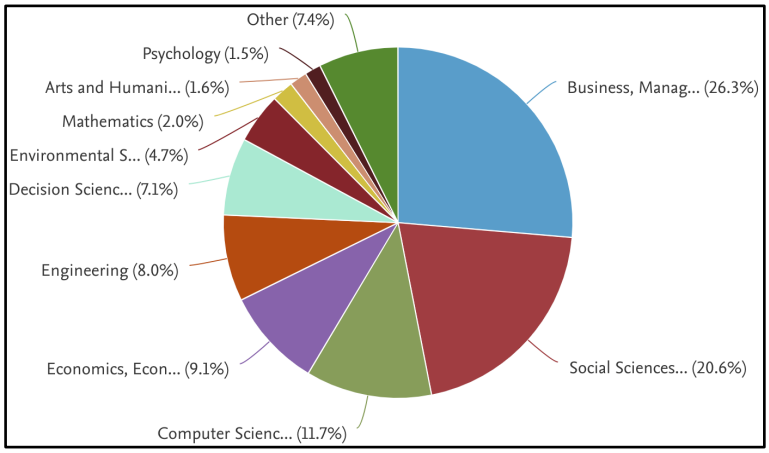


Figure 3: Publications by Area of Knowledge

It should be noted that the databases used for this research do not employ standard classifications for the areas of knowledge. Hence, a mapping between the areas was conducted before generating the graph.

4.6 Co-Citation Networks

Through co-citation analysis, it is possible to identify how often two authors are cited together. Two authors are considered co-cited when they are both cited by a third author. Therefore, the more frequently two authors are co-cited in documents, the stronger their co-citation relationship will be (Van Eck and Waltman 2014).

By setting a minimum threshold of five documents per author, meaning that authors must be co-cited in at least five articles, Figure 4 displays the groups of authors. A total of 177 authors were identified, grouped into nine clusters, with the largest cluster consisting of sixteen authors who interact frequently.

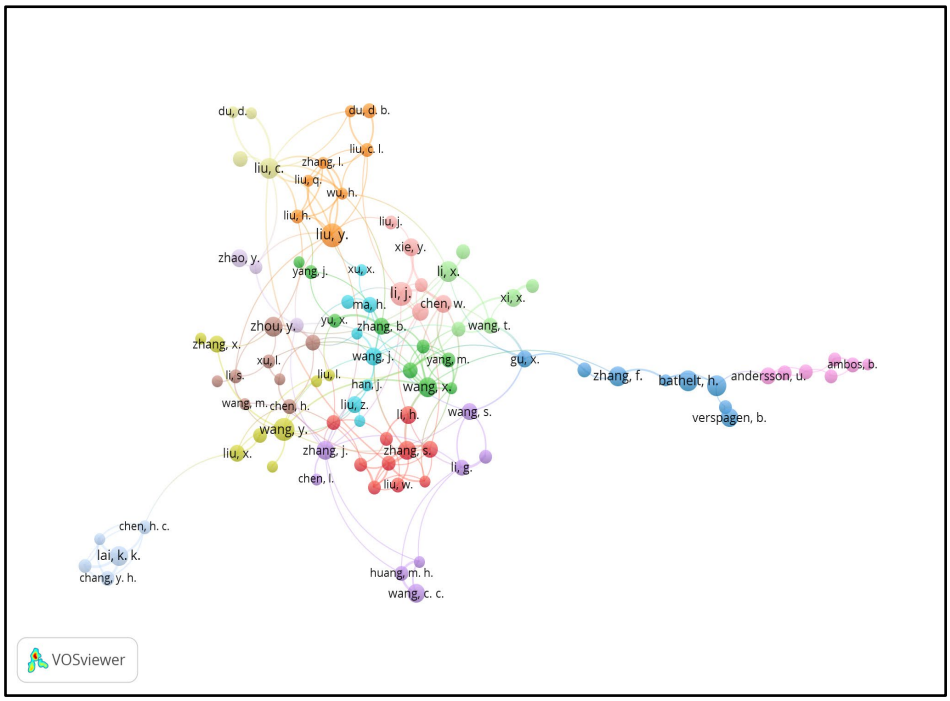


Figure 4: Co-Citation Networks

4.7 Keyword Co-Occurrence Networks

The co-occurrence relationship between two keywords is determined by the number of articles in a portfolio of documents in which both keywords occur simultaneously in the title, abstract, or keywords section (Van Eck and Waltman, 2014). Figure 5 depicts the network of keyword co-occurrences for the portfolio analyzed in this research.

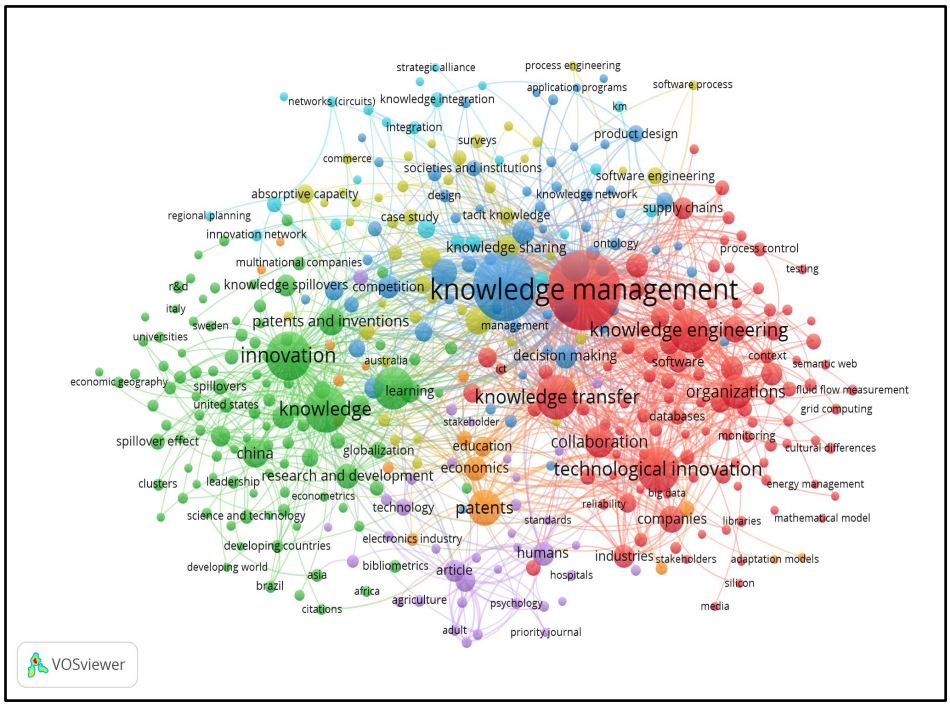


Figure 5: Keyword Co-Occurrence Networks

By setting a minimum frequency of 5 occurrences of keywords in documents, we identified a total of 517 co-occurring keywords, which were divided into seven clusters. As shown in Figure 5, two main research groups are clearly visible: Knowledge Management and Innovation. Other groups can also be observed tangentially to these main clusters, such as technological innovation, knowledge transfer, and the concept of knowledge itself.

5. Future Research in the Area of Knowledge Flow

The research has shown that the construct of Knowledge Flow (KF) is being studied in various fields of knowledge, with a greater emphasis currently in the social sciences. This provides opportunities for research in areas that have not yet been explored or have been little explored, such as engineering and security, where knowledge is a fundamental aspect for development and is considered a strategic resource. Interestingly, other themes and areas, such as organizational learning and health, are also being approached in research related to the flow of knowledge.

The study has demonstrated that two themes, Knowledge Management and Innovation, are correlated and associated with the construct of knowledge flow, indicating future research trends. It is important to note that the flow of knowledge is not considered a distinct process in knowledge management, but permeates the tangency between consolidated processes. Therefore, topics such as knowledge sharing, knowledge-based systems, knowledge acquisition, and information management are potential areas of research for future work. Table 7 presents a compilation of future research paths.

Table 7: Findings From the Research

Findings	Themes or areas for future research	Description
1	Safety engineering, healthcare, and organizational learning	Promising themes and areas to explore in the study of knowledge flow
2	Knowledge management and innovation	These two themes exhibit a clear relationship with the construct of knowledge flow. Thus, there is a need to further explore and delve into this correlation

Source: Authors 2023.

Regarding innovation, the terms with the highest frequency are knowledge, research and development, patents, and technological development. Future research in this area could focus on the flow of knowledge in innovation ecosystems and the creation of knowledge through patents, providing a second line of research.itself.

6. Conclusion

This research aimed to map the characteristics of scientific production related to the construct of knowledge flow, through bibliometric and sociometric indicators, in order to understand the state of the art and provide suggestions for future research in the field.

To enhance the validity of the results, the number of databases used was expanded. The study revealed that the author with the highest number of publications, Yongtae Park, is from South Korea. All three main bibliometric indicators - Lotka's Law, Bradford's Law, and Zipf's Law - were verified and confirmed in the research. Regarding Lotka's Law, the analysis of the networks generated in the research demonstrated that the construct of knowledge flow has reached a stable point, with the number of publications remaining constant over the past 10 years.

The study successfully achieved its objective by not only presenting bibliographic data but also identifying two areas for future work related to the flow of knowledge.

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Analysis of Critical Knowledge for Strengthening Resilience and Operational Safety

Jaime Miranda Junior, Denilson Sell, Lídia Neumann Potrich, Heron Jader Trierveiler and Paulo Mauricio Selig
Universidade Federal de Santa Catarina, Florianópolis/SC, Brasil

jaimemjunior@gmail.com
denilsonsell@gmail.com
lidia.potrich@gmail.com
heronjt@gmail.com
pauloselig@gmail.com

Abstract: Resilience, viewed from an engineering perspective, refers to a system's inherent ability to regulate its operation before, during, and after disruptions. Knowledge is a critical resource that enables resilient responses, as it is essential for responding, monitoring, anticipating unforeseen events, and learning from their occurrences. However, despite the importance of knowledge in promoting resilience in operational safety, there is a lack of tools in the literature that provide evidence and explanation of knowledge resources. To address this gap, this article presents the development stages of an instrument based on the Critical Decision Method to elicit critical knowledge in Operational Safety Events (OSEs). The instrument includes a set of questions that guide the identification of decision-making points and the exploration of knowledge resources mobilized at each stage, founded on situational awareness, resilience engineering, and knowledge engineering. Prospective analysis sessions and retrospective OSE analyses were conducted with teams of workers from offshore oil and gas production and exploration platforms to assess the instrument's feasibility. The instrument enabled the identification of critical knowledge in both scenarios, which served as valuable input for promoting security and resilience. The instrument also facilitated the identification of opportunities to promote organizational learning and the development of effective actions to strengthen intangible resources that influence resilient responses, thereby enabling a thorough exploration of knowledge resources in retrospective analyses or prospective sessions of accidents and severe operational safety events.

Keywords: Critical knowledge, Resilience, Knowledge management Operational safety

1. Introduction

In high-risk sectors such as aviation, oil, gas, and energy industries, accidents can have significant human, social, environmental, and economic consequences. These accidents and incidents often arise not only from unintentional or individual factors but also from social and organizational factors (Hovden et al. 2018). In complex operations, it is impractical to anticipate all potential occurrences. Additionally, the organizational environment is becoming increasingly complex due to factors such as the advancement of digital technologies, the digitization of market and work relationships, the data revolution, and the emerging demands and challenges of society (Hirose and Sawaragi 2020; Reiman et al. 2021).

Given the unpredictability and constant need for adaptation within complex systems, a new paradigm named Safety II has emerged in the realm of safety management. Resilience engineering is viewed as a means of implementing and operationalizing this novel approach. Safety II provides an alternative to conventional safety management concepts (Safety I) that rely on division and predictability.

Hollnagel et al. (2006) define resilience as the inherent capability of a system to regulate its functioning before, during, and after disruptions, enabling it to sustain essential operations even in the face of serious accidents or ongoing stressors. Efforts have been made to enhance resilience engineering through the development of tools and research. One such tool is the Resilience Analysis Grid (RAG), devised by Hollnagel (2015), which offers a practical means of assessing resilience. However, these tools do not provide a specific direction from a knowledge perspective, as they fail to explicitly recognize knowledge as an active organizational resource. According to Hollnagel et al. (2006), knowledge plays a pivotal role in bolstering the resilient capabilities of complex socio-technical systems. Therefore, there is a need for an instrument that can identify and extract critical knowledge from Operational Safety Events (OSEs) to strengthen a system's resilience potential.

This article presents the development of a tool, named the CDM Roadmap, for eliciting critical knowledge to support resilience potential using the Critical Decision Method (CDM). The CDM Roadmap is designed to guide the qualification of critical knowledge in recognizing system conditions (based on principles of situational awareness) and implementing responses (based on the perspective of resilience engineering).

2. Concepts

2.1 Resilience Engineering

The concept of "resilience engineering" gained prominence following the inaugural Resilience Engineering Symposium held in Sweden in 2004, and the subsequent publication of the book "Resilience Engineering: Concepts and Precepts" by Hollnagel, Woods, and Leveson in 2006.

Hollnagel (2014) introduced the terms "Safety I" and "Safety II" to differentiate between two perspectives on safety in complex systems. Safety I primarily focuses on retrospectively analyzing failures and accidents to understand their causes and prevent similar incidents in the future. In contrast, Safety II takes a complementary approach by incorporating knowledge about how and why things go right. Within the Safety II paradigm lies the discipline of Resilience Engineering, which aims to design, manage, and evaluate the resilience potential in complex systems, thereby enhancing safety and resilience.

Hollnagel (2011) identified four fundamental capabilities that characterize a resilient system: (1) Responsiveness, which pertains to the ability to manage regular and irregular interruptions and disturbances, either through prepared responses or by adjusting the system's normal functioning; (2) Monitoring Ability, which involves the capacity to monitor current and potential short-term threats; (3) Anticipation Ability, which encompasses the ability to anticipate future events, threats, opportunities, including possible changes, interruptions, pressures, and latent risks; and finally, (4) Learning Ability, which is the capacity to learn from experience, particularly to extract the appropriate lessons from relevant experiences, both successes, and failures. Figure 1 illustrates these four capabilities.

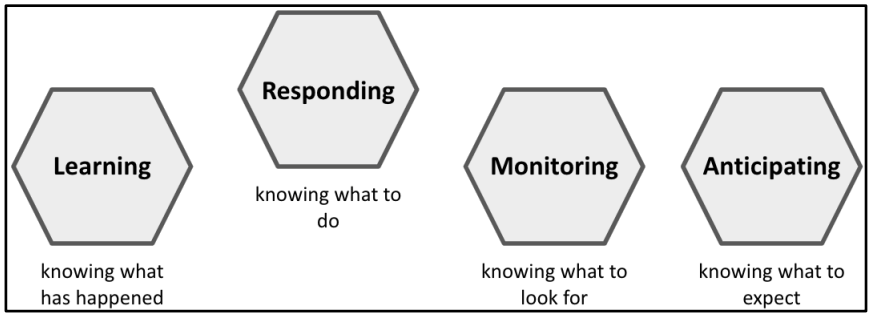


Figure 1: The capabilities of a Resilient System. Source: Hollnagel, 2011

Resilient systems aim to enhance the security of complex systems by developing and bolstering adaptive technological and organizational capabilities (Saleh, Veitch and Musharraf, 2020). Resilience engineering has introduced innovative approaches to understanding and operating within complex systems. In terms of safety improvement, it deviates from the traditional practice of retrospectively investigating adverse events and instead emphasizes proactive learning from everyday work processes, including the identification of successful outcomes (Hegde et al., 2020). Within this framework, knowledge emerges as a pivotal factor in fortifying the resilient capacities of complex systems (Hollnagel, Woods and David, 2006).

2.2 Critical Knowledge

The term "knowledge" lacks a clear conceptual consensus in the literature, as its understanding varies depending on the context, worldviews, and analytical perspectives. It can be viewed as a result of research across multiple disciplines and generated in various spheres such as scientific, theological, common sense, or philosophical (Pacheco, 2016). Within the organizational domain, Nonaka and Takeuchi (1995) introduced the concept of "knowledge" and argued for its management as a valuable asset. APQC (2014) defines the knowledge, in the organizational context, as the collective understanding possessed by employees regarding work-related disciplines, products, processes, customers, interpersonal relationships, mistakes, and successes.

The term "knowledge" is associated with at least three epistemologies: cognitivist, autopoietic, and connectionist. The cognitivist perspective posits that knowledge is acquired through the identification, collection, and dissemination of information. The connectionist view emphasizes communication and relationships as sources of knowledge creation. In contrast, the autopoietic view regards interpretation as the generator of knowledge. Irrespective of the chosen epistemology, the notion of critical knowledge can be determined. Huang and Cummings (2011) propose that critical knowledge encompasses expertise, ideas, and

vital insights that enable individuals to accomplish tasks, representing the highest quality knowledge within an organization that is shared among its members.

The literature presents various models for analyzing the level of criticality of knowledge, one of which is the Critical Knowledge Factors (CKF) model developed by the Paris Knowledge Management Club. This model comprises 20 criteria for assessing criticality, organized into four thematic axes. This study adopts this model due to its simplicity and comprehensiveness. The criteria are displayed in Table 1.

Table 1: Criteria of Criticality

Thematic axis	Criteria
Rarity	Number and availability of experts, outsourcing, leadership, originality, confidentiality.
Utility	Correspondence with strategic objectives, value creation, emergent, adaptability, and use.
Difficulty capturing knowledge	Identification of sources of knowledge, mobilization of networks, tacit knowledge, the importance of tangible sources of knowledge, and speed of obsolescence.
Nature of knowledge	Depth, complexity, appropriation difficulty, the importance of past experiences, and dependence on the environment.

Source: Ermine, Boughzala, and Tounkara (2006).

2.3 Critical Decision Method (CDM)

The process of identifying and extracting expert knowledge in a specific domain can be simplified through various elicitation methods and techniques. The literature offers several tools for this purpose, including the Critical Decision Method (CDM), concept classification, repertoire grids, ladder grids, and limited information tasks (Shadbolt and Smart, 2015).

The CDM, a method based on critical incidents, involves conducting cognitive investigations to evaluate and qualify specific situations and identify decision-making processes during incidents. These investigations are carried out through retrospective interviews focusing on real non-routine incidents that required judgment or decision-making (Klein et al., 1989). The selection of the CDM for this study is justified by two main reasons. Firstly, the CDM focuses on non-routine events, which are particularly relevant to safety incidents. Secondly, the CDM facilitates the identification of decision-making points, aiding in the identification of the knowledge applied in a given situation.

According to Klein et al. (1989), the CDM stands out as a unique knowledge elicitation technique due to its distinctive characteristics, which include:

(i) Focus on non-routine cases: The CDM concentrates on non-routine or challenging incidents that provide abundant data and tacit knowledge that may not be formalized in domain procedures. (ii) Case-based approach: The CDM employs a case-based approach, which proves valuable in gathering specific and relevant information when investigating concrete and non-routine incidents. (iii) Cognitive probes: The CDM's questions require decision-makers to reflect on the strategies and foundations of their decision-making, revealing their underlying knowledge and reasoning. (iv) Semi-structured survey: The CDM adopts a semi-structured approach that strikes a balance between a fully structured and free-form interview. While specific questions are asked for each decision point, the ordering and wording can follow the flow of the interview dialogue.

These characteristics render the CDM a valuable tool for eliciting and comprehending the knowledge utilized by experts in non-routine situations. The steps of the CDM are presented in Table 2.

Table 2: CDM steps

Step	Name	Description
1	Select incident	Select incidents (events) that exemplify non-routine aspects within a specific domain.
2	Get an unstructured incident report	Request the interviewee to provide a detailed account of the incident, starting from the moment they first noticed it until it was considered under control. The account should be provided without interruptions, except for minor clarifications.
3	Build the incident timeline	Construct a timeline of the incident, outlining the sequence and duration of each event.
4	Identification of the decision point	During the construction of the timeline, identify the specific decisions that were made at various points during the incident.
5	Decision point investigation	For each decision point, inquire about relevant aspects such as clues, objectives, knowledge utilized, and assessment of the situation, among others.

Source: Adapted from Klein et al., (1989).

3. CDM Roadmap Development Process

The CDM Roadmap serves as a comprehensive tool to facilitate the identification and extraction of critical knowledge in operational safety events, along with the associated factors that either foster or hinder resilient responses. Its applicability extends to organizations and systems engaged in critical safety operations, encompassing both retrospective analysis of past events and prospective analysis of potential events. Industries such as aviation, healthcare, civil construction, nuclear power plants, and the oil and gas sector exemplify domains that exhibit these characteristics.

By providing a structured approach, the CDM Roadmap enables the implementation of the Critical Decisions Method for extracting critical knowledge and its corresponding factors within operational safety events. This systematic approach proves valuable across a range of organizations and systems involved in critical safety operations, facilitating both the examination of historical events and the anticipation of future scenarios. Sectors such as aviation, healthcare, civil construction, nuclear power plants, and the oil and gas industry represent notable fields wherein the CDM Roadmap can be effectively employed to extract critical knowledge and foster resilient responses.

The development of the CDM Roadmap was founded upon the Critical Decisions Method (CDM), employing the five-step process depicted in Figure 2.



Figure 2: Research Method Used. Sources: authors, 2023

During the initial phase of the study, the research team conducted a comprehensive literature search in electronic databases to identify key elements and factors contributing to a resilient response. This search was conducted in five distinct phases, and the identified variables were meticulously organized, refined, and reviewed. A total of 34 variables were identified and defined, all of which were found to play a critical role in enabling a resilient response. These variables were subsequently categorized into twelve distinct groups, including situational awareness, monitoring ability, organizational learning, response-ability, analytical management, participation and decision-making, knowledge repository, resilience, contingency capabilities, safety margins, available resources, and monitoring systems.

In the second phase, specific questions were formulated based on the identified elements from the previous stage. Five overarching questions were devised and aligned with the study objectives. The initial question aimed to elicit the interviewee's identification and characterization of the operational safety event under discussion.

The subsequent question focused on extracting vital information and knowledge pertaining to the diagnosis of the security event. Another question was designed to uncover information and knowledge associated with the intervention or actions taken. Finally, the last question sought to identify factors that either facilitated or hindered the security event. It is important to note that the questions within the CDM Roadmap aimed to capture and extract knowledge relevant to the critical knowledge factors (CKF) axis, which presents a unique challenge, as discussed in the section on critical knowledge.

Table 3 displays the questions, their objectives, and their connection to the CDM, thereby forming the initial version of the instrument.

Table 3: Questions from the CDM Roadmap Developed

Purpose of the question	Questions	Relationship with the steps of the CDM
Interviewee identification	What is your name, job title, and/or role? How many years of experience do you have in this field, both at your current organization and at other companies? Could you provide a brief overview of your daily activities?	----
OSE identification	Could you tell me an episode where your experience helped in solving a problem?	Select incidents. Get an unstructured incident report. Construct the incident timeline.
Diagnosis	How did you realize that the event would be unusual/difficult? What were the primary pieces of information or clues available when you first realized an accident was imminent? What knowledge did you employ to interpret this information?	Identification of the decision point
Intervention	Considering the perception of the event, what action plan was established? What information and critical knowledge were used to develop this plan? How were the necessary skills mobilized for the implementation of the action plan?	Decision point investigation.
Difficult or facilitating factors	Were there any factors that impeded the design or implementation of the action plan?	---

Sources: authors, 2023.

During the third phase, the CDM Roadmap was applied in storytelling sessions involving professionals engaged in oil and gas exploration operations. These sessions took place virtually between 2020 and 2021 as a result of the COVID-19 pandemic. The roadmap served as a guiding framework for non-participant observation during the sessions, which were facilitated by two researchers. The participants were five professionals from diverse roles in the industry, such as engineers, managers, and safety officers. They were encouraged to share stories and insights about potential safety events that could occur on oil production and drilling platforms, while also discussing contextual factors and industry practices. Two additional researchers acted as participant observers and utilized the CDM Roadmap to identify critical knowledge on security events. Subsequently, the observations were validated through interview transcripts. The findings emphasized the significance of identifying and enhancing critical knowledge for fostering resilient responses, including aspects related to formalization, accessibility, and barriers and enablers to knowledge utilization.

During the fourth phase of the CDM Roadmap development process, the initial version of the instrument was evaluated and analyzed based on its application in the previous phase. This stage involved a critical assessment of the instrument's efficacy and identified areas for potential improvement. To accomplish this, validation cycles were conducted involving both researchers and professionals with expertise in complex sociotechnical systems.

Table 4 presents an overview of the validation cycles carried out during this stage, highlighting the key activities and participants involved.

Table 4: CDM Roadmap Validation Cycles

Date	Activity
May/2022	1st validation of the roadmap with researchers
Jun/2022	2nd validation of the roadmap with researchers
Jul/2022	3rd validation of the roadmap with researchers
Aug/2022	4th validation of the roadmap with researchers
Aug/2022	Validation of the roadmap with a professional from the oil and gas industry
Aug/2022	5th validation of the roadmap with researchers

Source: Authors, 2023.

Through each validation cycle, valuable insights and recommendations were incorporated into the development of the instrument. The most notable suggestion for improvement involved separating and distinguishing the Roadmap into two distinct instruments. The first instrument is intended to be utilized in the aftermath of an accident or incident, focusing on understanding the factors that led to the failure. Conversely, the second instrument is designed to be applied in regular work situations, with a focus on identifying successful practices and extracting knowledge that can be utilized to prevent future accidents or near misses. Tables 5 and 6 provide a detailed breakdown of the two disassembled CDM Roadmaps, each tailored to its specific purpose.

Table 5: CDM Roadmap - Positive Perspective

Goal	Question
Interviewee identification	What is your name, job title, and/or position? How many years have you worked in this field, both at your current company and at other companies? Can you provide a brief overview of your daily work activities?
OSE identification	Briefly describes an operational safety event that could have led to a serious accident but did not and why.
Diagnosis	How and why was this event perceived as atypical, outside of "normal work"? What were the main pieces of information (clues) available at that time that allowed for the identification of the operational security event? What knowledge was utilized to interpret this information and generate possible solutions?
Intervention	Has an action plan or similar been established based on the diagnosis/analysis of the event? If so, how and for what purpose? What were the primary sources of information used to define and implement the necessary actions? What were the critical or essential pieces of knowledge required to implement the actions, based on the operational safety event that occurred? How was the mobilization of the necessary skills for the action plan carried out?
Difficult or facilitating factors (resources)	Is there any element or factor that hindered or facilitated the development and implementation of the action plan?

Source: Authors, 2023.

It is important to acknowledge that both Roadmaps incorporate checkpoints for each objective to validate the interviewee's responses. However, due to space constraints, these checkpoints have not been included in the tables.

Table 6: CDM Roadmap - Negative Perspective

Goal	Question
Interviewee identification	What is your name, job title, and/or position? How many years have you worked in this field, both at your current company and at other companies? Can you provide a brief overview of your daily work activities?
OSE ratification that culminated in the accident	Could you describe, in your vision, how the accident happened?
Diagnosis	Did you at any point realize that this was going to be an OSE that would culminate in an accident? If yes: What were the main pieces of information (clues) available at that time that allowed for the identification of the operational security event? What knowledge was utilized to interpret this information and generate possible solutions? What knowledge was utilized to interpret this information? With whom and where were this knowledge? What were the main pieces of information (clues) available at that time that allowed for the identification of the operational security event? If not: When did you realize and/or were informed about the accident? Upon learning about the accident, can you identify any contributing factors that led to it?
Intervention	How was the action plan established based on the perception of the described OSE? Were there any other suggestions to mitigate future accidents that were not implemented? What information and critical knowledge were used to define this objective? How were the necessary skills mobilized to implement the action plan?
Difficult or facilitating factors (resources)	Were there any factors that hindered or facilitated the design or implementation of the action plan?

Source: Authors, 2023

The final step, which will be detailed in the following section, involved the subsequent implementation of the CDM Roadmap in an operational security event, integrating the modifications derived from the validation cycles.

4. Application of the CDM Roadmap

4.1 Context and Description of the Second Application

Considering the revised structure of the CDM Roadmap, which now incorporates distinct sets of questions for examining positive and negative aspects of events, the positive perspective Roadmap was chosen for the second implementation. An operational security event (OSE) was selected, wherein professionals successfully averted a potentially hazardous situation and prevented an accident from transpiring.

This specific OSE was identified during an interview conducted in 2021 by two researchers with a professional from the oil and gas industry. The objective of the interview was to investigate three operations performed on an oil exploration platform: (i) offloading operations; (ii) high-pressure converter operations; and (iii) cargo handling. Additionally, the researchers sought to identify any non-routine situations related to these operations that had a favorable outcome without any accidents. Based on the interview transcript featuring an experienced oil and gas industry professional with over thirty years of expertise, an OSE was highlighted wherein a sailor's foot became entangled in a rope while retrieving the armature cable. A summary of the feasibility analysis scenario where the Roadmap was employed is presented in Table 7.

Table 7: CDM Roadmap Application Scenario

Activity	Description
Complex sociotechnical system	Oil and gas industry
Performed operation	Offloading: is the process of transferring oil or gas from one ship to another
OSE within the operation performed	"when the cable was being collected from the frame, a professional who was working on the operation got his leg caught"

Source: Authors, 2023.

The findings obtained from the application and the subsequent discussions will be presented in the forthcoming section.

4.2 Results and Discussions

The application of the CDM Roadmap was based on an interview transcript with an oil and gas industry professional. It is essential to acknowledge that not all questions were addressed since the CDM Roadmap was not utilized as an interview guide. Table 8 provides the principal evidence pertaining to the set of questions in the CDM Roadmap that adopts a positive perspective.

Table 8: Main Evidence of Application of the CDM Roadmap

Block	Description
OSE identification	*"Within the offloading operation, we were collecting the frame cable, which is the "sanso", between the connections of the two tiles, which makes the mooring between the tiles, and there was a moment when the sailor who was working with me, he went, trying to remove, the cable, which we call it in maritime language, the guy died, when it gets stuck between one leg and the other, so it got stuck there, and he went to hit it with his foot to remove it, something you should never do, the what happened, when he crashed, the cable wrapped around his foot and he went over the winch..."*
Diagnosis	*"So in operation, we will never put our hand, hit the hand, hit with the foot. Because it's very fast, hit the cable is tensioned, as you hit there, it will create flexibility, the first thing it will do is wrap it around your foot, your leg, your hand and you hit everything …"* *"I saw the cable swing, I said (person's name) what are you going to do with that cable there – (person's name) said: No, No, I'm going to tap my foot. But I stayed tuned, I said, look, don't do that, and at that point he started to pull, pulling slowly, because it was a slow operation. And there I became more aware, and my attention divided back and forth, dividing my attention into two radios, so, you get you to feel pressured, whether you like it or not, you are being pressured. When he did it the first time, I said, don't do it, but he didn't appreciate it, it happened again, the cable tensed, he put his foot in ..."*
Intervention	*"So I had at that time other solutions to avoid the problem of cable strangulation on the spool …"* *"But then, at that moment I was very calm, I called the ship's guard. I told them to stop collecting the cable and release the cable, and then, I moved the winch, calmly over here, it got stuck with my foot, I kept turning the winch in reverse, his foot gave way, I went there, I distorted the cable and took him out …"* *"Past experience offshore is a way to bring security home."* *"His approach time is slow, when he reaches 2/3 Miles he comes at 4/5 knots, he doesn't come..."*

Block	Description
	"There are ships that are bow and bow, this ship only has a hose in the flesh, but most of the ships I worked on had two hoses …"
Difficult and/or facilitating factors (resources)	*"... I was wearing headphones talking to a guy in English, giving him an order in Portuguese..."* *"Today there is no exclusive training for this type of work, the training is on the ship itself, in the operation, the younger workers are always accompanying the more experienced ones …"*

Source: Authors, 2023.

The identification of the interviewee and the specific operational security event (OSE) played a crucial role in providing context and assessing the relevance of the situation. Once confirmed, the questioning process proceeded. It is evident that professionals in the industry must possess a substantial amount of technical and procedural knowledge to execute offloading operations successfully. This entails understanding various ship types, equipment, and following step-by-step procedures. However, as evidenced by the Diagnosis and Intervention blocks, the interviewee's extensive field experience proved essential for accurately diagnosing the situation.

The information obtained during the diagnostic phase, particularly regarding meteorological aspects and the interviewee's actions during the activity, proved fundamental in identifying an atypical scenario and formulating an action plan. The interview also shed light on critical aspects, such as communication challenges among workers and the psychological pressure that workers encounter in such scenarios.

5. Conclusion

The main objective of this article was to present and evaluate the development process of the CDM (Critical Decision Method) Roadmap, a tool designed to support the identification and extraction of critical knowledge from operational safety events. The tool aims to assist organizations in learning from past events and improving their responses to future situations. The article emphasizes the positive outcomes of the CDM Roadmap, particularly in refining the instrument and enhancing its effectiveness in steps four and five of the development process. Furthermore, the division of the roadmap into two parts with different perspectives proved beneficial, allowing for more targeted and specific questions regarding the context.

The CDM Roadmap revealed significant insights into critical knowledge and knowledge transfer within organizations. A noteworthy finding was the often tacit nature of critical knowledge for preventing operational safety events, which is predominantly held by individual team members. This highlights the importance of formalizing this knowledge and finding ways to share it within the organization, preventing the loss of valuable information and ensuring that all team members have access to the necessary tools for effective responses. Another crucial finding was the need for specialized training programs for offshore activities. The reliance on observation and conversations with experienced colleagues among newer professionals highlights the significance of structured training to ensure a solid foundation of knowledge and skills for all team members. Lastly, the CDM Roadmap identified barriers that hinder knowledge flow and task execution. By acknowledging these barriers, organizations can take measures to remove them and foster a supportive learning and collaborative environment, thereby enhancing their ability to respond to operational safety events and other challenges. Overall, the CDM Roadmap appears to be a valuable tool for organizations seeking to learn from operational safety events and enhance their resilience. By guiding the identification and extraction of critical knowledge, it facilitates organizations' understanding of the factors that facilitate or hinder resilient responses, enabling them to implement corrective measures.

As a next step in the research, further application of the CDM Roadmap is anticipated, with the interview process being guided by the roadmap itself. Additionally, a potential area for future work would be the development of a roadmap to better qualify the knowledge that arises from the CDM Roadmap, establishing targeted actions for knowledge management (KM).

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GLAM Wikiprojects as a Form of Organizational Cooperation Between Wikipedia and Cultural Institutions

Anna Karczewska
Czestochowa University of Technology, Poland

anna.karczewska@pcz.pl

Abstract. The development of new communication technologies enabled the digitalization of the knowledge resources of cultural institutions all over the world and made them available to a wider audience. This was possible through the cooperation of cultural institutions with Wikipedia's WikiProjects and engagement of the users from numerous countries. It seems important to recognize if this form of cooperation between Wikipedians and institutions is effective and attracts enough participants. The article takes up the subject of the character and effects of this cooperation. The aim of the paper is to study the activity of Wikipedians, including newcomers, in GLAM (Galleries, Libraries, Archives, and Museums) WikiProjects in several language versions of Wikipedia as an open knowledge project. The research questions concerned the characteristics of the activity of Wikipedians in GLAM WikiProjects and the differences between the behaviour of Wikipedians in GLAM WikiProjects in different language versions. The method used in the research is the content analysis, which includes quantitative tools. The author acquired and calculated the data on the activity of GLAM Wikiprojects participants thanks to the Wikipedia *xTools* tool. The calculations were made on participants of GLAM WikiProjects from five language versions of Wikipedia. The main conclusion from the research is that the results of this kind of organization of work, especially in terms of newcomers, are not satisfactory. The most effective participants are the coordinators of the projects or/and the Wikipedians with the highest seniority. Newly acquired participants most often do not continue their activity for long time. However, there are some differences in different language versions of Wikipedia. English one has better results in retaining and engaging new users. What is interesting is that despite the wide popularization and engagement of the GLAM institutions in the collaboration with Wikipedia, there is a relatively low interest of new Wikipedians in GLAM Wikiprojects. In order to reach a successful cooperation, it is significant to improve the effectiveness of welcoming, engaging, and retaining newcomers in the projects. The results may be of use to the practitioners of the virtual communities of practice which focus on creating and sharing knowledge.

Keywords: Cooperation, Knowledge management, Cultural institutions, Online Open source project, Organization

1. Introduction

The tremendous advances in information and communication technologies in recent years have enabled the development of the phenomena of online groups and collectives, which are generally referred to as online communities. Many of these communities have developed their separate cultures, with their own norms and codes of behaviour. A term that is often applied to them, namely, "community of practice", denotes a group of like-minded people (often professionals) whose purpose is to support, learn from and promote mutual understanding through collaboration amongst the electronic group (Wenger 1998). Such a community was formed around the idea of open knowledge resources, i.e. Wikimedia. Wikipedia and its related projects of Wikimedia are one of the public document repositories (PDRs), which are essential resources made available on the Internet. They are maintained by voluntary contributions from readers and users who are not remunerated for their activity in the project (Peddibhotla and Subramani, 2007).

In Wikipedia, the online global encyclopaedia, the creation of articles is organized, among others, in the form of WikiProjects. These are Wikipedia pages (different from article pages) that enable collaboration by providing access to the tools, tasks and goals of the project, as well as discussions focused on coordinating group work. WikiProject user groups operate through the afore-mentioned sites by using various coordination mechanisms to motivate and structure member contributions to create and improve articles related to specific topics (Gilbert et al., 2013, p. 1). WikiProject pages "provide a centralized repository of design tools, tasks, and goals, while also discussion for explicit group coordination" (Gilbert et al., 2013, p. 1). These tools enable the creation of shared awareness of members and non-members by editing articles relevant to the project WikiProject members, working on a narrow specialization, may perceive themselves as experts in their field, which provides them with the identification and motivation to be active in Wikipedia.

Lessig (2009) indicates that there is great creative potential in virtual communities actively involved in the creation of a global culture. Likewise, the amount of digital data created and collected by cultural heritage institutions such as museums, galleries, libraries and archives is constantly growing; many repositories publish data as raw dumps, but often without any structure and semantics, which limits the ability of users to put this information into context. Many institutions also face technical challenges related to the digitalization and

sharing of resources (Nishanbaev et al., 2019, p. 1471). One of the ways of sharing resources in more structured way is the cooperation of cultural institutions with the community centred around Wikimedia.

Relationships between cultural heritage organizations and the Wikimedia communities working on Wikimedia projects date back to the beginning of cooperation with museums and archives, for example with the British Museum in 2010. They are designed to encourage GLAM organizations (Galleries, Libraries, Archives and Museums) to participate in Wikimedia communities of which WikiProjects in Wikipedia are a part. Early GLAM-Wiki partnerships focused on uploading digital content to Wikimedia Commons, placing Wikimedia-appointed experts called Wikipedians in Residence and organizing editathons, namely, collaborative editing actions with experts on Wikipedia (Stinson, 2018, p. 1).

> *In recent years, partnerships with cultural heritage institutions have been changing. For example, libraries are collaborating with Wikimedia communities as part of sharing their digitized resources, which are either in the public domain or made available under an open licence. At the same time, partnerships with specific cultural institutions are being formed around Wikiproject pages. The aim of this article is to examine the activity of Internet users within WikiProjects focused around cultural institutions - GLAMs (Galleries, Libraries, Archives and Museums) in five language versions of Wikipedia: Polish, English, Swedish, Italian and French. The research may be of interest to the theoreticians and practitioners specializing in virtual communities creating and sharing knowledge.*

2. Literature Review

The development of the Internet and new communication technologies has enabled people to collaborate on an unprecedented scale, but the effectiveness rules for organizing such extensive cooperation between people from different cultural backgrounds are not clearly established. Wikipedia is a very effective example of such large-scale, decentralized collaboration. One cannot generalize the terms and conditions of operating from offline to online groups (Choi et al., 2010, p. 1). Therefore, examining the successes and failures of the particular forms of organizing online group collaboration is a particularly important research topic, especially the recruitment and retention of new members for community tasks.

One of the forms of work organization in Wikipedia is that of WikiProjects. In compliance with the approach used by researchers on the subject, one can define WikiProjects as "collections of pages that enable persistent group collaboration around particular subject matter domains or editing tasks" (Morgan et al., 2013, p. 1), collections which have their own code of conduct. Each WikiProject has a dedicated page that exists in a namespace separately from the article content. Participants can join a project by adding their name or nickname to the list of members on the site. WikiProjects provide mechanisms for the self-identification of members - they can place project banners on their user pages. This identification appears to have a positive effect on their level of motivation and editing activity. After joining a Wikiproject, editors dedicate most of their work to creating articles for the project (Kittur et al., 2009).

The GLAM WikiProjects were created in order to coordinate cooperation between cultural institutions and Wikimedia. Cooperation with Wikimedia can take place on several levels. As part of Wikipedia, they may provide resources to help those writing articles and assist with research. Under Wikimedia Commons (free media repository), they may contribute images, video, and other media, as well as meta-data and media descriptions. In cooperation with Wikisource (library of primary sources), the institutions may provide manuscripts for scanning and uploading, while in terms of Wikidata they can integrate Wikidata into existing meta-data projects and donate openly licensed data to Wikidata (https://outreach.wikimedia.org/wiki/GLAM/Get_started).

Thanks to these projects, the Wikimedia community expands the sources of knowledge, learns from GLAM specialists in the field of structuring and protection of knowledge (the so-called Wikipedians in Residence) and gain new editors. On the other hand, the representatives of institutions gain experience in the area of the openness of resources and open cooperation, while also extend their influence on domain-specific knowledge. Residents work with the institution's employees on the digitization and organization of resources that can be made available in Wikipedia, while also organizing events and teaching employees how to cooperate with Wikipedia (Stinson, 2018, p. 17). On a global scale, Wikipedians in residence played formal roles in almost 200 institutions (Wikimedian in residence, 2023). An example of successful cooperation in the Polish version of Wikipedia is a project created with the National Ethnographic Museum that is aimed at documenting the culture of the Carpathian region. The project required in-depth training for the volunteers, and close supervision of the museum staff to ensure that the knowledge of the communities documented was gathered

accurately (Szafran-Kozakowska, Pędzich, and Moraczewska 2016). Skolik (2017) examined in more detail the institutionalization processes in Wikimedia projects in Central-Eastern Europe.

Tharani (2021, p. 1) points out that libraries have started to cooperate with Wikidata, e.g. through WikiProjects, to improve global access to their collections of knowledge. Wikidata has great potential to become a repository for data disambiguation and merging in terms of its sustainable integration with library operations, which remains a huge challenge. McKenna et al. (2018, p. 7) conducted a survey among 185 information professionals from various cultural institutions. The results show that there is a number of usability challenges with Linked Data tools that create barriers for professionals working around Linked Data. Specialized LD tools designed for work and expertise of information professionals can help overcome these problems.

Wikiprojects are a specific form of coordination of online collaboration. Morgan et al. (2013, p. 1) analysed the content of 788 discussions related to working on 138 WikiProjects to recognize the role that WikiProjects play in cooperation with Wikipedia. Their results indicate that WikiProject collaboration is more open and less structured than in other virtual teams, while WikiProjects function more like FLOSS (Free/Libre/Open Source Software) projects than traditional ones. Some WikiProjects are not formally structured and usually consist of a few contributors maintaining project communication who support the work activities of a large number of peripheral contributors (often non-members). Project coordinators are largely self-assigned and their activities are carried out independently (Morgan et al., 2013, p. 9).

Kittur et al. (2008) showed the existence of a relationship between a high level of activity on article talk pages and the quality level of articles in the initial stages of their creation. Viegas et al. (2007) and Schneider et al. (2010) found that discussions on article talk pages focus mainly on coordinating editing individual articles (Morgan et al., 2013). However, the research does not provide clear conclusions regarding the relationship between the coordination work and the quality of articles created. Ung and Dalle (2010) investigated 644 French WikiProjects in terms of the relationship between discussion activity on the project's talk page and editing activity and concluded that the most active discussion participants were not the most active editors. In most cases, a small group of active discussion participants played a major role in organizing the work of a wider group of peripheral members rather than being involved in the larger article content production. These smaller groups of project members may function as a hub acting as facilitators and technical support by answering questions, providing feedback etc. (Morgan et al., 2013, p. 8).

Although encyclopaedia articles are the most noticeable product of the work of Wikipedia editors, they spend a great deal of their time on organizational activities not directly related to extending or writing new articles (Kittur et al. 2007). Their meta-work is very important for supporting the editorial community and maintaining the quality of Wikipedia (Wilkinson and Huberman, 2007). These include activities related to maintenance, administration and quality assurance, such as the prevention of vandalism, mentoring, new user onboarding and conflict resolution (Morgan et al., 2013, p. 1). Usually this work is undertaken voluntarily by more experienced users, whose activity does not require controlling.

Maintaining the efficiency of editorial work is important for the implementation of community tasks. Platt & Romero (2018) analysed the relationship between the structural properties of WikiProject's editor networks and their effectiveness. Their results suggest the potential benefits of decentralized collaboration in smaller, tightly-knit teams.

An insightful study conducted on the users of Amazon.com resources showed the relationship between the type of motivation of the user and the contribution to the discussion on the article. "Self-oriented motives are positively related to the amount of input, while other oriented motives are positively related to the quality of the input" (Peddibhotla and Subramani, 2007, p. 22). Individual motivation includes: self-expression, personal development and personal satisfaction. Other oriented motivations include the following: social affiliation, reciprocity or altruism. The authors suggest that similar patterns occur in other online repositories such as Wikipedia. In turn, Choi et al. (2010, p.115) examined the impact of various socialization tactics on the involvement of newcomers in projects. In the study of online groups, in contrast with studies of offline groups (…), standardized tactics (uniform for all) were negatively associated with the input of a new user, while more personalized tactics were positively associated with it. These results are significant for Wikipedia community striving to acquire and retain new users for its projects.

There are a number of studies on the effectiveness of work within WikiProjects and the retention of new users involved in projects, but that type of research does not focus specifically on the effectiveness of GLAM

WikiProjects. On the other hand, the existing research mainly concerns problems and technical barriers related to library and Wikimedia databases (McKenna et al., 2018; Tharani, 2021). Thus, there is a research gap that this article attempts to fill by examining the activity of Internet users with different language backgrounds within GLAM WikiProjects.

3. Methodology

The aim of the conducted research was to study the activity of Internet users within WikiProjects focused around cultural institutions - GLAMs in five language versions of Wikipedia: English, French, Italian, Polish and Swedish. The research questions asked in the research process were as follows:

Q1: What are the characteristics of the activity of Wikipedians in GLAM WikiProjects?

Q2: Are there any differences between the activity of Wikipedians in GLAM WikiProjects in different language versions?

The method used in the research is the content analysis method, which included quantitative tools. The calculations were made on a random sample of 406 users – the participants of GLAM WikiProjects - from five language versions of Wikipedia. At the first stage of the research, the candidates were chosen from randomly selected Wikiprojects of five language versions. Then, the *xTools* tool was used to generate the data about the activity of selected participants. *XTools* collects statistical data for each registered account on Wikipedia and its related projects. The collected data included the following:

- the number of the articles created by the user in the space of Wikipedia,
- the number of deleted articles created by the user,
- the number of all editions made by the user in Wikipedia,
- the number of editions on the user page discussion (a page discussing the particular user's activity in Wikipedia),
- the number of editions in the "talk" space (discussing the content and quality of articles; interaction with others),
- the number of editions in the "meta" space (discussing the organization of work on Wikipedia),
- date of registration of the user,
- date of last activity of the user,
- ID number assigned to the user while registering,
- number of times thanks was expressed to the user for his input,
- number of times thanks was expressed by the user to other users.

At the second stage of the research, the data was collected and statistically analysed using Statistica software. The ratios of the chosen data was counted as follows: talk editions of a user to all editions of a user and meta editions of a user to all editions of a user to obtain respectively the indicators of the social activity and organizational activity of a user. The seniority of a user was determined by calculating the difference between his first and last edition (in terms of years and days). The Rho-Spearman statistical measure of correlation between variables was used (with the adopted $p<0.05$). Descriptive statistics were also used to investigate the main trends in the behaviour of Wikipedians in GLAM WikiProjects and the differences in their behaviour in different WikiProject language versions.

4. Research Results

In order to answer the research questions, the descriptive statistics concerning the studied variables were counted and analysed. The median and quartiles of the number of created articles were determined. As results from the calculations, a huge number of participants did not create any articles in GLAM WikiProjects or Wikipedia. The details are included in Table 1.

Table 1: Descriptive Statistics of a Variable: Number of Created Articles

	Descriptive statistics					
	N	Median	Minimum	Maximum	Upper quartile	Lower quartile
number of created articles	406	1.0	0.0	11336.0	0.0	22.0

The median of created articles in Wikipedia was only 1. Around 75% of participants created up to 20 articles, including 66% with no more than 6 articles. Almost half of the participants did not create any articles (43%). The results are presented in Figure 1.

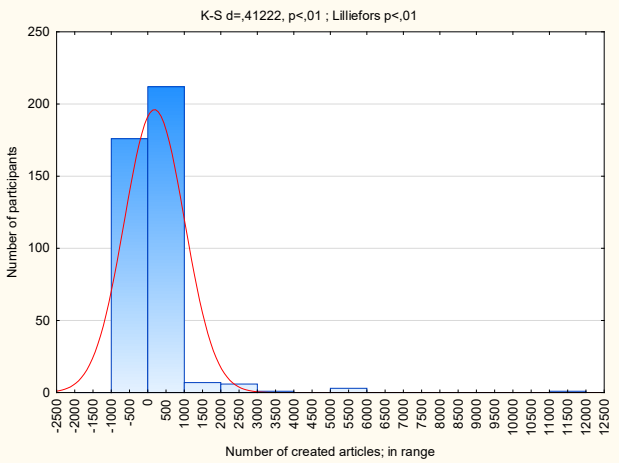


Figure 1: Number of Participants who Created a Particular Number Articles (in ranges)

A similar situation occurred in various language versions of Wikipedia, however there were small differences between them. They are presented in Table 2.

Table 2: Descriptive Statistics of a Variable: Number of Created Articles in Different Language Versions of Wikipedia

	Descriptive statistics					
	N	Median	Minimum	Maximum	Upper	Lower
number of created articles in English	68	9.0	0.0	5938.0	0.0	179.5
number of created articles in French	112	5.5	0.0	11336.0	0.0	98.0
number of created articles in Italian	92	0.0	0.0	2256.0	0.0	3.0
number of created articles in Polish	77	0.0	0.0	5694.0	0.0	6.0
number of created articles in Swedish	58	1.0	0.0	113.0	0.0	3.0

A small amount of articles created for a significant number of users was characteristic for all of the researched language versions. Yet, the median of articles created in English language version was 9, whereas 5.5 in French, while in Italian, Polish and Swedish it was 0. The English language version stood out positively from the rest of the researched versions.

As a second aspect of the trends in activity of Wikipedians in WikiProjects, the seniority and the amount of articles were studied. It turned out that 20% of the most experienced users created 73% of articles. (Table 3).

Table 3: Descriptive Statistics of a Variable: Number of Created Articles in Different Language Versions of Wikipedia

Cumulative percentage of the oldest users	Cumulative percentage of created articles
5%	27.1%
10%	41.9%
15%	56.8%
20%	72.7%
50%	80.0%

The length of activity of a participant in Wikipedia was most often 1.6 years. Only a small number of participants represented the higher ranges of seniority in Wikipedia activity. This trend may be observed in Figure 2.

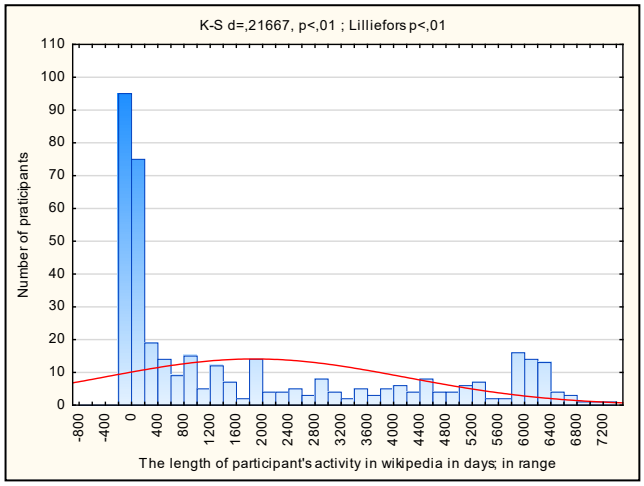


Figure 2: The Length of a Participant's Activity in Wikipedia in Terms Of Days

Moreover, the length of the activity of a participant in different language versions was counted. The differences between versions were noted and are shown in Figure 3.

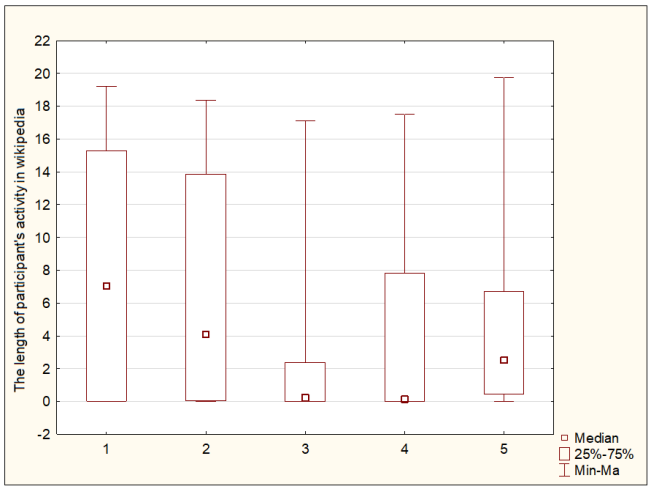


Figure 3: The Length of a Participant's Activity in Years in Different Language Versions of Wikipedia (1- English; 2- French; 3- Italian; 4- Polish; 5- Swedish)

The English language version stands out positively from other versions. The median there is around 7.

Subsequently, the correlations between some variables describing activity in the creation of content and activity in "quality control" space and organizational (meta) space in Wikipedia were calculated and the results are presented in Table 4.

Table 4: Seniority of the Wikipedians and Their Activity in Creating the Content and in the social Spaces of Wikipedia

	ratio of talk editions/all editions	ratio of meta editions/all editions
seniority in years	0.493	0.438

The more experienced a user is, the more he/she controls the quality of the content and organizationally active he is in the space of Wikipedia. With the rise of experience, the self-confidence of the user may rise and the number of interactions with other members of the community increases. In WikiProjects, usually the most engaged participants are those who organized the project and encouraged others to join.

Another analysed variables related to thanks expressed to a user and thanks expressed by the user to other users. They were correlated with the level of activity of a user represented by the number of all his/her editions. The details are included in Table 5.

Table 5: Relations Between the Size of Editions in the Wikipedia and the Numbers of Thanks Expressed and Received by the User

	thanks expressed to the user	thanks expressed by the user
number of all editions	0.685	0.357

Together with the input of the user, thanks expressed to others and by him/her are rising. He/she can feel appreciated and this can enhance him/her to do more work for the community.

The following investigated issue was the relations between the activity in creating articles and the number of deleted articles by users and the activity of a user in "talk" space and "meta" space in Wikipedia, representing "quality control" and the organizational activity of a user (Table 6).

Table 6: Relations Between the Amount of Created Articles and Deleted Articles and the Number of Editions in the "Meta" and "Talk" Space in Wikipedia

	number of editions in the Wikipedia "talk" space	**number of editions in the Wikipedia "meta" space**
number of created articles	0.845	0.766
number of deleted articles	0.732	0.709

The more created articles the user gets, the more activity both in the meta and talk space is shown. The more articles the user creates, the more activity beyond the content creation he/she develops. Likewise, the more deleted editions the user has, the more activity in the "meta" and "talk" space he/she shows. One of the explanations may be that the deleted amount of articles could provoke discussion about the reasons and legitimacy of this decision on the talk pages.

5. Discussion

According to the findings of conducted research concerning characteristics of participants activity in GLAMs, around 75% of participants created up to 20 articles including 66% with no more than 6 articles. Moreover, almost half of the participants did not create any articles (43%). It appears that one of the aims of the GLAM WikiProjects, which is to engage members of cultural institutions in the edition of articles, is only realized to a small extent. Additionally, the participants do not stay in the projects for long – 40% only register and do not show any activity. The length of activity of participants in Wikipedia was most often 1.6 years (median). Only a small number of participants represent more seniority in Wikipedia activity. As Choi points out (2010, p. 1), generally most new users in Wikipedia have made fewer edits over time, but declines in editions have slowed or reversed for those greeted with welcoming messages, offered help, and constructive criticism. Perhaps the way newcomers are invited and treated at the beginning of their activity in GLAM WikiProjects should be analysed and organized in a new way.

Morgan et al. (2013, p. 9) suggest that community builders and coordinators wishing to support WikiProjects or other similar self-organizing volunteer projects in open collaboration systems should provide coordination mechanisms that work not only for large, well-organized groups, but also for smaller, more open and less formal groups. In particular, new users in communities such as Wikipedia face social and technical barriers that hinder the acquisition of knowledge and may discourage them from engaging in a project (Halfaker et al. 2013).

What is interesting in terms of activity of participants from different cultures, among the five studied language versions of Wikipedia, the English version stood out positively in terms of the median of created articles and length of participation time in Wikipedia. It is a popular and well-developed language version, which is edited by people from different cultures and has a long tradition of engaging newcomers. It is worth analysing the practices of English Wikipedia in a qualitative study in order to draw conclusions on what determines its effectiveness in this respect. From the point of view of the retention of new users, it is important to provide various types of means related to navigation in the working environment and provide support in using them. Newcomers may feel overwhelmed by the rules of article creation or the software used (Preece, 2001). The way of expressing criticism and communication style during the quality control process of articles plays a role in the retention of newcomers. Choi et al (2010, p. 107) distinguished seven useful tactics that may increase

the engagement of newcomers: offers of assistance, invitations to join, welcoming messages, requests to work on tasks, constructive criticism, positive feedback, as well as personally related comments.

Another analysed aspect of the activity of WikiProject participants was editing the activity of different types of users – more and less experienced ones. The data indicates that 20% of the most experienced users create 73% of articles. The results are in accordance with the critical mass theory. The critical mass is "a small segment of the population that chooses to make a big contribution to the collective action, while the majority do little or nothing. These few individuals are precisely those who diverge most from the average" (Oliver, Marwell and Teixeira, 1985, p. 524). These disproportions are reflected in subject-related literature. Some studies claim that even 88% of the content is created in Wikipedia by 3% of users (Wikipedia Statistics English, 2023).

In WikiProjects, coordination work and content creation are loosely connected, while editors do most of their work independently of each other (Morgan et al., 2013, p. 8). As correlations calculated in the conducted research shows, the more experienced a user is, the more he/she controls the quality of the content and organizationally active he/she is in the space of Wikipedia (0.493). What is more, the more articles the user creates, the more activity beyond the content creation he/she develops ("meta" space in Wikipedia) (0.766), regardless of the criticism he/she faces (deleted articles). Likewise, the appreciation in terms of thanks expressed for the user's activity is a useful tool that may enhance the motivation for editing (0.685).

Success in online cooperation may be aided by greater decentralization or conformity-based decision-making, while also closer collaboration between smaller teams (Platt and Romero, 2018, p. 10). Hence, the GLAM WikiProjects are a good place in the space of Wikipedia to reach this success, provided some of the problematic aspects of motivating and retention of new users are addressed.

6. Conclusion

The considerations undertaken in this article may make a contribution in recognizing the conditions for engaging new participants in GLAM WikiProjects. The findings of the research indicate that the engagement and retention of new participants is not satisfactory (around 40% do not create content nor stay in the project) and the majority of the content is created by a small percentage of the more experienced users. It seems that the more experience a user gains, the more active in the organizational sphere he/she becomes, while also the more appreciation he/she receives and more motivated he/she becomes.

However, the partnerships between Wikipedia and cultural institutions have brought numerous advantages for both sides, especially in the sphere of sharing resources and expanding mutual knowledge of both sides of the working environment, which is a good start for future cooperation. The limitation of this research concerns the limited scope of language versions of Wikipedia. The future study might expand the number of language versions as well as participants of WikiProjects as well as include qualitative data for more in-depth conclusions.

As McKenna indicates (2018, p. 16), in today's world where the Internet is the first and most often the main place where users look for information, it is essential that cultural institutions make data resources available online. Partnerships with Wikipedia's GLAM WikiProjects play an important role in this process, so it is worth improving the effectiveness of welcoming, engaging, and retaining newcomers in the projects.

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Aesthetics as Knowledge: An Aspect in the Future of KM?

Clemens Kerschbaum
Vienna University of Economics and Business, Austria

Clemens.Kerschbaum@wu.ac.at

Abstract: Knowledge Management (KM) is concerned with the process of capturing, organizing, sharing or utilizing knowledge within an organization. At least since the works of Nonaka and Takeuchi in the 90s, it is a commonplace that the term knowledge, as understood from the perspective of KM, includes both explicit and tacit elements. However, it seems that the focus of many KM initiatives and resulting KM systems still lies mostly on the more explicit facets of knowledge. This has two implications for the field: the first is the obvious danger of confusing knowledge management with information management. The second, which is actually a consequence of the first, is that the focus on technology and explicit knowledge can lead to a diffusion of the field of KM towards more technical domains such as Semantic Web, Knowledge Graphs or Machine Learning and Artificial Intelligence. Those fields have arguably become way more capable of managing explicit knowledge and draw the attention of companies away from 'traditional' KM systems (Davenport, 2015). Thus, in this paper, I argue that KM research should somewhat reconsider its strengths which lie in the management of tacit knowledge that is closely tied to humans. Following this argument, I propose organizational aesthetics as one of many promising avenues for KM research in the future. The idea for this stems from a recent literature review on organizational aesthetics that identifies three perspectives on the topic – one being *aesthetics as a knowledge tool* (Baldessarelli, Stigliani and Elsbach, 2022). According to this perspective, aesthetics is seen as a form of knowledge that originates in sensory perceptions and is permanently deployed in the interaction with organizations, organizational artifacts, and social settings. The present paper hence aims to contextualize the notion of organizational aesthetics for the field of KM to give an overview of the idea and offer a basis for discussion on whether aesthetics could be a useful field for future inquiry.

Keywords: Organizational aesthetics, Tacit knowledge, Future of KM, Perspectives on knowledge, Knowledge creation, Capacity to act

1. Introduction

Most people will, at first glance, not associate aesthetics with knowledge. Probably even less so would practitioners - and maybe even researchers - in the area of Knowledge Management (KM) connect aesthetics to their field of study. However, with this paper I want to break down the concept of aesthetics, and more precisely, *organizational aesthetics* in relation to knowledge types and definitions for the field of KM. As I will show, aesthetics is indeed not so far from knowledge, as understood by the KM community, and it could potentially be an interesting avenue for contemporary and future KM.

I present the idea of aesthetics in the context of KM because I perceive the field as in a state where new streams are being thought of and start establishing themselves. Examples include the notion of *responsible KM* (rKM) that has been coined by Susanne Durst (Durst, 2021) and taken up for example by Raysa Rocha, Florian Kragulj and colleagues (Rocha, Kragulj and Pinheiro, 2022) in the context of wisdom in organizations, or also the movement towards spiritual KM that has been developed by a group of researchers around Constantin Bratianu and Alexander Kaiser (Bratianu, 2015, 2017; Kaiser, 2023) in an attempt to include purpose and personal development into the field of KM. Such initiatives currently broaden the scope of KM that seems to have been very focused on technology and the rather mechanistic 'production' of knowledge, as argued by some.

Already in 2015, Thomas Davenport had written an article for the Wall Street Journal in which he argued that KM had faded since the 2010s. According to his view, the field had over-emphasized those technical facets of KM which led to an abundance of many KM initiatives because people did not change their behavior towards acquiring new, or sharing their knowledge just because a new system has been put in place. In addition, the advance of other technologies such as powerful search engines for external knowledge (e.g. Google) made in-house databases of explicit knowledge relatively obsolete. Ultimately, Davenport argues, despite its technical focus, KM seems to have failed to properly incorporate up-to-date data analytics in its study area which subsequently led to the cannibalization of traditional KM in most cases through more innovative, data driven analytic approaches. Hence, following this view and taking up the recent efforts towards a more human-centered approach to the field of KM, I would like to bring aesthetics to the table in an attempt to get a particularly human aspect back into the loop of knowledge-generation. Why it is particularly aesthetics that I believe in as a potential driver for the relevance of future KM will be shown after a brief introduction to the concept.

2. Organizational Aesthetics

Aesthetics, seen from a scientific perspective, describes all sorts of meaning and knowledge that sensory perceptions elicit in a human being (Baumgarten, 1988; Taylor and Hansen, 2005; Baldessarelli, Stigliani and Elsbach, 2022). Contrary to the terms usage in colloquial language, aesthetics hence includes beauty and art, but is not limited to those concepts. Instead, there are plenty of other aesthetic categories such as, for example, the comic, the sublime, the ugly or the grotesque (Strati, 1992), just to name some. Apart from those explicit categories, aesthetic perceptions can lead to all sorts of perceived meanings. Aesthetic perceptions are by definition highly subjective and always root in direct personal experience. Thus, aesthetics can also been seen as a precursor to knowledge because we first experience the world, and are hence subject to aesthetic perceptions, before we can engage in intellectual and conceptual thought about the world. However, how a person aesthetically perceives an artifact, a situation, or basically anything that can be experienced through the senses, may vary and naturally differs from each individual to another.

With regards to organizations, the scientific field of organizational aesthetics is concerned with the study of organizational life as experienced and understood through the senses of organizational members (Strati, 1992; Gagliardi, 2006). So whenever there are people involved, there will necessarily be aesthetic perception. Thus, the concept has been researched in different fields e.g. in terms of creative work in an architecture firm (Ewenstein and Whyte, 2007), medicine (Creed, Taylor and Hudson, 2020), innovation (Akgün, Keskin and Kırçovalı, 2019) or also in the leadership domain (Hansen, Ropo and Sauer, 2007). According to the respective research interest and the design of a particular study, aesthetics can be seen from different viewpoints.

Reviewing the field, Taylor and Hansen (2005) in this regard identify different scopes of organizational aesthetics: aesthetics understood as an epistemology, as criteria for judgement or as establishing connection (Taylor and Hansen, 2005). A more recent review of empirical studies on the concept has shown that there are three main perspectives on the role of aesthetics in organizations: aesthetics can be understood as (a) a directed stimulus that influences the behavior of people in and around organizations, (b) an open-ended outcome that describes the personal aesthetic experience of a person engaging in, or with an organization and, (c) as a knowledge tool which describes how people make use of their aesthetic perceptions and the meaning therefrom to execute work (Baldessarelli, Stigliani and Elsbach, 2022). What makes aesthetics appealing from an organizational perspective is its holistic character i.e. that it integrates all sensory perceptions and respective meaning generated from them, focusing primarily on the effect – the meaning generated from such perception. Respectively, the notion of aesthetics has been a popular concept in pragmatism especially in William James' and John Dewey's works. Aesthetics later also appears in Chester Barnards seminal "Functions of the Executive" where he builds on pragmatist views to argue that management is to a large part about sensing the organization as a whole, which is best described through the terms "feeling, judgement, sense, proportion, balance or appropriateness" (Barnard, 1938, p. 123). However, notions of aesthetics, although not explicitly stated as such, can be also found in more contemporary management theories such as Scharmer's Theory U (Scharmer, 2007) or the, by now, well-known Design Thinking framework for innovation (Shrivastava et al., 2017).

3. Conceptualizing Aesthetics in Terms of Knowledge Management

The above-mentioned examples already suggest some connection between aesthetics and topics of KM. This section hence takes a more systematic look at the intersection of the two fields.

When looking at the purpose of Knowledge Management that derives from a knowledge-based perspective on organizations, we know that its main goal is to support the combination and application of knowledge that is embedded in culture, identity, routines, policies, systems, documents and individual employees (Grant, 1996; Spender, 1996; Alavi and Leidner, 2001). However, it is not merely the amount of existing knowledge that matters most but the ability to apply it and also the ability to generate new knowledge on top of the existing (Alavi and Leidner, 2001). Let alone, the term knowledge can mean different things depending on the context that it is used in, and accordingly, a multitude of definitions for knowledge have been proposed.

Hence, we first have to locate the term aesthetics within those definitions to create an understanding of how it can be useful for KM.

3.1 Perspectives on Knowledge and the Role of Aesthetics

To this end, I will draw to Alavi & Leidner's (2001) overview of knowledge taxonomies and perspectives on knowledge and reflect their relation towards aesthetics and vice versa. I use their paper as a starting point,

because it is one of the most cited accounts of knowledge definitions in the field and has served as a basis for many consecutive studies on the topic. Table 1 contains an overview of the perspectives on knowledge, enhanced by a brief description of the potential relation to aesthetics. As we will see, some perspectives have a closer connection than others, while some have no noteworthy connection at all. The latter are marked N/A (not applicable) in the table.

Table 1: Enhanced Overview of Perspectives on Knowledge. Adapted from Alavi & Leidner (2001)

Perspective	Explanation	Implications for KM	Relation to Aesthetics
Knowledge vis-à-vis data and information	Knowledge is personalized information on the basis of processed data	KM must expose individuals to potentially useful information	N/A
State of mind	Knowledge is the state of knowing and understanding	KM involves enhancing individuals learning and understanding through provision of information	Enabling individuals to expand personal knowledge through aesthetic experiences
Object	Knowledge as an object to be stored and manipulated	KM must build and manage knowledge stocks	Aesthetic perception of objects (both physical and intangible). Aesthetics as a frame of reference for knowledge
Process	Knowledge is a process of applying expertise. Simultaneous knowing and acting	KM focuses on knowledge flows and the process of creation, sharing and distributing knowledge	Aesthetics as a knowledge tool deployed in organizational work
Access to information	Knowledge is a condition of access to information	KM focus is organized access and retrieval of content	N/A
Capability	Knowledge is the potential to influence action	Building core competencies and understanding strategic know how	Aesthetics as precursor of knowledge, necessary requirement to gather experience and build competence; 'link to the future'

As for the perspectives *Knowledge vis-à-vis Data and Information* and *Access to Information,* there is no noteworthy connection to aesthetics, as those perspectives focus primarily on explicit knowledge and its representation. The knowledge captured within this perspective is rather objective due to its explicit nature, in a sense that the knowledge itself is the same for everybody i.e., it does not include a subjective component in its representational form. Both of these perspectives can be considered rather mechanistic accounts which assume that knowledge can be 'managed' in a technical sense, or that its distribution can be more or less controlled.

Knowledge as a S*tate of Mind* means the sum of what has been perceived, discovered or learned (Schubert et al., 1998 cf. Alavi and Leidner, 2001). Here, especially the aspect of perception establishes a link towards aesthetics. Since aesthetics means the sensorial perception and meaning elicited through such perception, aesthetics is a part of the acquisition of new knowledge. Within this perspective, enabling the acquisition of individual knowledge and its application to organizational domains is focal. Thus, the provision of opportunities for learning are crucial and can be supported through considerations of aesthetics within the process. This could mean to give people as many opportunities as possible to perceive artifacts or situations in the organizational context in order to facilitate their individual learning and broaden their knowledge.

If knowledge is understood as an *object,* it can itself be subject to aesthetic perception. An illustrative example would be an organizational process that is typically considered organizational knowledge. That process can elicit different meanings for organizational members. Some may find it useful and important while others might consider it annoying or outright grotesque. Hence, aesthetics can act as a frame of reference for the evaluation of artifacts that people encounter in an organization (Creed, Taylor and Hudson, 2020) – such as knowledge. Although the authors did not explicitly coin it as such, we see an example for that mechanism of

evaluation in Nonaka & Takeuchi's (1995) Knowledge Creating Company where the authors argue that organizational intention is "*the most important criterion for judging the truthfulness of a given piece of knowledge*" (Nonaka, 1995, p.74). Such intention is heavily value laden and aims to foster commitment towards the organizations purpose that roots in a positive aesthetic evaluation of the organizations purpose (Kerschbaum, 2022).

Knowledge as a process of applying expertise (that includes simultaneous knowing and acting) opens up a broad connection to aesthetics. This view aligns neatly with Baldessarelli, Stigliani and Elsbach's (2022) perspective of aesthetics as a *knowledge tool.* This perspective includes all studies of aesthetics in which aesthetics is deployed in everyday work. The authors differentiate between aesthetics as a knowledge tool to *accomplish creativity* and aesthetics as a knowledge tool *intertwined with organizing.* Here, the first describes the notion that aesthetics is basically activity that creates value. Illustrative examples are the design of new fragrances or the work of a chef when creating dishes and therefore applying his or her senses of smell and taste. In this understanding of aesthetics, the human senses are used to create or manipulate artifacts in order to generate a desired outcome (Baldessarelli, Stigliani and Elsbach, 2022). For the view of *knowledge as a process*, aesthetics can hence be seen as a constant companion in the application, creation or the sharing of knowledge which naturally involves the senses. This is particularly the case with tacit knowledge, a type of knowledge that roots in and is generated through the personal experience of the knower (Polanyi and Sen, 2009).

Knowledge as a capability emphasizes the potential to influence future action, based on the capacity to interpret information that is necessary for decision making (Alavi and Leidner, 2001). This perspective is in line with later accounts of knowledge as a capacity to act (e.g. Sveiby, 2001). Central to this view is the consideration of individuals as "*primary intangible resource"* as Sveiby (2001, p.355) puts it. The view of knowledge as a *capability* or *capacity* to act is often associated to organizational strategy and includes both elements of rational planning and emergent properties (Bolisani and Bratianu, 2017). The emergent properties stem from individual learnings or the experience of an organization's members and pay tribute to the fact that not everything can be rationally analyzed in a complex environments. Accordingly, it has been proposed to rely on forms of knowledge such as *self-transcending knowledge* which can be acquired through high states of attention and being grounded in the present (Scharmer, 2007; Flowers *et al.*, 2011; Kaiser and Peschl, 2020). From the description of such knowledge, it has probably become evident already that aesthetics is at the core of the perception of this knowledge. Apart from its role in strategic decision-making in modern-day complex environments, it has been proclaimed that to a large extent, organizational life as such is built on tacit knowledge and aesthetics respectively (Strati, 1999; Down, Sternberg and Horvath, 2000).

3.2 Aesthetics as Knowledge

From the brief analysis above, we see that aesthetics can play a role for the acquisition of individual knowledge (state of mind-view), the evaluation of existing or new knowledge (object-view), the application of knowledge (process-view) and, integrating those, if we consider individuals as our *primary intangible resource* (capacity to act-view). However, in more explicit accounts of knowledge (data & information-views) it is rather underpart.

Thus, in terms of KM, we can probably focus on the "soft side" of the field that follows the idea that knowledge sharing and creation, and respectively the creation of organizational knowledge is a dynamic process between individuals and the organization (Nonaka, 1995). According to Nonaka and Takeuchi, the root for knowledge creation lies in the transformation of tacit into explicit knowledge and vice versa. They describe the transformation process through a four-phased model (known as the SECI knowledge spiral) that contains knowledge exchange from tacit to tacit, tacit to explicit, explicit to explicit and explicit to tacit knowledge. Yet, an organization, according to Nonaka and Takeuchi, "*cannot create knowledge by itself"* (Nonaka, 1995 p.72)*,* but requires individual *tacit* knowledge for that purpose. Their understanding of tacit knowledge is based on the original conceptual thoughts of Michael Polanyi (Polanyi and Sen, 2009).

Taylor and Hansen (2005) on the other hand argue that aesthetics in organizations finds its strongest voice in exactly that tacit knowledge coined by Polanyi which Nonaka and Takeuchi see as a basis for knowledge creation in the firm. In fact, Taylor and Hansen (2005) mention tacit knowledge when they speak about aesthetics as an epistemology. They state that tacit knowing corresponds roughly to sensory/aesthetic knowing and is commonly juxtaposed to explicit/rational knowledge.

Going into detail in Polanyi's original argument, he describes that tacit knowledge roots in sensory perceptions that, altogether, elicit a particular meaning. However, only through that elicited meaning, we can even think

about what perceptions elicited that meaning, an insight that manifests in the famous quote that *"we can know more than we can tell"*. To illustrate that point, Polanyi gives the example of humans' ability to recognize physiognomy on a face: we can recognize it, but it is almost impossible to tell what led us to the perception. Furthermore, only through the meaning i.e. the particular facial expression and mood, can we even think about the features of the perception that made us perceive that particular meaning (Polanyi and Sen, 2009, pp.12). The same concept applies in many other activities that involve skill or ability, from someone riding a bicycle to a surgeon performing a complicated surgical procedure. This ultimately leads to the conclusion that "our body is the ultimate instrument of all our external knowledge […]. And, we are *relying* on our awareness of contacts of our body with things outside for *attending* to these things." (Polanyi and Sen, 2009, pp.15).

Yet, identifying the features that led us to some particular meaning is usually not and end in itself but a means to understand the comprehensive entity they constitute. Put differently, according to Polanyi, it would make no sense to analyze every entity towards its constitutive elements in all detail. Doing so, could even destroy our tacit (holistic) understanding of complex matters (Polanyi and Sen, 2009, p.18).

This line of argumentation explains why tacit knowledge is so important for organizations - because it enables the understanding organizational issues in their full complexity. It allows an understanding of situations, contexts or problems that can hardly be depicted in a reductionist, analytical manner let alone be understood or solved through analytical means. Aesthetics, in that regard, hits exactly the same notch as it emphasizes the holistic meaning that arises from all sensory perceptions.

Strati (2016), coming from the field of organizational aesthetics explains the roots of aesthetics in a philosophical sense as (a) an antithesis to Cartesian rationality, (b) the sensitive judgement that evaluates feelings etc., and (c) the aesthetic judgement of something being perfect or imperfect (taste). To all of which the act of perceiving is a central element. He argues that aesthetics in organizations takes into account (amongst others) the importance of the human person in the process of organizational knowledge, the corporeality of personal knowledge in organizational life and the socially constructed character of aesthetic knowing in organizational settings. Thus, for organizational learning – and this will also apply to KM – Strati (2016) argues that the generation of knowledge cannot rely solely on the translation of all knowledge into "cognitive knowledge" (explicit knowledge in KM terms). Instead (citing Polanyi) one should take account of tacit knowledge, that is the awareness of knowing how to do something without being able to tell why or how, for which the aesthetic understanding is fundamental. Strati then proceeds to identify tacit knowledge as the common ground between Organizational Learning and organizational aesthetics (Strati, 2016).

To conclude the section on tacit knowledge and organizational aesthetics, we can see a considerable overlap of the two fields. Yet, to my personal understanding, from the literature, it is not becoming entirely clear which relation the concepts actually have. Indeed, both concepts are concerned with inexplicable types of knowledge that require subjective, personal experience and after all appear very similar. What aesthetics adds however, is the criteria for judgement on the basis of organizational knowledge which is "*personal and collectively socially constructed at once"* (Strati, 2016, p. 4). This insight takes into account, the socially constructed taste of individuals who prefer some things, situations, styles, appearances, etc. over others on the basis of their previous experiences in society as such. Thus, especially *organizational* aesthetics adds a more collective flavor to tacit knowledge in an organizational context (Erden, von Krogh and Nonaka, 2008), making it an interesting concept to address calls from contemporary KM ideas, like those illustrated in the introduction.

4. Findings and Conclusion

The first insight we can draw from this brief overview, is that the more mechanistic the definition of knowledge, and with it the more technical the management of such knowledge is, the fewer are the points of contact with aesthetics. This is no surprise, because when knowledge is seen as *access to information* or *personalized information on the basis of structured data*, it is well feasible to make it explicit and describe its structure. Such definitions of knowledge put less emphasize on the tacit component of knowledge that is highly subjective and inexpressible.

Conversely, the strongest tie between KM and (organizational) aesthetics can be found in those approaches that assert high value to individual, subjective knowledge.

When looking deeper into the notion of individual knowledge, in particular tacit knowledge, we find that this knowledge roots in subjective personal experience, which is very similar to, and in part also building on the concepts of aesthetic perception and organizational aesthetics. From the descriptions and definitions in the literature, the concepts appear even so similar that it may be questionable, what the actual differences are.

This would be the first interesting area for further research that I would like to point out. So far, from my experience with both fields, my assumption is that conceptually, tacit knowing and aesthetic knowing appear almost identical in its structure and epistemic roots. However, the difference seems to lie in the aims of the concepts: (organizational) aesthetics is much more about a holistic perspective on organizations (Strati, 1992) and their meaning to us. Aesthetics also has a different "flavor" in that it is about the coherence of a given system (be it a thing, a visual image, a situation or an organization as a whole). This includes the element of connection that manifests in the feeling of *'belonging to'* a system instead of just being *in* a system (Ramirez, 1991). Tacit knowing on the other hand has less of a systemic orientation but rather addresses the individual *knowing* of skills and the capacity to find and solve ill-defined problems.

By any means, if we seek to expand our knowledge of organizations in general, and also facets of particular organizations, we might want to consider aesthetics as an additional source for valuable insight. The knowledge that aesthetics promises, concerns in particular knowledge about belonging to a system or what fits or does not fit into a given system, context or organizations respectively.

From the perspective of KM we could inquire into aesthetics by asking (for example) questions about how to implement a particular aesthetic, how to describe such an aesthetic, how to sensitize people for aesthetic perceptions or how to enable meaningful experience in an organizational context. Knowledge derived from aesthetics could be especially beneficial to deal with uncertainty (Kerschbaum, 2022) and to develop an organizations intention, vision (Nonaka, 1995; Nonaka and Takeuchi, 2021) but also to influence an organizations shared frame of reference to facilitate change (White, 1996).

Yet, the big question in the end is, whether these questions are (still) in the scope of KM, and will hence be an area of interest in the future. Is it just the *management* of knowledge (providing ideal solutions for a mostly given problem) and the focus on making knowledge tangible, or is it rather about *facilitating* holistic knowledge to lead innovation – the appreciation of a sense of *responsibility for the pursuit of a hidden truth, which demands his services for revealing it* (Polanyi and Sen, 2009, p. 25)*,* that drives the field of KM in the future?

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Knowledge Sharing and Service Innovation in Academic Libraries

Omar Khalil[1] and Hatem Khalil[2]
[1]Kuwait University, Kuwait City, Kuwait
[2]National Authority for Social Insurance, Hurghada, Egypt

omar.khalil@ku.edu.kw
hgkhalilk@yahoo.com

Abstract: Innovation is becoming a survival strategy for academic libraries, which strive to preserve their relevance and contribution. Knowledge sharing (KS) is believed to be an important factor in creating innovative capabilities and improving innovation. Yet, only scant empirical research has investigated the possible effect of KS on service innovation (SEI). This study adopted a research model to analyze the effect of KS on SEI as well as the mediating effects of information technology innovation (ITI) and management innovation (MIN) on the relationship between KS and SEI. The results are derived using a data set from two large academic libraries in Egypt. Although KS has a significant total effect on SEI, its role in augmenting SEI is only secondary since it depends mainly on the mediating roles of ITI and MIN. These results are interesting because they deviate from the assumptions and results of many previous studies on KS and SEI.

Keywords: Service innovation, Knowledge sharing, IT innovation, Management innovation, Academic libraries

1. Introduction

Academic libraries have recently experienced immense pressure to maintain their value and service to user communities (Brundy, 2015; Yeh and Walter, 2017). With the emergence of numerous information technology (IT)-related innovations, the transition to digital services, and increased demands for new services, users have been abandoning academic libraries (Islam, Agarwal, and Ikeda, 2017). Hence, academic libraries consider service innovation (SEI) a strategic imperative for sustaining value and transforming their service in the emerging digital environment (Li, 2006; Islam, Agarwal, and Ikeda, 2017; Goddard, 2020).

However, the extant literature recommends knowledge sharing (KS) as an important factor influencing innovation capabilities and innovation performance (e.g., Darroch and McNaughton, 2002; Kaewchur, Anussornnitisarn, and Pastuszak, 2013; Pacios, 2020). KS presumably increases accessibility to new knowledge, improves decision-making, and augments innovation capability (Nonaka, Von Krogh, and Voelpel, 2006). Yet, research on innovation in academic libraries is scattered (Brundy, 2015), and quantitative studies investigating KS and innovation services in libraries are limited (Islam, Agarwal, and Ikeda, 2017).

This study proposes that KS may not necessarily improve SEI if it doesn't simultaneously improve IT innovation (ITI) and management innovation (MIN) (Darroch and McNaughton, 2002). It adopts a research model to hypothesize and test the mediating effect of ITI and MIN on the relationship between KS and SEI in academic libraries. The results of this research will provide empirical evidence that contributes to the growing body of knowledge on KS and innovation and help academic library leaders chart directions for improving service innovation (Brundy, 2015).

2. Theoretical Background

Damanpour and Aravind (2012) classify innovation into technical and non-technical categories. The non-technical innovation includes the overlapping MIN and administrative innovations (Birkinshaw, Hamel, and Mol, 2008; Khosravi, Newton, and Rezvani, 2019). Technical innovation refers to product, service, or process innovations (Walker, Damanpour, and Devece, 2011; Damanpour, 2014). In this study, ITI is considered a technological innovation, which denotes the adoption of advanced information technologies and systems to significantly improve organizational processes, management practice (e.g., MIN), and organizational outcomes (e.g., SEI). Innovation, particularly SEI, is central for academic libraries to continuously grow and survive (Li, 2006; Vaughan, 2013; Brundy, 2015; Islam, Agarwal, and Ikeda, 2017; Yeh and Walter, 2017). SEI in academic libraries may include changing the existing library service programs in response to the changing needs of users, introducing new IT-enabled service programs, and presenting new services that support new paradigms of teaching and research (Walter and Lankes, 2015).

KS is viewed as the process of transferring experience and organizational knowledge to business processes through communication channels between individuals (Oyemomi, Neaga, and Alkhuraiji, 2016). KS is an essential process for innovation. Through KS, employees can mutually exchange their knowledge and contribute to innovation (Ye, Liu, and Tan, 2021). Besides, through interaction, modification, and common consensus, an idea

or concept transforms into a different innovative idea, and the knowledge grows in a spiral cycle that helps boost innovation performance (Wang et al, 2021). Academic librarians could generate creative and implementable SEI ideas based on organizational knowledge and knowledge from direct user contact. Although KS is assumed to play a significant role in SEI generation and improvement, we argue that this role could be augmented and mediated by ITI and MI.

ITI includes the creation or use of new technologies to facilitate and provide services to customers (De Vries, Bekkers, and Tummers, 2016). The service innovation capability of a library depends on its employees' and users' knowledge and skills, culture, IT adoption, and routines for new service development (Islam, Agarwal, and Ikeda, 2017). The innovative use of IT capabilities could, and has, transformed library services from traditional services (e.g., card catalogs, printed books and periodicals, bibliographic instruction, in-person, or face-to-face reference) to new services and delivery modes such as electronic collections (e.g., e-books, e-journals, and databases), virtual reference services, and other online services. Academic libraries need to continue exploiting new IT systems to offer services in innovative ways to meet the changing needs of users (Moyo, 2004).

MIN denotes the development and use of new approaches for performing the work of management, new organizational strategy and structure, and new processes that produce changes in the organization's managerial procedures and administrative systems (e.g., Birkinshaw, Hamel, and Mol, 2008; Damanpour and Aravind, 2012; Damanpour, 2014; De Vries, Bekkers, and Tummers, 2016). MIN presents a distinct departure from traditional management principles, processes, and practices to the establishment of new management practices intended to enhance organizational performance (Mol and Birkinshaw, 2009). To facilitate SEI, managers should be innovative leaders who foster an innovation-supportive culture, tie performance evaluations and rewards to innovation outcomes, and create dedicated innovation teams with high levels of decision-making autonomy (Yeh and Walter, 2017).

3. Research Model and Hypotheses

3.1 Research Model

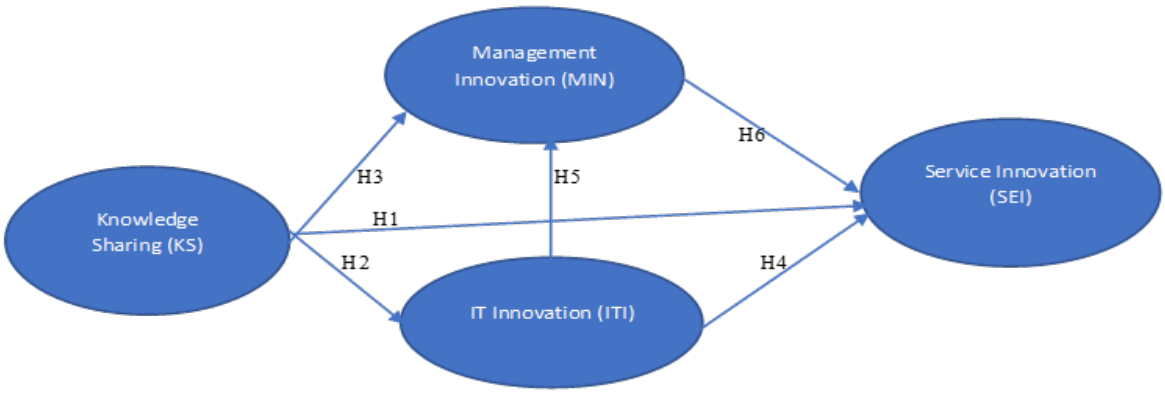


Figure 1: The Research Model

Figure 1 depicts the research model. The model has been constructed based on our review of the relevant literature. The model examines the possible influence of KS on SEI and evaluates the mediating roles of MIN and ITI in the relationship between KS and SEI.

3.2 Research Hypotheses

3.2.1 Knowledge sharing (KS) influence

The extant literature suggests a strong link between KS and innovation performance in organizations (e.g., Kamaşak and Bulutlar, 2010; Wang and Wang, 2012; Saenz, Aramburu, and Blanco, 2012; Kaewchur, Anussornnitisarn, and Pastuszak, 2013; Podrug, Filipovic, and Kovac, 2017; Pacios, 2020; Goddard, 2020). As such, innovation depends on KS (Castaneda and Cuellar, 2020). Although the results of the scanty research on the relationship between KS and SEI in academic libraries are inconclusive (e.g., Islam, Agarwal, and Ikeda, 2017), we predict KS will influence SEI in the investigated academic libraries.

H1: Knowledge sharing (KS) has a positive effect on service innovation (SEI).

Numerous studies (e.g., Davison, Ou, and Martinsons, 2013; Witherspoon et al, 2013; Norek, 2013; Ibrahim, Mohamad, and Shah, 2020; Yepes and López, 2023) report assumptions and results in support of a directional relationship from IT to KS. However, we propose that KS is a likely antecedent of ITI. Since KS is a social and organizational process, it arguably influences ITI. A fitting human resources practice in an organization could create a commitment-based environment and establish an appropriate organizational social climate (Nahapiet and Ghoshal, 1998), which motivates employees to work together and share knowledge. This, in turn, may drive the need to adopt a contemporary IT infrastructure to facilitate KS (Collins and Smith, 2006). Although the literature is short on empirical evidence on the effect of KS on ITI, we propose that KS will influence ITI.

H2: Knowledge sharing (KS) has a positive effect on IT innovation (ITI).

Mol and Birkinshaw (2009) underline the importance of knowledge sources as stimuli for the introduction of new management practices. In addition, resource-based and knowledge-based views claim that organizations with large stocks of resources and knowledge are more likely to successfully introduce new MIN (Mol and Birkinshaw, 2009). Also, knowledge management (KM), which aims to acquire, share, use, and develop knowledge (Chang and Lee, 2008), and organizational learning, which allows the development, acquisition, and transformation of knowledge, should help develop novel ideas for management practice (Camisón and Villar-López, 2011; de Souza Bermejo et al, 2015; Khosravi, Newton, and Rezvani, 2019). Hence, we predict that KS will influence MIN in the investigated academic libraries.

H3: Knowledge sharing (KS) has a positive effect on management innovation (MIN).

3.2.2 IT innovation (ITI) influence

Effective utilization of ITI (e.g., communication infrastructures, groupware, e-mail, document management, data warehousing, workflow software, decision support systems, portal sites, social networks, on-line knowledge sharing, and discussion support systems) enables employees to interact and share knowledge and information, which could in turn influence service or product innovation (e.g., Pérez-González, Trigueros-Preciado, and Popa, 2017; Islam, Agarwal, and Ikeda, 2017). Also, information synergy and IT capability can enhance an organization's capacity to generate new ideas and improve organizational performance (Kaewchur, Anussornnitisarn, and Pastuszak, 2013). Hence, we predict that ITI will influence SEI in the investigated libraries.

H4: IT innovation (ITI) has a positive effect on service innovation (SEI).

The introduction of new IT and new information systems for management purposes is an important dimension of MIN (e.g., Walker, R. M., Damanpour, F., and Devece, 2011; Hecker and Ganter, 2013; Kraśnicka, Głód, and Wronka, 2016) and a source for innovation (Borins, 2001). In addition, Hecker and Ganter (2013) believe that KS and organizational practices evolving from the use of modern IT are important elements of MIN. Similarly, Černe, Jaklič, and Škerlavaj (2013) denote that KS improves MIN by utilizing IT systems to facilitate information and knowledge flow. Therefore, we predict that ITI will influence MIN in the investigated libraries.

H5: IT innovation (ITI) has a positive effect on management innovation (MIN).

3.2.3 Management innovation (MIN) influence

MIN practice provides valued working practices and organizational flexibility that could expand the ability to adopt new processes or technological innovations (e.g., products and services) (Le Bas, Mothe, and Nguyen-Thi, 2015; Kraśnicka, Głód, and Wronka, 2016; Khosravi, Newton, and Rezvani, 2019). Moreover, innovative managers can inspire their employees to be innovative and to search for new ideas, products, services, or processes (Mol and Birkinshaw, 2009; Cavagnoli, 2011; Hollen, Van Den Bosch, and Volberda, 2013). Yet, empirical studies on the relationship between MIN and SEI are sparse (Khosravi, Newton, and Rezvani, 2019). We propose that MIN will influence SEI in the investigated libraries.

H6: Management innovation (MIN) has a positive effect on service innovation (SEI).

4. Research Method

4.1 Measurement

The constructs in the research model were operationalized and measured using multi-item reflective measures, based on measures previously used in the relevant literature (e.g., Yu et al., 2010; Walker et al., 2011; Islam et al. 2017; Awais and Ameen, 2019; Gunjal, 2017)) and revised as necessary. The measuring scales include KS (10

items), ITI (9 items), MIN (8 items), and SEI (10 items). Examples of KS items are "I share my knowledge and service-related lessons learned with my colleagues across the library" and "I share my knowledge on users' needs and ideas for service improvement with my colleagues through conversations and dialogues." Examples of ITI items are "The library provides links to full-text search results through its online catalog" and "The library has a technical support staff that helps initiate and provide first-rate services." Examples of MIN items are "The library management adjusts its organizational structures on a regular basis" and "The library administration occasionally changes policies to enhance library services." And examples of SEI include "The library offers new services as a result of users' needs analysis" and "The library innovates new services and programs through knowledge sharing among its staff." All items were measured using five-point scales, ranging from "1" (strongly disagree) to "5" (strongly agree).

4.2 Population and Sample

The population for this research includes only the librarians who are directly involved in providing library service in the academic library at Cairo University (110 employees) and the academic library at American University (89 employees). A survey was developed to collect the data using a non-probability convenience sample. A total of 105 complete responses were collected (55 responses from Cairo University and 50 responses from the American University), with a response rate of 52.7%.

4.3 Sample Profile

The female informants in the sample are 50.5% (n = 53), and 90.5% of the informants hold bachelor's or higher degrees. In addition, 42.9% have degrees in library and information sciences, 27.6% are managers, and 53.3% have at least 15 years of experience.

5. Analysis and Results

We first performed a preliminary evaluation of the measurement model via a confirmatory factor analysis to describe relationships between hidden variables of the model (Wu et al, 2016) and to verify the reliability and convergent validity of the constructs. Table 1 summarizes the resultant measurement model. Notably, some items have been excluded to enhance the reliability of the measurement model. In addition, the SEI construct analysis reveals the emergence of two factors: 'personalized service innovation' (PSI) and 'web-enabled service innovation' (WSI). The results suggest that, aside from WSI, all constructs in the model have adequate reliability ($\alpha \geq 0.70$), convergent validity (AVE ≥ 0.50), and factor loadings (≥ 0.60; Hair, Barry, and Rolph, 2010).

Table 1. The Confirmatory Factor Analysis Results

Dimensions	Factor Loading	Reliability Coefficient (α)	Average Variance Explained (AVE)
Knowledge Sharing (KS)		0.800	0.636
KS2	.772		
KS3	.786		
KS4	.766		
KS7	.661		
Management Innovation (MIN)		0.912	0.742
MIN3	.821		
MIN4	.724		
MIN5	.812		
MIN7	.701		
MIN8	.807		
IT Innovation (ITI)		0.865	0.656
ITI3	.625		
ITI4	.639		
ITI5	.787		

Dimensions	Factor Loading	Reliability Coefficient (α)	Average Variance Explained (AVE)
ITI6	.706		
ITI7	.682		
Personalized Service Innovation (PSI)		0.807	0.640
SEI1	.721		
SEI2	.748		
SEI4	.627		
SEI5	.638		
Web-Enabled Service Innovation (WSI)		0.677	0.608
SEI7	.645		
SEI8	.731		
SEI9	.751		
OVERALL MODEL		0.926	0.691

We revised the research model and hypotheses to reflect the results of the confirmatory factor analysis. Table 2 displays the original and revised research hypotheses.

Table 2: The Original and Revised Research Hypotheses

Original Hypotheses	Revised Hypotheses
H1: Knowledge sharing (KS) has a positive effect on service innovation (SEI).	H1a: Knowledge sharing (KS) has a positive effect on personalized service innovation (PSI). H1b: Knowledge sharing (KS) has a positive effect on web-enabled service innovation (WSI).
H4: IT innovation (ITI) has a positive effect on service innovation (SEI).	H4a: IT innovation (ITI) has a positive effect on personalized service innovation (PSI). H4b: IT innovation (ITI) has a positive effect on web-enabled service innovation (WSI).
H6: Management innovation (MIN) has a positive effect on service innovation (SEI).	H6a: Management innovation (MIN) has a positive effect on personalized service innovation (PSI). H6b: Management innovation (MIN) has a positive effect on web-enabled service innovation (WSI).

Table 3 provides descriptive statistics for the research variables. Overall, and based on the means and the related p-values, the respondents agree that they share significant knowledge and experience with colleagues, their libraries adopt various ITI innovations, their administrators adopt diverse forms of managerial innovations, and their libraries provide user communities with both innovative personalized service (PSI) and innovative web-enabled service (WSI).

Next, we used the Partial Least Squares Sequential Structural Modeling (PLS-SEM) method to further verify the measurement model fit, evaluate a predictive model for the data set, and test the research hypotheses. Hence, we utilized the Smart PLS 4.0 software, and the bootstrapping method run by 5,000 subsamples (Sarstedt et al, 2016) to assess both the measurement and structural models.

Table 3: Descriptive Statistics

	Min	Max	Mean	Std. Dev	t-Value	P-Value
KS	1.00	5.00	3.9281	.64014	14.856	<.001
MIN	1.00	5.00	3.6935	.80901	8.783	<.001
ITI	2.60	5.00	4.2079	.63893	19.373	<.001
PSI	2.01	5.03	3.9193	.67606	13.934	<.001
WSI	1.61	5.00	4.0529	.63537	16.981	<.001

Note: The difference from 3 (the midpoint of the scale) is significant at $p \leq 0.05$.

5.1 Assessment of the Measurement Model

The measurement model assessment further verifies the reliability and validity of the constructs. The assessment entails examining the internal consistency, reliability, convergent validity, and discriminant validity of the adapted measures (Marcoulides and Saunders, 2006). Table 4 summarizes the results. Except for WSI, all alpha coefficients fall within the recommended range (0.70–0.95; Hair et al, 2019). Also, each construct explains greater than 50% of the indicator's variance, thus providing acceptable item reliability (Hair et al, 2019; Sarstedt, Ringle, and Hair, 2021). All composite reliability coefficients are well above the recommended threshold (≥ 0.50; Hair et al, 2019), which demonstrates the reliability of the adapted measures. We also assessed the convergence validity of the measurement model by examining the AVE values, and all AVEs are above the recommended threshold (≥ 0.50; Hair et al, 2019). We finally assessed the discriminant validity of the measures following Fornell and Larcker's (1981) criterion. The results indicate the existence of discriminant validity since the square root of the latent variables' AVEs is greater than the correlation that each construct has with the other constructs.

Table 4: Construct Reliability and Validity

Constructs	Cronbach's Alpha (α)	Composite Reliability	Average Variance Extracted (AVE)
KS	0.808	0.815	0.636
MIN	0.913	0.915	0.741
ITI	0.868	0.875	0.655
PSI	0.812	0.818	0.640
WSI	0.677	0.708	0.606

5.2 Assessment of the Structural Model

We adopted procedures that have been specifically designed to assess the adequacy of the prediction-oriented PLS-SEM models (Shmueli et al, 2016) to assess the structural model. Figure 2 depicts the consequential model, which shows the direct effects of the different paths. The R^2 values for the two endogenous variables in the model (PSI and WSI) are 0.468 and 0.367, respectively. These results suggest that the model has moderate explanatory power as well as a modest predictive relevance (Hair, Barry, and Rolph, 2010). In addition, since the SRMR index is 0.078 (< 0.08), the model is adequately fitted, although the NFI index (0.726) is relatively lower than the recommended threshold (≥ 0.90; Henseler, Hubona, and Ray, 2016).

5.3 Testing the Hypotheses

Table 5 depicts the causal relationships (paths) between the exogenous and endogenous variables in the structural model, along with It also shows the total path coefficients, t-values, and p-values. The total path coefficients, which determine the magnitude of the direct and indirect effects that the exogenous variables have on the endogenous variables, are used to test the revised research hypotheses. Although KS has non-significant direct effects on PSI and WSI, its significant total indirect positive effects make its total positive effects on PSI and WSI significant. KS also has significant positive effects on ITI and MIN. In addition, ITI has significant positive effects on PSI and MIN. MIN, however, has a significant positive effect on PSI and a non-significant positive effect on WSI. These results support the acceptance of all hypotheses except H6b.

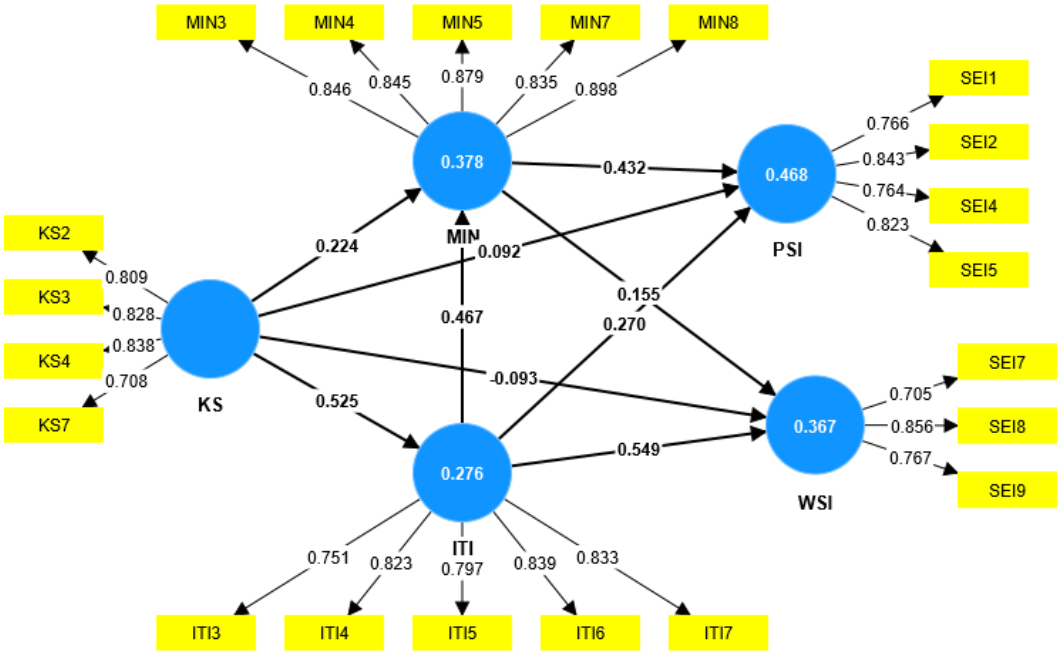


Figure 2: The Consequential Model

Table 5: Path Coefficients

Paths	Path Coefficient	t-Value	P-Value	Significance*	Hypothesis
Total Effects:					
KS -> PSI	0.437	4.235	0.000	S	H1a
KS -> WSI	0.268	2.4	0.016	S	H1b
KS -> ITI	0.525	6.076	0.000	S	H2
KS -> MIN	0.469	4.542	0.000	S	H3
ITI -> PSI	0.472	5.133	0.000	S	H4a
ITI -> WSI	0.622	5.818	0.000	S	H4b
ITI -> MIN	0.467	5.029	0.000	S	H5
MIN -> PSI	0.432	4.341	0.000	S	H6a
MIN -> WSI	0.155	1.387	0.166	NS	H6b

* S = Significant, NS = Not Significant

6. Discussion

Our results disclose that the investigated libraries provide noteworthy innovative services (SEI) to their user communities. More specifically, they offer personalized service innovation (PSI) and web-enabled service innovation (WSI). The PSI includes new services and programs (e.g., digital publishing for various information sources, seminars, and workshops on online and library search, etc.) for different user groups based on the analysis of users' needs and the sharing of knowledge among staff members. The WSI includes IT-enabled services made available to users via the web (e.g., service to scientific research projects, use of RSS to inform users about new collections, reservation of library resources and collections, inter-library loan service, etc.). In addition, the results demonstrate that KS, MIN, and ITI are important drivers of the two types of service innovation (PSI and WSI). Collectively, KS, MIN, and ITI explain 47% and 37% of the variances in PSI and WSI, respectively. Subsequently, our research model has moderate explanatory power and modest predictive relevance.

Notably, the employees in the investigated libraries reportedly share personal and organizational knowledge via different communication channels; and KS has significant total effects on PSI and WSI, although the direct effects

of KS on these two types of service innovation are insignificant. In particular, the significant total indirect effect KS has on PSI occurs through the significant indirect specific effects of the KS-ITI-PSI and KS-ITI-MIN-PSI paths, and the significant total indirect effect that KS has on WSI occurs through the significant indirect specific effect of the KS-ITI-WSI path. Compared to MIN, ITI plays a stronger mediating role between KS and service innovation (i.e., PSI and WSI).

These results, however, challenge the assumption of the existence of a direct relationship between KS and organizational performance (e.g., SEI) reported in numerous previous studies. They confirm that KS plays only a supporting role in generating service innovation. Sharing knowledge and experience among employees improves service innovation only when it brings about improvements in other innovation areas such as MIN and ITI practices. This supporting role of KS in stimulating service innovation substantiates Darroch and McNaughton's (2002) conclusion that KS provides only indirect support for innovation.

7. Implications

The results of this study have both theoretical and practical implications. As to the theoretical implications, this study supplements the scanty empirical research on innovation, particularly in service organizations. Its empirical results contribute to the growing body of knowledge on innovation management and its influencing factors in academic libraries. Although KS has been recognized in the literature as a significant contributor to product/service innovation development, it is important to recognize that the role of KS is only secondary and is contingent on whether it simultaneously contributes to the development of other innovations (e.g., ITI and MIN) in an organization. This is an intriguing result since it departs from the assumptions and results of previous studies on KS and SEI. In addition, innovations (e.g., ITI, MIN, and SEI) are seemingly interrelated, and the relationships among innovation types are likely bi-directional. Researchers may therefore further investigate and verify the assumed two-way relationships among innovation types and between innovation types and KS in different settings.

Libraries need to develop innovation strategies bearing in mind that innovations (e.g., managerial, IT, service, process, social, etc.) are interrelated. If they seek to improve service innovation to meet the demands of their users, they should simultaneously promote their management and IT innovations and encourage their employees to share more knowledge. Hence, the innovation strategy for a library should guide the preparation and execution of plans designed to develop an innovation portfolio suitable to the library's mission and objectives. The plans should be backed up with the requisite human resources and IT infrastructure (Vaughan, 2013). Senior managers should manage the human resources allocation and training processes to create a team of "movers and shakers" (Yeh and Walter, 2017). Senior managers should manage the human resources allocation and training processes to create a team of "movers and shakers" (Yeh and Walter, 2017), who willingly share knowledge and experience among themselves and with users.

8. Conclusions

Knowledge sharing (KS) is viewed as an important factor in creating innovative capabilities and improving innovation (Kaewchur, Anussornnitisarn, and Pastuszak, 2013; Pacios, 2020). Yet, quantitative studies investigating KS and service innovation (SEI) in academic libraries are limited (Brundy, 2015; Islam, Agarwal, and Ikeda, 2017), and information on the possible interdependence of the different types of innovations and their potential effect on SEI is deficient. This study provides empirical evidence on the effect of KS on SEI as well as the mediating effect of management innovation (MIN) and IT innovation (ITI) on the relation between KS and SEI in the investigated academic libraries. The results imply that KS plays only a secondary role in influencing SEI, and the mediating roles of MIN and ITI are essential for KS to spawn SEI. These results, however, should be interpreted considering their limitations, as they are derived from perceptual, cross-sectional data drawn from two Egyptian academic libraries. Particularly, the generalizability of these results may be challenged by potential cultural and policy differences across libraries and nations.

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Value Orientations of Students at the Kazakh National Women's Teacher Training University and their View Towards Mixed Education

Neilya Khibina[1], Aizhan Salimzhanova[1] and Zada Khibina[2]
[1]Center for Social and Gender Studies, Kazakh National Women's Teacher Training University, Almaty, Kazakhstan
[2]Department of History and Religious Studies, Faculty of History, Aktobe Regional University named after K. Zhubanov, Aktobe, Kazakhstan

neilya2204@mail.ru
aizhan.salimzhan@gmail.com
zada.xibina@mail.ru

Abstract: Value orientations are fundamental in the development of young people as individuals. Values play a special role in shaping the behavior and attitudes of young people, have a significant impact on their goals and beliefs. The main focus of the study is the values and social issues of students at the Kazakh National Women's Teacher Training University. The University was established on August 15, 1944. In this research, we particularly define future goals of the students at Women's Teacher Training University, their opinion about the University and the learning process. The main purpose of this study is to assess the attitudes of students towards obtaining a mixed (joint) education. Mixed education, also known as blended learning, co-education (abbreviated as co-ed or coed), is an education in which male and female students study/learn together. The study involved 5 005 female students of all faculties at the undergraduate, graduate and postgraduate levels, as well as college students (University has its college) at Kazakh National Women's Teacher Training University. Survey dates: October 15, 2021 - November 15, 2021. In the course of the study, it was found that the value orientations of students are focused, first of all, on the priorities in the field of education, that is, the orientation towards obtaining a unique education in a prestigious university, the preference for free education; location of the university, favorable socio-cultural environment, the level of information and technical support of the educational process. In addition, expectations for the future are focused on getting a prestigious, interesting, high-paying job that matches individual abilities and opportunities. The results of the study obtained during the survey can be used to analyze the attitude of female students towards mixed education; to study the quality of the provision of university services; studying students' satisfaction with the educational process; studying the difficulties faced by students in the learning process; and to determine what opportunities provided by the university are used by the student for personal development and activity.

Keywords: Value orientations, Values, Youth, Students, University, Educational process, Gender education, Mixed education

1. Introduction

The current stage of development of society, the individual and the state stimulates and determines the formation of new types of thinking. In the context of informatization of society and education, new opportunities appear to improve the effectiveness of the educational process. Society has undergone dramatic changes over the past ten years. The model of behavior and value orientations of modern society is changing. Education also cannot remain outside this process. The problem of developing young people's values, their structure and dynamics in a reformed society always remains relevant at all stages of society's life. Value orientations are fundamental in the development of young people as individuals. Values include a special role in shaping the behavior and activities of young people, values have a significant impact on the actions of young people and are reflected in goals, ideals, and beliefs.

Value orientations - is the attitude of the individual to material and spiritual goods, which are considered as objects, goals and means of meeting the needs of the group.

Each person has different value orientations and value systems. They change under the influence of internal attitudes, environmental conditions, including the socio-cultural environment of the university. At this stage of professional training the personality of the students is formed, their moral and professional qualities are improved, and the range of their values is determined.

The factors that form value orientations include material and economic; socio-psychological; socio-demographic (gender); age demographic; educational, etc.

Young people are most often a social group that indicate changes. They are prone to experiments, constantly changing their image, are more flexible (including ideas about gender norms and relationships) [Ioffe et al., 2020]. However, at present, the youth environment is heterogeneous, gender norms and the corresponding

roles can differ significantly in different social groups. Significantly increased the role of the subject of personality, manifested in the activity, independence, initiative of a person in professional, social and personal life, demonstrating at the same time a huge range of content of uniqueness, and their variability. That is what J. Butler called the structuring of similarity in acts of self-expression and self-presentation [Butler, 2000], later J. Kroger called this the illusion of similarity or inevitability [Kroger, 2007].

Kazakhstan is a large country, and there are contradictions in the development of the capital city and regions in terms of the specifics of socio-cultural, economic and educational conditions. We can assume that there are significant differences in the mentality of students living in big cities and smaller towns. The problem of youth is currently relevant in all aspects, however, there is incomplete elaboration of youth issues, absence of monitoring work, and also due to the fact that the views of young people are not asked and are not taken into account when considering important issues. Therefore, the Center for Social and Gender studies conducted a sociological study among students, undergraduate and graduate students of Kazakh National Women's Teacher Training University, in order to find out their opinions and thoughts.

The Kazakh National Women's Teacher Training University was founded on August 15, 1944 and ever since is educating only girls. . It has become the "forge of teachers" and strives to improve the quality of educational services and research potential provided by one of the leading pedagogical (teacher training) universities in Kazakhstan. It is only university in Central Asia that provides education only for female students. After 1954, government was considering of closing the university several times, but the authorities decided to keep the university [Kazakh National Women's Teacher Training University, 2019]. However, over time, the question arose whether this university was needed only for girls, or whether boys could also be taught there. In this regard, in order to determine this opinion, the idea arose to conduct such a sociological study among students of this university.

In determining the significance of the study, the focus was on the social problems of students at the university, the definition of their goals and the strategies used to achieve these goals, as well as the study of important questions and opinions about the educational institution during the educational process at the university, defining opinions about the present and future of the university. The main purpose of the study is to assess the attitude of students to obtaining a mixed education of boys and girls at the university. It is planned to determine the directions for further development of the university by determining the opinions of students on these issues. In connection with modern global changes, by defining the purpose of the study, the value orientations of young people studying at the university and their opinions on important issues related to the university will be identified, and recommendations will be developed to improve the quality of education and develop infrastructure in Kazakh National Women's Teacher Training University.

2. Literature Review

Value orientations of students of various universities of the CIS countries and the world

Various studies have been carried out on this topic of value orientations of students. In the literature, attention was paid to various aspects related to the study of moral ideals, they are reflected in the work of H.A. Berdyaeva, S.N. Bulgakov, F.M. Dostoevsky, I.A. Ilyina, P.N. Milyukova, V.V. Rozanova, V.S. Solovyova, P.A. Sorokina and others.The psychology of value orientations was studied in the works of B.G. Ananyeva, L.I. Bozhovich, B.I. Dodonova, A.G. Kovaleva, K.K. Platonova, S.L. Rubinstein, T.G. Sukhanskaya and others. A significant contribution to the foundation of the theory of values orientations was made by the sociologists W. Thomas and F. Znanetsky, who developed the concept of "social value". G. Rickert and M. Weber substantiated the method of "value relation". On the other hand, recent research focuses on the value orientation of university students, the transformation of value orientations of students; generational differences in value orientations towards higher education, etc. Thus, according to Slávka Čepelová and Silvia Barnová, along with a value orientation, focusing on the values of knowledge, education and economic aspects leads to an improvement in the quality of life; a better quality of life is determined by a value orientation focused on areas of knowledge, education, and economic values [Čepelová, Barnová 2020].

Value orientation research raises important issues presented by research on a range of topics, including the content of student value orientations that are transformed by virtual behaviors (Akhmadieva et al. 2016). The sensitivity of orientations at the level of both generations to the influences of gender and status (Meier 1970), assessments of students' views on the role of the online learning environment in shaping the value orientations of university students (Shabden et al. 2022).

The analysis of value orientations, at the cultural level, are analyzed in the studies of Geert Hofstede. Hofstede carried out his studies in the 1960s and 1970s and examines cross-cultural differences. Hofstede developed the

theory of cultural dimensions, that was based on value orientations of national cultures (Hofstede 1991; Hofstede 2014). Today, Hofstede's cultural values are used in the field of business, management, and organizational psychology (Soares et al. 2007; De Mooij, Hofstede 2010; Dubina, Ramos 2019). Hofstede's cultural dimensions can be taken into account in the analysis of value orientations of university students. Some studies show that the study of value orientations at the individual level can be helpful in examining the university students' personal and professional development (Bogomaz, Atamanova 2017).

The social-cognitive approach emphasizes the important role of students' beliefs and their interpretations of actual events, and the role of the achievement context for motivational dynamics (Weiner 1992; Pintrich et al. 1993; Wigfield, Cambria 2010). Social cognitive models of achievement motivation have several motivation constructs that can be organized in two broad categories: students' beliefs about their capability to perform a task, also called expectancy components, and their motivational beliefs about their reasons for choosing to do a task, also called value components (Pintrich et al. 1993). The literature on motivation constructs is extensive (Wigfield, Cambria 2010). In order to gain a comprehensive picture of the relation between students' motivation and their academic achievement, we can look at a traditional personality model of motivation, the theory of the achievement motive (McClelland et al. 1953). This model shows that students' motivation is conceptualized as a relatively stable trait. Students' goal orientations are broader cognitive orientations that they have toward their learning and reflect the reasons for doing a task (Dweck, Leggett 1988). McClelland et al. distinguish the achievement motives hope for success and fear of failure (McClelland, Atkinson 1953). In addition, the need for achievement is theorized to be domain-general and, therefore, assessed without referring to a certain domain or situation (Steinmayr, Spinath 2009).

3. Method

Questionnaire design

Method. On the basis of the designed questionnaire, the method of surveying students was used, that is, a quantitative research method, using descriptive statistics.

Research coverage. Sociological research conducted on the basis of Kazakh National Women's Teacher Training University.

*The target audience***.** Undergraduate and graduate students of the Institute of Pedagogy and Psychology; Institute of the Kazakh and world languages; Institute of Physics, Mathematics and Computing; Institute of Natural Sciences; Institute of Social Sciences, Humanities and Art; students of the College of Professional Education.

Total number of respondents: in total 5005 students, undergraduates and graduate students (1.2 courses), and college students of all faculties of the university took part in the study.

Research tool. The questionnaire was compiled by specialists from the Center for Social and Gender studies at Kazakh National Women's Teacher Training University. An anonymous survey was conducted based on a stratified random sample.

Online questionnaire was used to collect the data. Survey responses were automatically collected in Google Forms and IBM SPSS 22 (Statistical Package for the Social Sciences) was used to process the overall numerical information. This study do not require formal ethical approval because an anonymous survey was used to collect data. Questionnaires in Kazakh and Russian languages were developed.

The number of questions in the questionnaire is 17.

Survey Dates: October 15, 2021 - November 15, 2021.

4. Results and Discussion

Demographic data contains accurate information about the age, nationality, place of birth, status of settlements, marital status, financial situation of the respondents' families. The study involved 5005 respondents – undergraduate, graduate students, and college students of the university. In percentage terms, the age groups are distributed as shown in Figure 1.

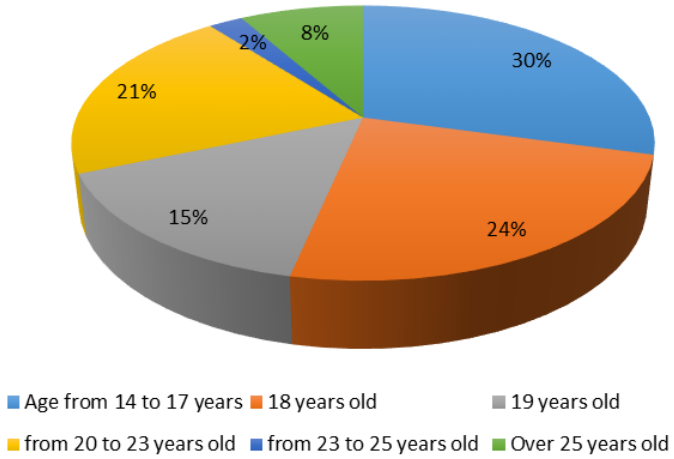


Figure 1: Age of Respondents

In the course of the study, an analysis of students was carried out according to national characteristics. Respondents' answers about their nationalities were the following: 89.77% - Kazakhs, 1.30% - Russians, 3.76% - Uighurs, 0.06% - Dungans, 0.32% - Tatars, 0.14% - Koreans, 0.02% - Armenians, 0.02% - Belarusians, 0.02% - Greeks, 0.22% - Azerbaijanis, 0.02% - Kurdish, 0.22% - Karakalpaks, 0.06% - Kyrgyz, 0.04% - Germans , 3.78% - Uzbeks, 0.02% - Polish, 0.02% - Gypsies, 0.18% - Turkish, 0.02% - Ukrainians and 0.02% - Chechens (Figure 2).

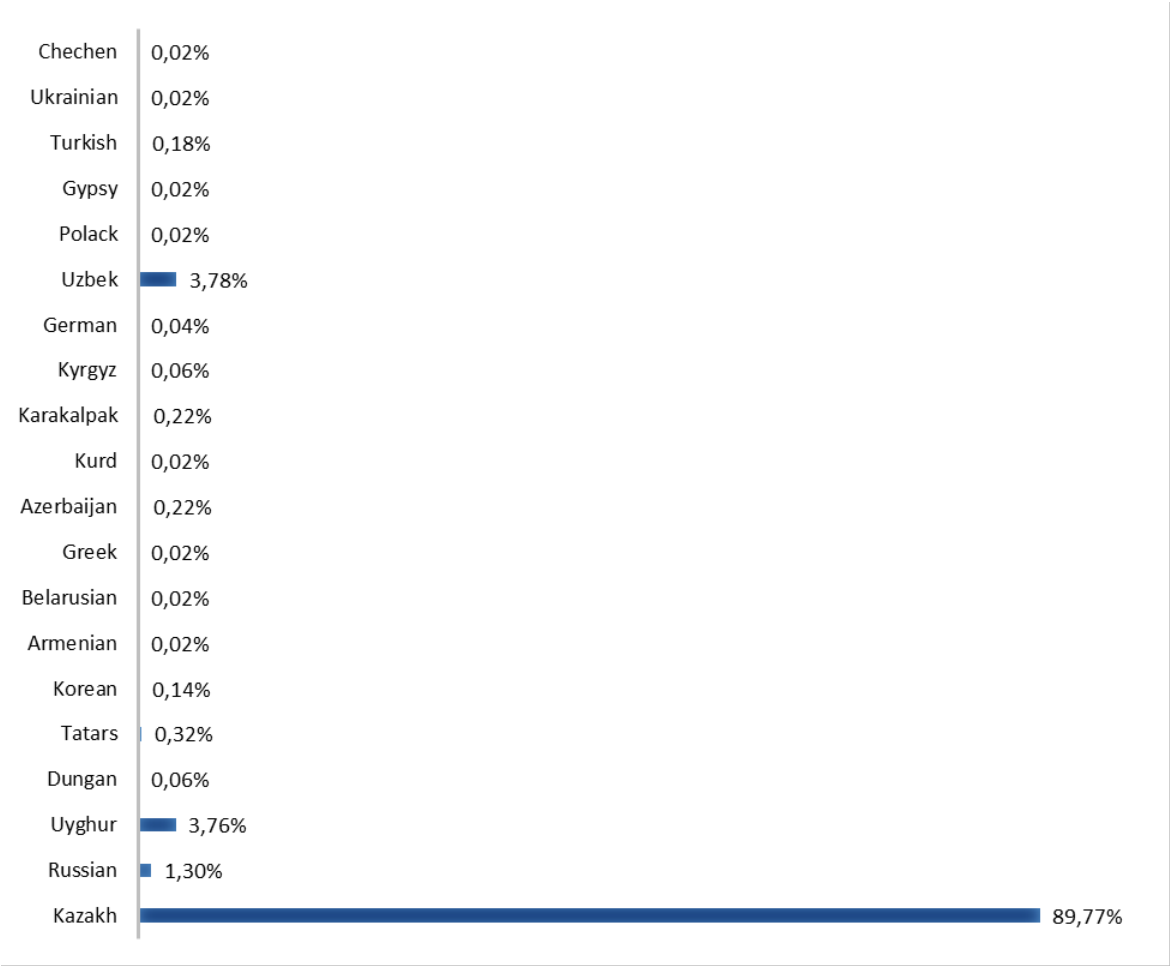


Figure 2: Nationality of Respondents

The majority of respondents (56%) are from the rural areas. Thirty percent of the students are from the cities (Figure 3).

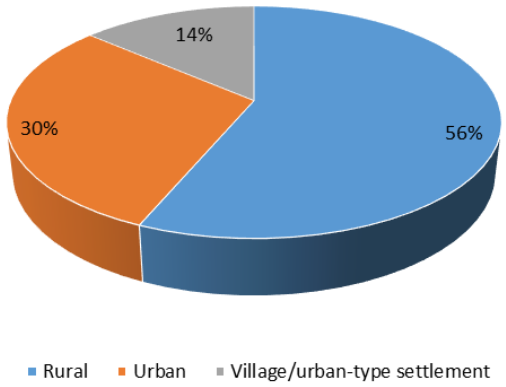


Figure 3: Place of Settlement of the Respondents

In addition, some factors determining the choice ask the following questions.

The research covers respondents studying at all levels of education: from undergraduate 1-4 courses to Master and PhD students. Particularly, 1st year students - 40.94%, 2nd year - 21.36%, 3rd year – 12.33%, 4th year bachelor's degree - 10.79%, master's degree - 3.80%, PhD student – 0.74%, 1st year (college) - 6.61%, 2nd year (college) - 2.94%, 3rd year (college) - 0.50% (Figure 4).

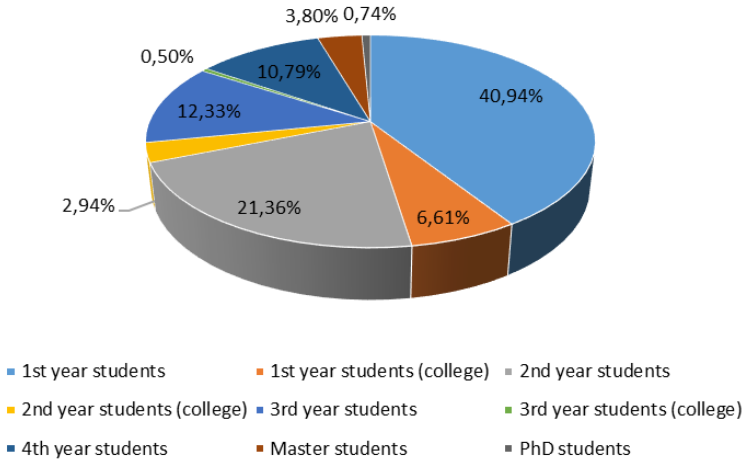


Figure 4: Distribution of Respondents by Course of Study

The overall distribution of respondents by institutes and colleges is presented as follows (Figure 5):

- Institute of Pedagogy and Psychology - 24%;
- Institute of the Kazakh and world languages - 23%;
- Institute of Physics, Mathematics and Computing - 16%;
- Institute of Natural Science-13%;
- nstitute of social sciences, Humanities and Art - 14%;
- College of Professional Education -10%.

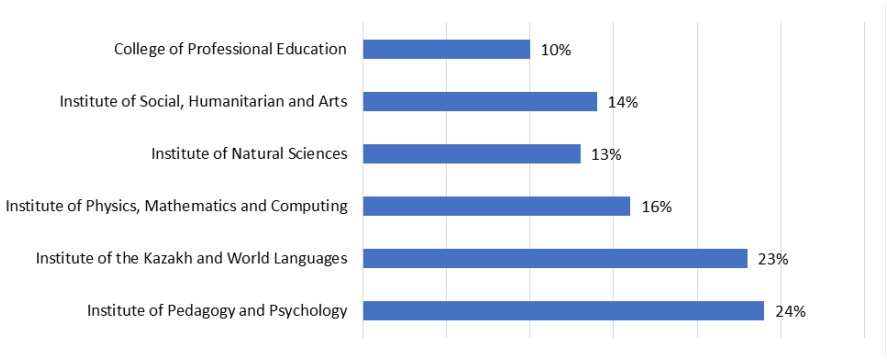


Figure 5: Distribution of Respondents by Institutes and College

82.54% of respondents indicated that they are not married, 15.57% are married, 0.68% - divorced, 0.24% - widows, 0.76% - were in a legally unregistered marriage (Figure 6).

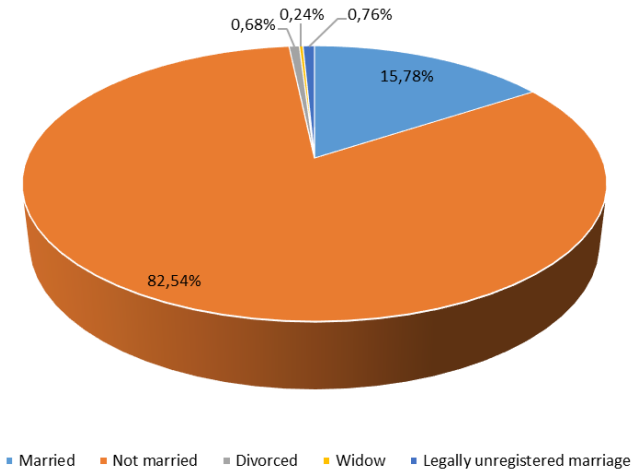


Figure 6: Marital Status of Respondents

The analysis of the financial situation of the families of the respondents was based primarily on the personal assessment of the participants. Three percent of respondents said that “there is only enough money for food”; 9% of respondents claimed that “there is enough money for food, but buying clothes is difficult”, 8% - “currently there are difficulties with buying a TV, refrigerator and washing machine”, 9% -“we have enough money to buy large household appliances, but not enough money to buy a car”, 30% - “our income is enough to buy all things, but not enough to buy apartment or a house”, 25% - “there are no financial difficulties, if necessary, we can also buy an apartment” (Figure 7). Sixteen percent of the respondents found it difficult to answer and attribute themselves to one of the listed groups.

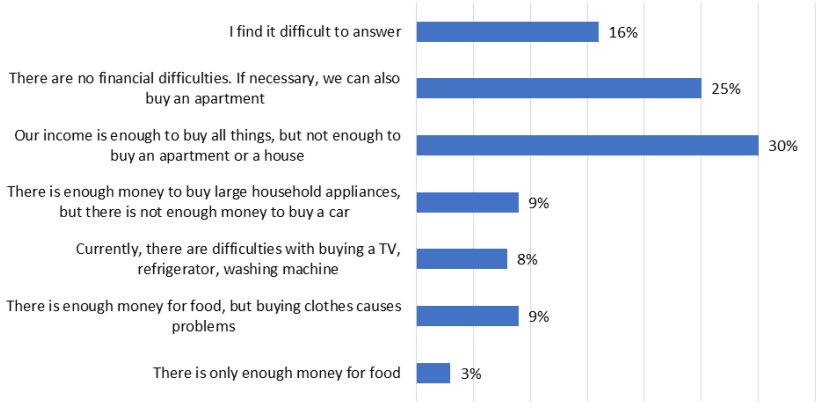


Figure 7: Financial Situation of Families of Students

Choosing a university is an important aspect in a young person's life. Some do it consciously, while others do it unconsciously due to a combination of external circumstances. The choice of an educational institution and a specialty in Kazakhstan leads to objective and subjective problems. The main objective problems are unemployment among graduates who are not in demand in their specialty, as well as profile fluctuations of graduates from law and economics schools. The subjective problem is the unwillingness to work in the specialty, since the profession was chosen incorrectly when enrolling to the university.

The study showed that the main motivation of the interviewed respondents to enroll to the Kazakh National Women's Teacher Training University was "the desire to have a profession in accordance with their abilities" (41%). 30% of students indicated the reason for choosing this university - "it was a joint decision with parents and relatives". Other relatively significant criteria are "by the advice of teachers" (3%), "by the advice of friends" (2%), "limitation of choice" (3%), "remoteness of the desired educational institutions from the place of residence" (1%), "the possibility receiving a scholarship" (6%), and "due to availability of educational state educational scholarship" (14%) (Figure 8).

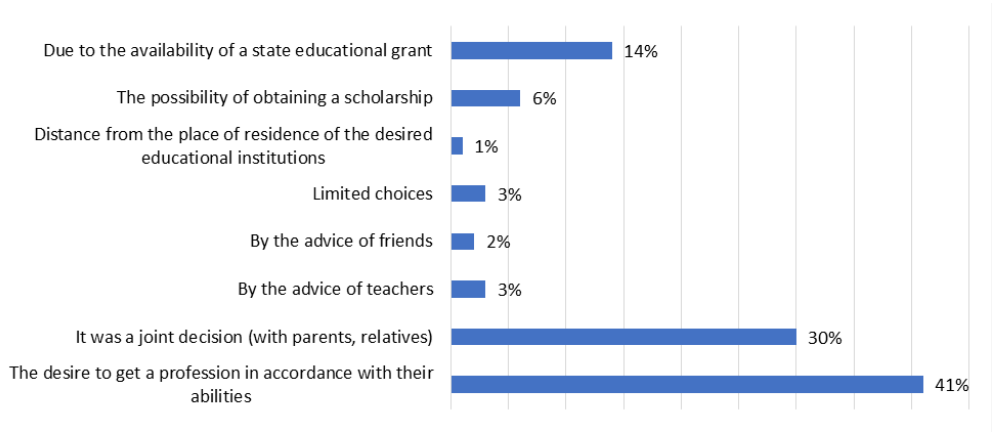


Figure 8: Reasons for Respondents' Choice of Kazakh National Women's Teacher Training University

In a market economy, the choice of a future profession for young girls is the most important task and reflects the actions of many motives of the individual. They arise from various needs and interests formed in public and private life.

Awareness of the choice, satisfaction with the chosen profession are considered in the answers:

- "I would choose this profession again in this educational institution" - 60%;
- "I would choose this specialty, but in another university" - 8%;
- "I would choose another specialty and another university - 13%;
- "I would choose another specialty in this university" - 19% (Figure 9).

Particular attention should be paid to the answers of 13% of respondents that would choose another profession and another university. Because such an answer suggests that students are not only not satisfied with their choice of profession, but also with the university.

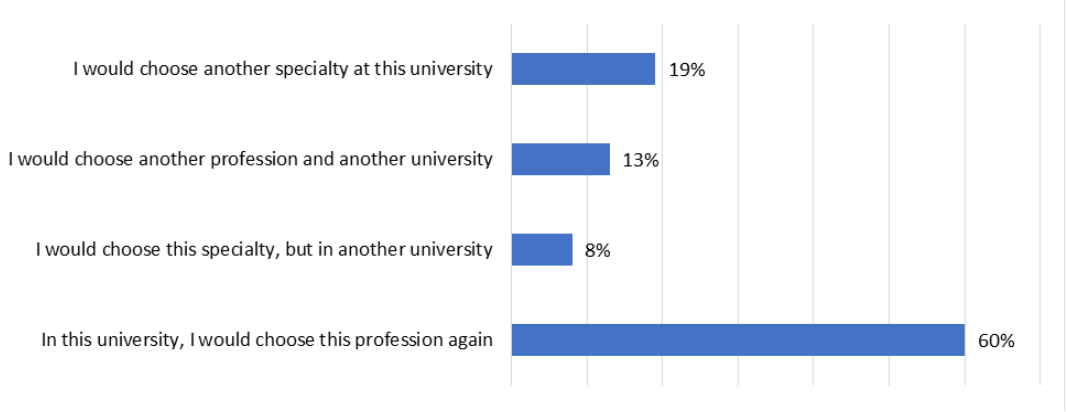


Figure 9: Opinions of Students About the Opportunity to Re-Select a Specialty

The question of the attitude of students to learning is directly related to the quality training of future specialists. Misconceptions about the profession, the quality of education in the univeristy, inadequate workload in subjects (too much or too little), attitude towards independent work, development of one's own skills in the specialty, all these form attitudes towards education and profession. The results of the survey showed that the statement “I study with great pleasure” was supported by 65%, 32% of students answered that they were only interested in certain subjects, 1% were indifferent to learning, and 2% have painful attitude to learning (Figure 10).

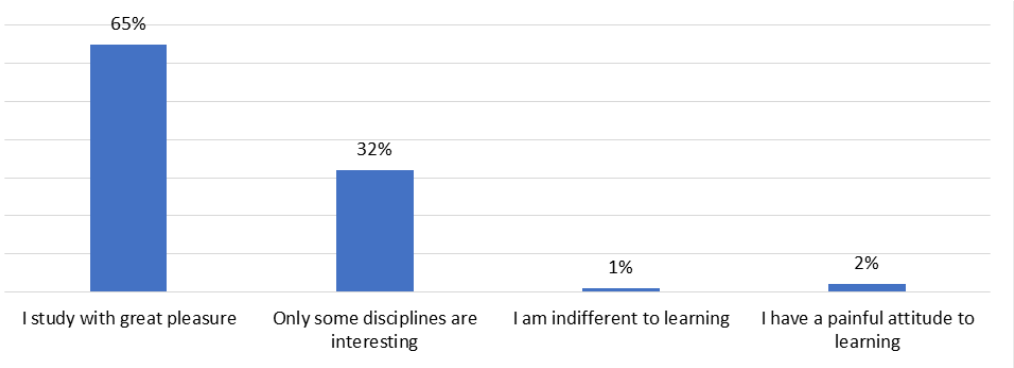


Figure 10: Respondents' Attitude to Study

At present, the issue of academic performance is especially relevant, as it is directly related to the quality training of the future specialist.

The reasons for the student’s poor performance in the classroom are the lack of motivation to learn, the inability to learn, the inability to study well, the wrong choice of profession and, as a result, the loss of motivation to learn, etc.

Poor academic performance can negatively affect the future both on the person himself and on the economy and society as a whole.

In this survey, we relied on the assumption that the future profession is chosen correctly, that the students like their majors and are satisfied with their studies. 64% of respondents answered that their academis performance is “good”, 28% answered that their performance is “very good”, 6% answered “satisfactory”, 1% answered “not very good”, and 1% find it difficult to answer (Figure 11).

The results of the survey showed that students with good academic performance have a special motivation for learning. Their success is in good organization of the learning process, dedication of time for learning at home and at the university, and using additional literature along with compulsary literature. Another important key to success is the constant desire for self-development.

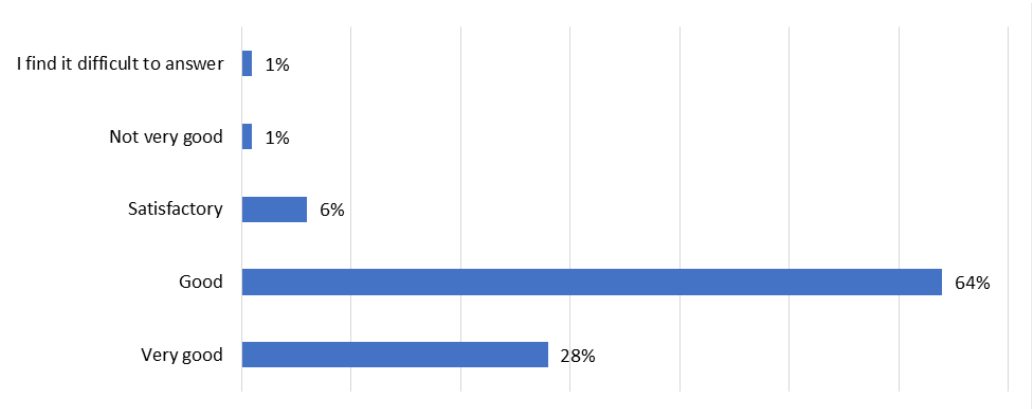


Figure 11: Academic Performance of Students at the University

Upon graduation, 67% of respondents are sure that they will find a job in their specialty, they believe that the profession of a teacher is always in demand and it will not be difficult to find a job in any educational institution in Kazakhstan, and 11% doubted they would find a job in their specialty. 17% are sure that they will find any job, but not in their specialty. 21% of respondents are skeptical about finding a job that meets their requirements.

21% of the respondents hope for help from their parents and relatives (Figure 12). According to the survey, the majority of respondents will work in their specialty after graduation.

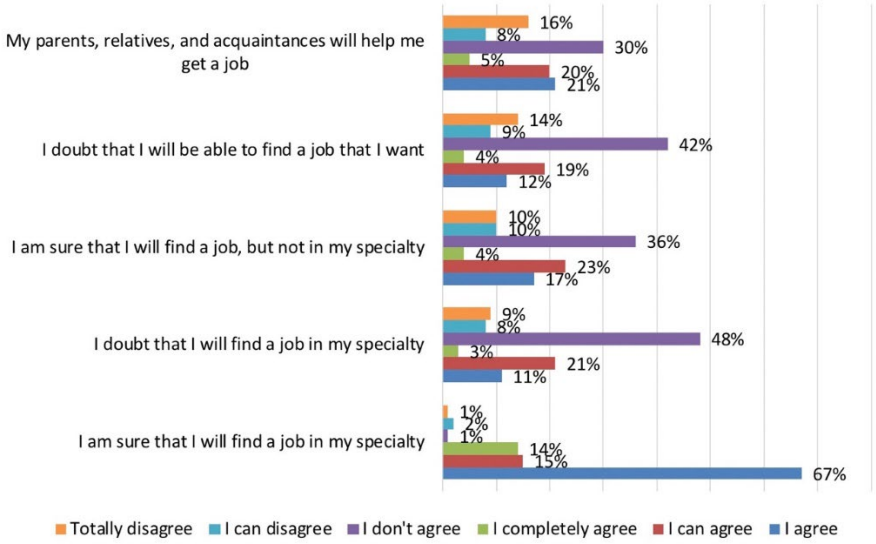


Figure 12: Students' Assessment of Employment Opportunities After Graduation

And the final topic of the survey is about the attitude of students at Kazakh National Women's Techaer Training University to the studying with boys (blended learning).

The question of the advantages and disadvantages of joint and separate education is not only a psychological and pedagogical, but also a socio-anthropological issue.

In this survey aothors tried to analyze the specifics of modern gender education, its role in shaping the gender culture of society.

The degree of satisfaction with the university is reflected in the following respondents' statements about why they have decided to study at Kazakh National Women's Teacher Training Univetsity:

- there is an individual approach for students (33.91%);
- financial aid for students (state and internal schollarships) (32.03%);
- encouragement of self-study (15.36%);
- university is equipped with a modern library (7.73%);
- the ability to independently choose the training program (5.65%);
- support for foreign students (5.31%) (Figure 13).

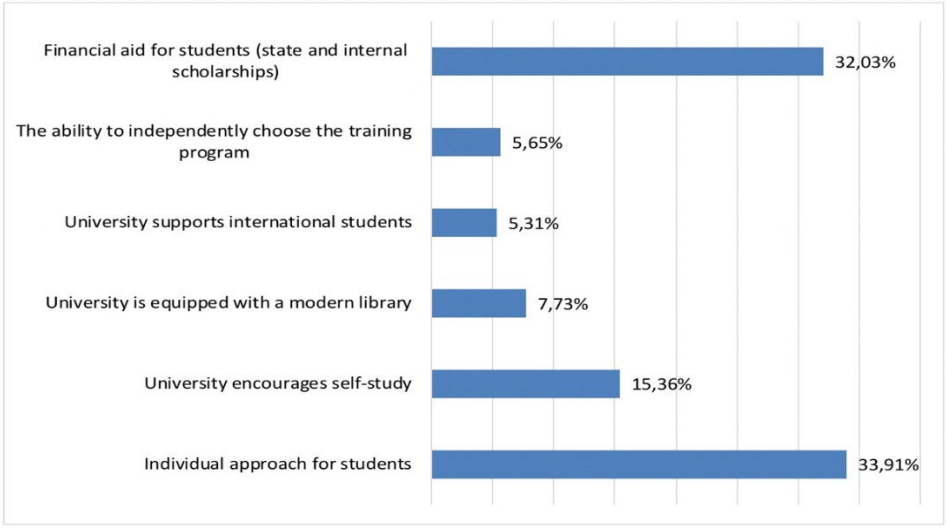


Figure 13: Reasons why Students Choose to Study at Kazakh National Women's Teacher Training University

Gender education implies gender differences in features of physical and mental development and related problems in learning. The resondents answers about the question if they want to stusy with male students was the following: 39% of respondents agreed that they would like to have a blended education in Kazakh National Women's Teacher Training University, 21% state that they would rather disagree, 14% have neutral point of view, and 25% did not think about blended (mixed) education (Figure 14).

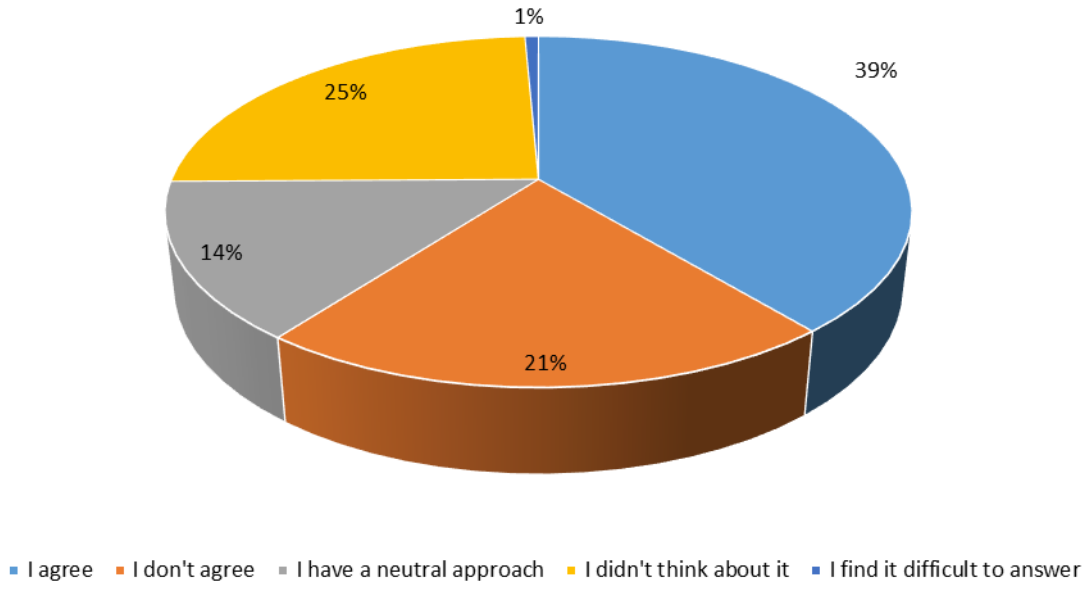


Figure 14: Respondents' Opinion About Having Male Students at the University

The survey results showed that 56% of students disagree with this statement "Will the university lose its uniqueness if both female and male students study at the university?", and 44% agree (Figure 15).

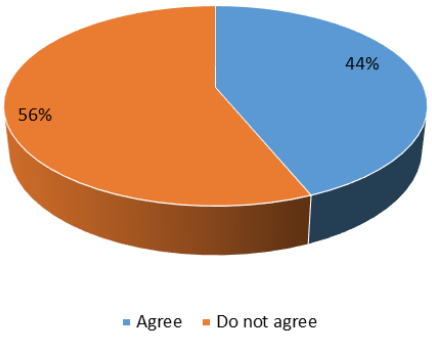


Figure 15: The Students' Views on the Question: "Will the University Lose its Uniqueness if Both Female and Male Students Study at the University?"

Analyzing the results obtained, we can conclude that the student understands the importance of higher education, has a strong attitude to entering a university. The student also appreciates such qualities as responsibility and good breeding, they are aimed at achieving their goals and obtaining the necessary knowledge (this is evidenced by rather high values - such means as strong will and self-control, courage in defending their views).

The data of the conducted research as a whole show the value of knowledge and education. Education is considered, on the one hand, as a factor in raising the social status and quality of life, a means of career development and improving material well-being. On the other hand, as a factor in the development of the individual, which allows one to join the achievements of culture and realize the creative potential of the individual.

5. Conclusion

As a result of the study, the following conclusions can be drawn:

The most important values for the respondents are professional, intellectual, family, social and financial values.

Value orientations that determine a person's life goals form the most significant vectors of their further social development.

Among the reasons why the respondents chose Kazakh National Women's Teacher Training University are "the desire to get a profession in accordance with their ability" - 41%; and "it is a joint decision (with parents, relatives)" - 30%. Based on these answers, we can conclude that the majority of young people come to the university in order to obtain a specific specialty.

It also turned out that 60% of respondents would choose this specialty again at Kazakh National Women's Teacher Training University.

Students highly appreciated the professionalism and individual methods of teaching (33.91%) in Kazakh National Women's Teacher Training University, noting that the main difference of the university is that it sets the goals of quality education for students.

Authors also found that 67% of respondents noted that they fully agreed with the statement "I am sure that I will find a job in my specialty". Therefore, students have positive about duture employment opprtunities.

One of the main objectives of the study was also identifying the opinions of university students about belended education (studying with boys). 39% of respondents said they would like to study with male students at the university, and 25% are against. Students support the idea of blended education in Kazakh National Women's Teacher Training University.

In addition, 44% of respondents claimed that the university will lose its uniqueness and status if there will be a blended education (with male students), and 56% of respondents do not agree with this statement. Respondents also noted that the university should be renamed and have common name, without specification that it is a women's university. And if in the future male students will be taught at this university, then it will be possible to introduce new educational courses and majors in STEM, in order to attract more talented boys and girls.

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Domain Applications of Project Management Knowledge (DAPMK): Beneficial Knowledge Transfer and Soft Skill Development for Life-Long Enhancement

Nasrullah Khilji, Stephen Roberts and George Middleton-Baker
School of Computing and Engineering, University of West London, UK

Nasrullah.Khilji@uwl.ac.uk
robeste1912@gmail.com
George.Middleton-Baker@uwl.ac.uk

Abstract: The focus of higher education in the developed economies of the Global North has steadily shifted since the 1970s from being dominantly rooted in academic knowledge and learning as an end in themselves towards a wider perspective. The needs of the professions, careers and employability were present then, but were generally a secondary concern for the HEIs. The expansion of HE across more diverse populations has produced successive changes in curriculum and more broadly in purposes, strategies, and philosophies of HE. Against the background of global, economic, societal, and technological changes, the need to maintain 'traditions' but with wider relevance to society, personal adaptability, and capability as well as support for lifelong careers and learning have come to impact, HE main agendas. Most undertakings in life require the ability to define requirements, shape responses and form processes which will lead to achieving desired goals. In short, this is the nature of 'project' as a concept and of project management as a means to undertake what is necessary. *This paper reports on how the concepts and techniques of Project Management (PM) can be beneficially transferred in a process of soft skill development for life-long enhancement in the transitions from HE to employability and career*. A project was set up at University of West London as part of their knowledge transfer activities. The researchers have established 'proof of concept' and are currently trialling pathways for providing learning opportunities with knowledge transfer and soft skill enhancement. The opportunity to adapt the root concepts of PM to any domain carries enormous potential for enhancing HE outcomes and for wider continuing education and skills development across communities.

Keywords: Soft skills, Employability, Dissemination of PM knowledge and techniques, Independent learning, Experiential learning, VLE-supported study

1. Introduction

The ongoing effects of the contemporary digital transformation evident at a global scale are receiving critical attention from the academic and scientific communities, policymakers, industry and commerce, the public media and not least from 'digital citizens' who are impacted directly and indirectly by the changes arising from the technologies. There are perceived benefits in terms of economy, costs, productivity, dissemination of information and facilitation of wealth creation. Yet, there are growing concerns about information security, cybercrime, impacts on underprepared users and citizens, the growth of surveillance, boundaries to expression and challenges to legal policy and law making. There are questions of relations between the nation states and 'powers' and the impacts on individuals and citizens. If these issues are coupled to the challenges of Artificial Intelligence (AI) and the crises of energy supply, global sustainability, and health of populations, then the horizon sometimes looks gloomy.

So much for planting our theme in the wider context. As a counterpoise to the turbulence that seems to follow in the wake of technology, the idea that appropriate education and learning will contribute as much, if not more, to our survival and thriving than (digital) technology alone needs examination. However, we choose to define a collective future and give it a name like 'digital citizen / citizenship' there is an irreducible human factor which must enter any calculation about the future. There is no doubt that technologies of any kind have enhanced human reach and competence, but human physical endowment in body, mind and spirit are and will remain fundamental to the identity of the human species. There is consensus about how to prepare for life and the future, although we immediately have to face up to global disparities in opportunities, inheritance, structural conditions and resources.

2. Academic and Institutional Support for the DAPMK Study

The specific project presented in this paper received seed funding under an internal UWL (University of West London) call to stimulate initiatives and innovations in knowledge transfer. The formal support was applied to the project between April 2022 and March 2023. Subsequently, support is moving to the possibilities of stakeholder engagement both internal to UWL and external. A putative business plan is under development, and this is pointing to further stages of development towards ways to engage with several broader agendas.

3. The DAPMK Project Concept and its Goals

As a response to the multiple transformations outlined, the concept of *'Domain Applications of Project Management Knowledge (DAPMK)'* was proposed as a beneficial means to promote knowledge transfer and soft skill development for life-long enhancement of personal development. Our discussion builds on an independent learning project underway at University of West London. Project management (PM) is a well-established and autonomous discipline and field of practice with established focal points; for-example, in engineering, construction and infrastructure; in business and commercial enterprises for areas of planning, design, implementation and re-engineering. Beyond these core applications there is massive potential for transferring PM knowledge and techniques into many other fields. This holds the promise of upskilling the workforce at large to meet future needs. PM is truly a utility and a competence of great value and applicability. Only a modest number of the staff are PM specialists but the case for wider propagation to generalists is strong.

The approach uses a sequence of activities examining Project Management as a component of soft skills acquisition in higher education in the context of developing employability, building soft skills competences in graduates, and the integration of knowledge, skills, activities, and practices. These activities develop employability, build soft skills competences in graduates, and facilitate integration of knowledge, skills, activities, and practices as the learner moves on into employment in their chosen occupation, as well as supporting them for the inherent dynamism and uncertainties of the labour market in varied sectors.

The project extends the range of application of well-established project management (PM) knowledge and techniques to diverse and non-standard curriculum areas. A *Root model of Project Management* provides the basis for a module prototype. A trial using students from UWL Schools is revealing useful results for continuing development. Conventional higher education can only achieve so much. Thus, independent learning using collective engagement to develop transferable knowledge and skills is a vital step in the long-term transformation of human capacity to meet the challenges of the digital transformation wherever and whenever it is encountered.

At this stage (mid-2023) we have accomplished a pilot study for development purposes, and this will be further trialled on a larger student group at UWL. What have we learned so far from our efforts and how can the like-minded practitioners and researchers enhance our collective knowledge in this field of soft-skills development?

4. Background Studies

A literature search was carried out to establish a baseline. A search was conducted using Google Scholar before a database search was employed using the ERIC, CORE and Science Direct databases identified as containing relevant archives of literature. This identified that there was a considerable amount of literature on teaching of soft skills, study skills and employability skills but *little relevant to the use of zero credit or low credit modules specifically teaching project management outside of the discipline of project management using a VLE*. The full search was carried out up to late 2022.

The following search terms were used:

- Virtual learning environment project management
- Project management VLE
- Blended learning project management
- Virtual learning environment project management soft skills
- Zero credit modules

The search yielded ten relevant journal articles and conference proceedings and a further two articles from the grey literature as well as a case study from Sheffield Hallam University. The main themes from the literature included the effectiveness of using VLEs with project management (Ojiako, et al., 2011) (González-Marcos, et al., 2016) (Puplampu & Tutesigensi, 2008) (González-Marcos, et al., 2017); the benefits of teaching project management outside of the project management field (Ojiako, et al., 2013) (Vanhoucke & Wauters, 2015) and ways in which micro credentials and zero credit modules can be delivered to improve student soft skills.

VLEs and project management and soft skills. The use of virtual learning environments has developed considerably since 2020 when COVID-19 restrictions required universities to switch to teaching remotely, necessitating the use of VLEs for almost all teaching and assessment.

Several papers are quite positive on use of VLEs for teaching project management skills with a study of graduate students undertaking distance learning courses using VLEs in Indonesia did find that students felt that they had

gained soft skills from through the use of these methods that could be delivered in a virtual environment (Ratnaningsih, 2013).

Teaching project management as a soft skill. In the papers surveyed there was a consensus that it was valuable to teach project concepts for its benefit as a soft skill that can be widely applied and that is valuable to employers when assessing the suitability of candidates.

Micro credit/zero credit modules and teaching project management. Shu-hui et al (2018) argues that micro credit courses can be a good way of encouraging students to study independently on a wide range of topics as the need for ever great scope of knowledge is required in fields such as ICT.

Carins et al. (2018) have written on their experience of introducing project management soft skills modules developed in partnership with students that aimed to give students transferrable skills. Their method was aimed to go beyond a "bolt on" method whereby they are entirely separate from the rest of the course content but was not fully integrated into the main curriculum of the courses it was delivered to. They found that this partnership model is good for transferring knowledge from one department to a broad audience.

They received limited student feedback on the programme which suggested low discontent but also significant apathy to the programme while some students felt the content unnecessary especially as it was compulsory (Ibid). The main challenge they found to implementing their model were the existing structures at their institution that created obstacles for working in partnerships across departments. Therefore, they concluded that their method of offering transferrable skills in a pseudo "bolt on" style of teaching of transferrable skills is viable but requires significant staff buy-in and enthusiasm (Cairns, et al., 2018).

Oxley & van Rooyen have written that the challenge for developers of micro-credentials based on skills is to focus on the needs of students with the argument that currently the focus is on needs of large companies. They also assert that zero credit modules often fail to motivate students. (Oxley & van Rooyen, 2021).

University of Sheffield reported success with a skill based zero credit module teaching soft skills to mathematics students. The approach incentivised students by becoming part of their transcript and was taught across all three undergraduate years (Rowlett & Waldock, 2017).

Recent studies report positive outcomes for game-based learning in PM (Jääskä and Aaltonen, 2022). A systematic review identified tutor training and delivery planning in PM courses as success factors (Farooq, Hamid, Alvi, & Omer, 2022). In Australia, Afzal & Crawford (2022) observed that VLE used in combination with communication platforms produced good performance on PM courses.

Emerging conclusions from studies. Project management skills are valuable to many fields and students benefit from learning transferrable skills associated with project management. There is some consensus in the literature that the best way to deliver skills-based modules with low or zero credits is to involve students in the design of skills modules to increase usefulness to of skills obtained and deliver modules at times that complement students' wider studies.

Experience from our trial is providing evidence of student usability, which will inform further development and post-course evaluation will explore the question of student contribution to design. We used non-monetary incentives to engage and reward trialists (student membership for a period to the professional body and university certification as evidence). We have identified two periods in the student year which can prove attractive to trialists without 'clashing' with other priorities in their study year.

Virtual learning environments offer a means to deliver project management skills and it has been demonstrated that it can be used as a way to give students new knowledge and skills. However, this research study project provides a case study highlighting the validity of this approach. Overall, there is limited research directly into the use of VLEs to deliver project management skills to students in diverse and non-curriculum areas and the field would benefit from further study. This project study is helping to break new ground in this area of independent learning in PM for soft skills and employability.

5. Pedagogical Underpinnings for Soft Skills Development

The project environment of this study reflects the HEI setting of UWL. UWL is a UK post-1992 university representing an example of the fifth or sixth generation of UK HEI in its historical setting. These are typically institutions of diverse and local origin, serving predominantly urban areas, and designed to promote access to their communities. After 30 years of 'new' governance they are nationally outward looking to support their regions, industry, commerce, services and employment needs; in addition, these HEIs are making international

links and partnerships. More specifically in the UK these institutions are profiling their academic offer towards the changing economy, engaging broadly with the digital technologies, and blending traditional university and higher education roles and values with national needs. Employability (of graduates) is the current overarching motif, and for the HEI means responsibilities for workforce enrichment, upskilling and maximization of individual capacities to prepare the graduate for a life of change, challenge, and flexibility in a highly competitive world.

The DAPMK project has emerged in this setting. Classic project management (PM) provides an ideal canvas to broaden experience for general graduates – that is for those who are not specializing in the discipline or in its close proximate disciplinary areas. Thus, the project is focused on '*domain applications (DA)*' – those which have few historic links to classic PM applications. In this approach the DA is the target for the PM application as a means of soft skills development to enhance employability. The processes engender knowledge transfer (from PM to DA) and then play a part in shaping the learner in ways useful and relevant to the emerging knowledge-based economy, exploiting both the digital / technology dimension as well as the social and personal dimension.

The learner population in the majority of undergraduate studies (Level 4 to 6) and postgraduate studies (Level 7) is faced with a heavily structured and loaded curriculum. There is a resource problem to be solved and pedagogical norms have been empirically determined and codified in HE quality assurance. The core parameters within course length are ones of study mode, study calendars, course and module credits, formal study/contact hours and recommended learning hours. Experience and reality shows that the margin to provide formal 'tool support' within courses is very low, although much is made of support and acquisition of technique within the learning structure. There is a strong belief in experiential processes of learning and consequential building of skills and techniques, but some doubt about formal effectiveness of these in producing personal transformation post-HE. An underlying intention of DAPMK is to address a widely usable alternative to the 'status quo'.

There are a number of approaches to 'extra-curricular' or voluntary learning where a motivated individual uses learning materials for independent study. In the pre-digital era providing support to learners beyond the printed page was rare if there was no means to support distance learning or to provide tutor support. What learning was achieved was undertaken in a linear mode with minimal external support. This mode was solitary and limited in scope. Dealing with complex tasks, extending assessment, and allowing for the benefits of group work, interaction and sharing study and outcomes was usually out of scope of these approaches. True the student could work at their own pace and location but this isolation from the hegemony of the classroom was limiting. The historical model of institutionalised learning and teaching was the only practical alternative. The 'school' model was not universally effective for achieving rapid, advanced, and more complex outcomes. But, change was inevitable and still continues with force to transform learning in formal and informal education as well as in industrial and workplace education and training.

Educationists stepped up their interest in skills and learning facilitation on the back of the great expansion of HE after the 1960s especially in the Anglo-American world and those influenced by it (e.g., Canada, Australia, New Zealand and to an extent in Scandinavia). Continental European HE traditions tended to follow rather than lead on these trends, but by the 1980s these issues were matters of global interest and concern. Since the 1990s and by 2000 the digital technologies have impacted very strongly on skills and learning facilitation. The evolution of educational technologies and the contemporary dominance of digital resources and platforms now provide clear means of support. The structures and resources available facilitate learning in all directions, synchronously and asynchronously, with interfaces and embedded tools to assist the learner (as well as the tutor) to be focused, creative, adaptable, communicative, and interactive

6. Learner Engagement Within the DAPMK Knowledge Transfer Pedagogy

This paper (*and the associated conference presentation*) provides a first report on a research micro area. At present, the methodological perspective is one of exploratory inquiry in the qualitative tradition, which if developed would be towards multifactorial real-world research. Our experience is offered as a case to those within a broader field of knowledge transfer pedagogy. So far, one prototype trial had been carried out (n=15) and the lessons learned from this will be incorporated in a larger UWL-based trial (n=60) with a more ambitious testing and proving plan with various stakeholder groups to follow. An active business plan could emerge from this phase. Gathering the trial groups required timely and delicate liaison with course leaders, as well as extended communication, explanation, reassurance and briefing with the triallists.

The project team has also had the experience of scheduling the project work within the student year, with its varied workflows, pressures, and priorities. The research subjects have to let their participation be governed by their main student priorities (of class attendance, study time, and assessment deadlines) irrespective of their

enthusiasm to participate and willingness to devote their time to personal development in terms of additional voluntary study time, with potentially high payoffs in terms of soft skill acquisition, employability and tangible benefits (student association with APM (Association for Project Management), certificate of participation, and additional experience to add to CV and profile).

The project team recognize the difference between the idealized work plan, and one tested by the reality of implementation. Yet, the experience and knowledge gathered from the 'gap' once again shows the value of pilot studies when the improvement to practice is incorporated into the subsequent work.

There are key components which have been brought together in the initial DAPMK project and its products.

- A model proposal outline which can be used to replicate the application in future settings.
- A distillation of the principles of PM by creating a Root Model of Project Management (RMPM).
- A synthesis of PM knowledge derived from a working experience of teaching project management in several universities and reflecting the contemporary culture of business and management education.
- The preparation of a model package for outlining the learning process (the DAPMK Study Guide for Participants).
- The engagement of student subjects to take part in trials of the DAPMK package.
- The interaction with course and staff tutors in the schools from which students have been engaged.
- The creation of a VLE platform to carry the package and materials to support links to other resources.
- Guidance processes and protocols for learner trialists.
- Arrangements to support a cycle of delivery of the package from inception and recruitment to monitoring and support over the cycle.
- Development of research instruments to support delivery as part of the research and to allow transformation into support materials for group and self-managed study in operational settings.
- Provisions for maintain student motivation & effort in a self-sustaining independent study situation.
- An evaluation of alternative settings and modes for delivery.

7. Expectations and Realities (Designers and Learners)

The recognition of the diversity of learner circumstances, their situation for participation in the experience and the personal resources they can bring to the task are crucial factors in generating expectations and determining the 'reality' of the experience. Factoring in the substantial higher education teaching experience of the tutor-researchers and their access to the experience of colleagues inevitably created a certain level of expectation on their part. Tutors develop senses of expectation about how their students and learners will engage and be impacted by the learning experience offered. This is no less true in the DAPMK approach even in a limited setting. Nevertheless, the tutor-researcher expectations are set high as their task has been to design techniques to reach a high standard of potential achievement. As the team shared the project idea with course leaders and tutors and engaged with students who could be potential trialists, the initial outcome was three convergent sets of views.

The project team had a strong belief in the approach, potential stakeholders were very interested and showing positive support, and student enthusiasm was strong (reflecting positive pre-disposition to such activities, employability, and career concerns as well as a sense of value to be gained and a motivation to undertake what was required of them). Pre-test and post-test instruments have provided indicative evidence of expectations and realities. Between the prototype phase of October 2022 to January 2023 and the next scaled up trial there is an ongoing recalibration of expectations and realities between stakeholders.

The responses from the pilot are qualitative and indicative only. The number of respondents (n=15) is below the threshold for drawing any generalizable conclusions, but the observations collected are valid for the context. To go further in this process will require more research resources to collect, process and evaluate data yielded.

Yet, there are some significant observations and pointers which can be elicited.

The study guide was purposefully explicit in what could produce effective outcomes, but how far can task progress be assumed (and tracked by products provided and uploaded to the VLE, or by monitoring the use of the VLE)? Logs and diaries and internal reporting was recommended but the yields are variable.

- The model used in the study guide provided for group activities, evaluation, reflection and progress tracking through tasks. This provides material for assessment by the learners (and by any external mentor, tutor, or assessor).

- Creating the study guide, the VLE and setting the whole process in train required a substantial effort. The first two elements are capital investment, but the operation of the process is a variable burden (and cost).
- Guidance was provided formally at the start of the process and then on a weekly basis. The lead tutor adopted a 'hands off' position so as to respect the autonomy of the learners.
- Questions emerged in the minds of the design team as the process progressed. The pilot was a good way to capture incidents and concerns, and a number of operational matters were resolved for future practice.
- Recorded outcomes, documents generated, and presentations made indicate that the learner experience has at least brought qualitative changes in experience and outlook.

8. Interests and Partnerships – a way Ahead

However, the DAPMK project has marked up a number of concrete gains which have wider significance:

The project is located within the literature on independent learning methods in the specific area of project management (PM) and confirms that there is a gap in provision.

A conceptual model has been created for the development of a learning platform for broadening the knowledge, skills and application of PM towards non-traditional domains. This concept has been embodied in both the project vision, goals and name DAPMK (Domain Applications of Project Management Knowledge).

The project has stimulated contacts with course leaders and students in other Schools to explore current practice and potential for domain applications of PM. In essence an internal knowledge transfer activity.

There is now a substantial fit for purpose independent / collaborative learning platform for the DAPMK project using the Root Model of Project Management as the knowledge framework. This platform has been developed on the UWL BB VLE with potential replicability to other platforms.

A fit for purpose curriculum and syllabus with a module compatible pedagogy has been elaborated and tested. Conventional PM teaching resources have been leveraged into the platform and curriculum to provide technical and knowledge support for the independent learners.

Trialling of the DAPMK module and platform is feasible for delivery. The underlying dynamics of implementing independent collaborative learning in real time in an HE environment are evident.

The project achieved key performance indicators in response to the HEI institutions requirements.

With the initial seed funding from UWL, strong support from the APM and some strong and positive feedback from course leaders at UWL there is momentum for further development. Initial indications for future development of a hybrid independent- collaborative learning platform and resource are favourable.

Students appear to respond to the idea of additional independent learning in the context of developing their soft skills for employability, as well as for experiencing learning about PM as non-specialists up to the level of acquiring a usable generic transferable skill. From a developer and educator perspective there is a need for initial investment in concept, programme, and platform development, as well as a system of supportive administration and necessary feedback and guidance methods. Course leaders are forming their own impressions and potential uses for such a non-specialist PM learning application with clear added value for the learner in terms of soft skill acquisition and employability.

9. Models for Development

The UWL Seed Fund provided a small but critical financial resource for the project group to initiate development in terms of making their proposal and contracting to deliver a response. UWL staff and technology resources have exploited sunk costs underpinned by tutor obligations to undertake development and research. The work done suggests considerable field potential and there is ambition to pursue this. Any future development will need a cost model to address development overheads and operating costs. A number of stages have been identified towards a possible 'business plan' which is compatible and replicable within the HEI environment.

UWL / HEI Internal Exploitation as a model for wider application: In this model the DAPMK platform would be developed as a conventional validated module. To date, this development is pending although there is known interest in it from participating Schools.

Under this model of university Internal Exploitation, the Schools would need to make the budgetary case for development in the normal manner. Once the module was validated for use it would be appropriate to seek professional accreditation from bodies like APM, with whom the team have explored development. The validated module could be delivered for full credit, but also could be considered for zero credit use in a course, where the module is mandated as part of the qualification.

UWL / HEI Enterprises and the enterprise skilling model: The DAPMK learning platform has feasible commercial potential to generate revenue for stakeholders and investors. Part of the model of university enterprises is to exploit intellectual capital for commercial gain. In reality the corporate notion of a university is one of a collective of stakeholder interests, who can profit by recognizing their mutual interests and potential for collaborative endeavour. UK universities started to develop a business and commercial 'face' from the 1970s: UWL with its initial foundation priorities has been a later comer to the possibilities of adjunct commercial enterprises. However, many Schools have had a very long industry facing culture even in its FE/HE days of ECHE (Hospitality, Tourism, Arts, Media, Music, Law) but these were not seen as institutionally strategic and were poorly represented in the organizational arrangements. In the last ten years there has been progressive and substantial change. The DAPMK project is well suited to leverage into this environment.

'Enterprise' is now recognised as a school axis as much as one that can be run through a Central Agency (e.g. university company or similar vehicle). The universities have been developing an enterprise environment with commercial possibilities, but it may not be widely appreciated, understood, or fully encouraged (given the many demands on the university and its staff at large).

Investments required, resource costs, market characteristics, delivery requirements, pricing and revenues, budgets and commercial strategy are all factors within university expertise. However, these models may not be flexible and/or innovative enough to respond to market conditions and opportunities.

The DAPMK has considered how their 'IP' can be developed equitably to the mutual advantage of all stakeholders. The university has organizational, business, and financial capacity as well as legal authority to contract, but the academic and research stakeholders provide the substantial majority of the "*knowledge, IP and pedagogical resources"*.

Training Partnerships (TP): multiple stakeholders: A third model is a Training Partnership. Different capabilities from different partners would be recognised in a coalition. Over the last year the DAPMK team has been surveying the field of potential partners.

A collaborative TP would need to be created so that it could identify a degree of freedom and commercial autonomy as the basis for its sustainability, operations, and creation of beneficial surplus. The DAPMK team are modelling the design of such an entity and to move ahead would need to identify suitable specific partners to develop a workable business plan. The TP would establish a number of 'delivery platforms' with support required and offered. Packages could be delivered to various segments:

- Independent groups with direct delivery
- Supported franchises for a) industrial and commercial clients who can be of small, medium and large scale; b) public sector bodies; c) Voluntary and third sector, which may also cover SME social enterprises.

This model is usable at both national and international levels.

10. Platform and Pedagogy: The way to Transformation and Success

The DAPMK approach exemplifies and exploits the utility of blended learning. Multiple dimensional uses of digital technology are showing the way to a global standard for all education and training. Clearly, the imbalances in access and resources still inhibit global reach, but the expectation has been created and realization will follow in stages. Blended formulas provide a flexible menu across the range of techniques, exploitation of knowledge and communication. These become the main routes to knowledge transfer, skills enrichment, employability, innovation, productivity, and wealth creation.

11. Assessment of the 'Learning Experience and Transformation'

The indicative outcomes, even at this early stage show the possibilities. The experiences observed show that learner curiosity, desire for engagement and constructive motivation provide the catalysts for experience, which

when allowed time, opportunity, and space to follow the DAPMK module led to greater knowledge, improved competences, and a positive consolidation of learning outcomes.

Our goal has been to demonstrate that classic project management can be transferred to domain contexts, with beneficial outcomes for participants. The constraining factors are not surprising. Giving a realistic allowance of time for the process to transform is a critical success factor. The interaction that can be developed for experiential learning and what learners can contribute to the process are parameters with qualitative impact. Experienced tutors in HE possesses an accumulated corpus of knowledge and technique which suggests what will work and what will not. If the outcome from DAPMK type experiential learning follows the overall grade outcomes across HE courses (in different countries, cultures, and systems) the predicted outcomes will be at least as good as the 'normal' curve for the HE learner population

12. Maintenance, Development, and Transformation

Human capability is the other side of the coin of technology. We have built a case for PM as a generic toolset which can be exported to non-classic domains. The DAPMK model offers a route to transformation in a world of digital technologies, where extending soft skills and knowledge are driving forces in improving employability, investing in people and workforce to achieve personal, collective and sustainable wealth creation in any context.

This paper reports on how the concepts and techniques of Project Management (PM) can be beneficially transferred in a process of soft skill development for life-long enhancement in the transitions from HE to employability and career. What can we draw upon form our experience so far? We have established 'proof of concept' for a developable process of skills and knowledge enhancement which offers great possibilities for career and personal development and employability.

The prototype was designed with independent collaborative learning in higher education in mind. There are learners who can engage in the challenge of a higher order of task demand that is required (*similar to real world conditions*) and who are prepared to bring personal discipline and application to the tasks. Achieving the outcomes certainly indicate a higher order of employability and soft skills. To widen the volume of successful outcomes in normal HE operating conditions will require increased levels of tutor support (or even AI-assisted support). Our initial experience suggests there are many maintenance and development issues we have yet to tackle. What we have learned about the modality of DAPMK in an HE environment also needs to be adapted to the wider industrial and organizational world, and this will be explored in future collaborations.

There is a 'PM learning gap' at the centre of discussions and actions on employability and skilling for the ongoing digital transformation. Thus, we encourage collaborators in every arena to provide focus and resources to assist in overcoming the knowledge and skills gap in Project Management.

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Knowledge Management in Multimedia Communication with the use of Software Agents

Leszek Kiełtyka
Czestochowa University of Technology, Faculty of Management, Poland

leszek.kieltyka@pcz.pl

Abstract: This paper presents the problem of knowledge management related to software agents and agent systems (i.e. systems composed of communicating and cooperating software agents). The author presents basic theoretical issues, but the main focus is on the areas of application of software agents in multimedia communication - both existing and prospective applications. Particular attention has been paid to the applications of software agents for: supporting customer service processes through the Contact Centre system; supporting the distance learning system; creating virtual assistants in the form of conversation bots; searching for information in the Semantic Web, and assisting in setting up a video conference call. Software agents are often referred to as 'intelligent' - due to their intelligent behaviour. At their core, they involve: perception, reasoning, learning, communication and operation in complex environments, using all multimedia techniques and procedures. Software agents and agent systems, as presented in this article, represent a new approach to the analysis, design and implementation of complex (usually decentralised and distributed) computer systems, offering a whole range of concepts, techniques and tools to significantly improve the software development process. The ability of software agents to make autonomous decisions have been a subject of considerations. Among other things, they are based on the example of cognitive sciences, which deal with modelling real processes of information processing in humans and building programmes that imitate these processes. Research on the common understanding of shared knowledge and knowledge management in agent-based systems focuses on ontologies, understood as a description of the relationship between the way knowledge is represented and the concept represented by that knowledge. In contrast, research on knowledge sharing has focused on communication languages and their associated - interaction protocol and message transport protocol.

Keywords: Software agents, Agent systems, Distance learning, Conversation bots

1. Introduction

In the era of the Knowledge Based Economy (KBE), information and knowledge constitute key resources of enterprises. The activities of economic entities depend very much on the information technologies they use, which encompass much more than just computers and their software; they also include know-how and, consequently, intellectual capital.

Knowledge management, as a young management field, encompasses the latest methods and techniques to ensure the most effective use of knowledge resources, especially those accumulated in organisations. The literature on the subject is abundant in the definitions that characterise knowledge management (Kiełtyka, 2013). One of them that could be quoted here is the definition proposed by Polanyi (Polanyi and Sen, 2009), in the following wording "Knowledge management is a set of processes allowing to transform the tacit knowledge possessed by the employees of an organisation and its environment into explicit knowledge resources valuable to the organisation, allowing it to gain a competitive advantage".

The importance of managing information, and subsequently knowledge that is based on it, is increasing with the process of globalisation and the tightening of cooperative ties between companies. Without the ability to quickly acquire and transfer information, as well as to skilfully use the knowledge accumulated within a company, it is impossible to manage effectively, make decisions or create effective strategies.

The paper presents principles and methods of creating and using multimedia messages in the field of knowledge management. The basic idea and at the same time the main idea of the study is the thesis that it is possible to distinguish a group of software agents supporting various forms of knowledge management carried out on the basis of multimedia messages. The decision-maker's cognitive system, supported by an isolated group of software agents, is the essential regulator of knowledge and information selection, guaranteeing the effectiveness of decision-making. The measure of quality is adjustment to individual needs and human characteristics. The decision-maker is a specific system that assimilates and generates information. Learning about the peculiarities of this group of software agents and associating them with multimedia is crucial in creating effective decision-making tools.

2. Multimedia Communicators

Multimedia communicators are a heterogeneous group. The most basic solutions are used for direct communication on the Internet. They offer modern audio and video chat technology, spell-checking, the ability

to change 'skins', support avatars, drag & drop image transfer, multiple conversations in a single window and built-in radio. These solutions are mainly intended for private (individual) users. Therefore, despite their many versions and improvements, they are characterised by their ease of use and installation, while the creation of contact lists is still intuitive and simple, and new services are available at the click of a button.

The popularity of instant messaging is also influenced by the fact that versions are available for many platforms, including Linux, PocketPC or PalmOS, from which users can freely exchange information. The more advanced multimedia communicators contain usability features such as video conferencing and HD video chat.

In accordance with the thesis that it is possible to identify a group of software agents supporting various forms of knowledge management based on multimedia messages, we should try to use commercial solutions available on the market for this purpose, such as: Windows Live Messenger or Camfrog Video Chat. Instant messaging producers also create solutions intended for specific groups of users. The group of so-called social communicators includes, for example, Xfire (a global communicator for gamers, which enables text and voice chat during gaming) or Evermotion Communicator (instant messaging created by one of the largest portals in the computer graphics industry). Although solutions for individual users comprise the largest part of the instant messaging market, business solutions constitute a technologically developed group. Examples of popular business solutions on the market include GGPro or LIVECHAT Communicator. These are used not only for chatting, but also manage the company's communication and enable the sharing of business and private contact lists, and thus manage the use of other communicators in the company, perhaps also through software agents.

It is generally accepted that a software agent is software that assists managers and functions on their behalf. "A software agent, as opposed to the reactive software of the past - reacting to user instructions - is supposed to be proactive, i.e. once the user's needs have been specified, it will perform tasks for them. The agent must be equipped with a specific set of skills and knowledge (heuristics) and other activities (cooperation, communication, command and control) (Kiełtyka, 2020).

In turn, a multi-agent system is a system made up of communicating and cooperating agents pursuing common goals. When creating enterprises for the new era, the features, advantages, areas or skills of using multimedia programmes should be taken into account, especially by software agents.

Multimedia communication is realised by displaying information in a number of multimedia formats. These include static and dynamic images, video, graphics, audio, text and animation. A single instance of multimedia communication does not necessarily have all the components listed. Multimedia communication presents information in interesting, creative way that helps many different types of information to internalise data. Multimedia communication proved particularly useful during the COVID-19 pandemic. The outbreak of the COVID-19 pandemic was a shock to education systems around the world and forced the closure of schools. Remote continuity of learning became a particular challenge for vocational education, a key component of which is practical classes that are difficult to deliver remotely. Multimedia communication has proved particularly useful in preserving the continuity of both education and business entities. Students felt comfortable with multimedia because the Internet itself is filled with all types of media and they could find the type of multimedia that would particularly benefit their communication and learning style (Grewening et al., 2021).

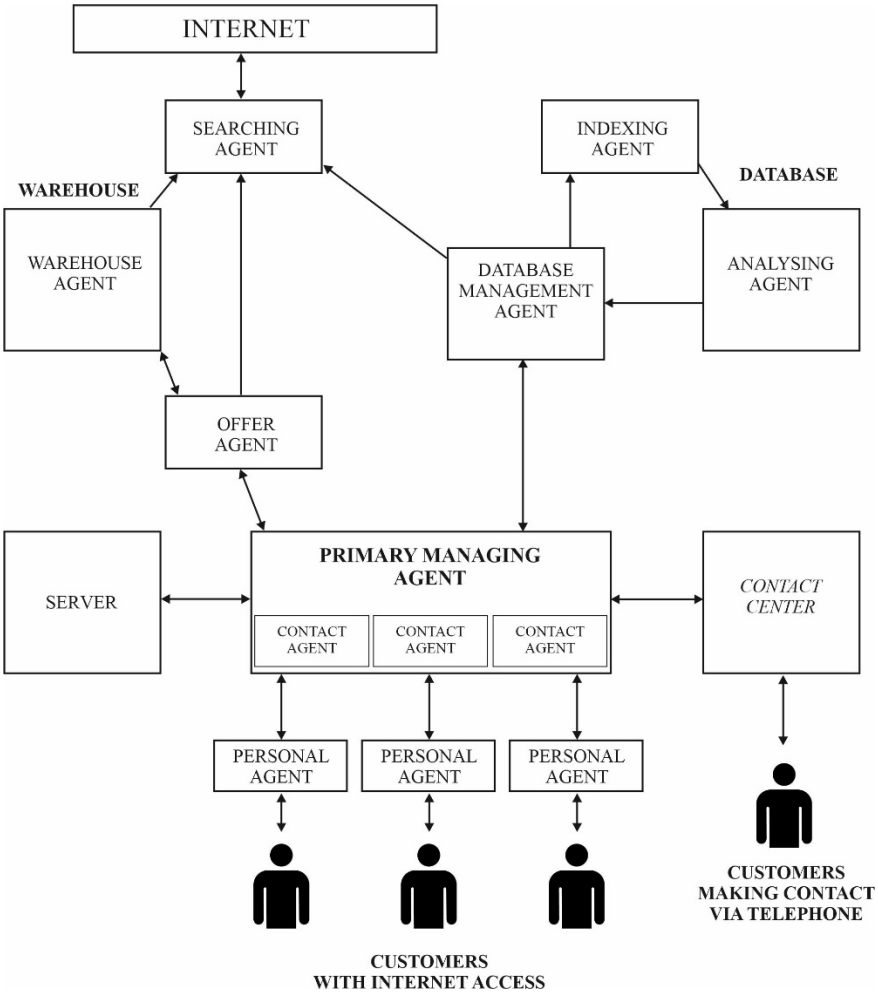
Software agents and agent systems built on them are inspired by real systems and organisations. Particularly close links can be observed with the fields of Artificial Intelligence (AI) and Cognitive Science (CS). Therefore, software agents are often referred to as 'intelligent' (Kieltyka, 2013), and the degree of their intelligence is also analysed in the literature on the subject. The set of characteristics attributed to software agents and agent systems is as follows: reactiveness, autonomy, interactivity, intelligence, reasoning based on collected knowledge, mobility, reliability, capacity for reasoning), ability to communicate, goal orientation, adaptivity, predictivity, capacity for cooperation, learning ability (Paprzycki, 2021). An important issue in open systems is the cooperation of software agents developed by different manufacturers. This is only possible if the used technological solutions are compatible (Kieltyka and Niedbal, 2015).

The article focuses on several application areas of software agents using multimedia communication.

3. Agent System Supporting Operations of Contact Centre

Not so long ago, the standard customer contact centre (call centre) consisted of a few telephone lines for communicating with agents - people. Today, this is no longer enough to meet customer expectations. Nowadays, a large proportion of customers prefer to use Internet services and e-mail, only as a last resort opting for a telephone call. For this reason, the call centre is now transforming into a contact centre. This is an organisational

and technological solution which allows for the integrated and equal treatment of all channels of communication with the customer, such as telephone, e-mail, SMS (Short Message Service), Live chat (live conversation), contact via a form placed on a website, and visual contact. The Contact Centre unifies the standard of customer service regardless of the communication channel and makes it possible to build an information base of all contacts occurring at the meeting point of the enterprise and its customers. The functions of searching, displaying information about the caller, their previous problems currently can be performed by a software agent. The Contact Centre system is a virtual environment, which makes it a natural environment for software agents. A group of software agents operating within an agent system could, for example, be used to run a contact centre in a web shop (Al-Jaljouli et al., 2018). The software agents would then take on the role of collecting customer data, analysing the collected data, contacting customers to provide an offer (Fig.1).



Source: Own elaboration

Figure: 1: Agent System Supporting Operations of Contact Centre

The server running the agent system supporting Contact Centre operations receives the data from the database and then converts the data for the customer into the appropriate format, thus creating knowledge packages. For example: if the communication is to take place via e-mail, it converts the data into a text or HTML (HyperText Markup Language) document; if, on the other hand, the customer has requested an SMS, the data is converted into the appropriate format and sent via the GSM (Global System for Mobile Communications) mobile phone network. Communication between agents within the system is in ACL (Agent Communication Language), with the exception of database agents, which communicate in RDQL (RDF Data Query Language).

4. Supporting Distance Learning System

In distance learning, software agents can be used to assist the 'virtual' learner. The software agent can suggest to them specific content on the web, where there are materials facilitating learning (Aldhelai et al., 2015). It can also keep track of a given student's learning progress, suggest what he or she still needs to work on and select appropriate tests for him or her. The use of software agents relieves the workload of humans controlling

students. In addition, instructor's fatigue or a wrong adjustment of the materials to the students' level of knowledge can be associated with a loss of interest and desire to acquire knowledge. It is possible to automate repetitive, routine tasks performed by a teacher (human). Tasks such as, for example: answering simple questions, reminding learners of the necessity and deadlines for sending in solved assignments or checking computer code can be performed by a software agent - called in this case a knowledge robot or knowbot. Knowledge robots are placed between the teacher and the learner, enabling interaction.

Currently, there are numerous IT solutions that support distance learning. Some of them are based on software agents and agent systems built from them. For example, there is a proposal by researchers at the University of Tokyo called Web On-line Force-Directed Animated Visualisation (WebOFDAV for short) (Kulej-Dudek, 2012). Other examples include the system developed at Tottori University (Japan), based on P2P architecture and mobile software agents (Kulej-Dudek, 2012) or the DILE (Distributed Intelligent Learning Environment) system developed at Pelotas University (Brazil), based on the FIPA-OS platform (Hyla, 2005; Aldhelai et al., 2015).

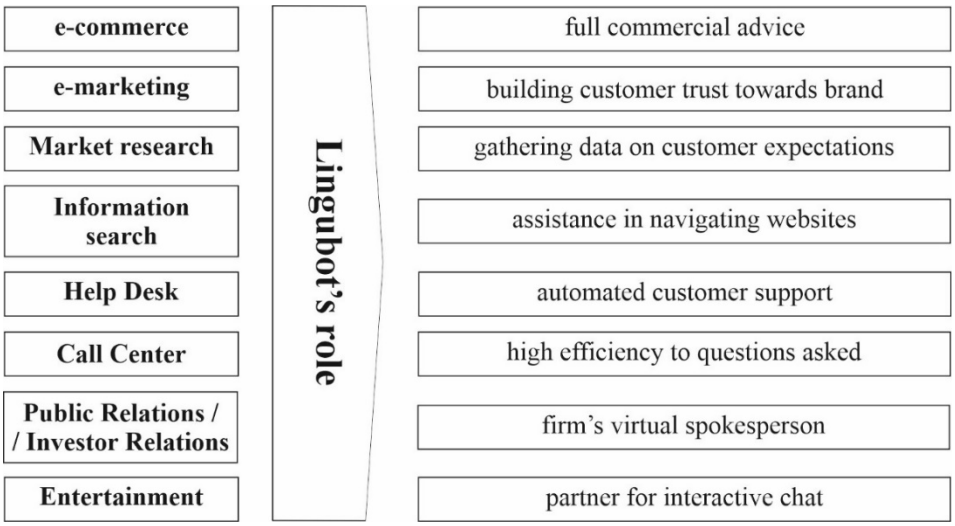
5. Virtual Assistants in the Form Of Conversation bots

Software agents equipped with artificial intelligence elements are so-called conversation bots, also called lingubots, chatbots or chatterbots. These are computer programmes, placed on social networks and considered in the field of online marketing communication as innovative solutions (Van den Broeck et al., 2019), with which a human can converse - primarily using a keyboard. During the conversation, they can express their own emotions. The high level of interactivity in communication compensates for the impersonal nature of the chatbot (Go and Sundar, 2019).

Conversational bots that use human speech and respond in the form of a question are also called virtual advisors, personal assistants, digital assistants or virtual assistants (Gentch, 2019; Corti and Gillespie, 2016; Mehrotra et al., 2017).

The person seeking information is not forced to mundane browsing through individual pages, tables or links, as the lingubot presents the relevant data, opens the right page, and assists in filling in forms. This approach increases user satisfaction, which leads to more frequent visits to a particular organisation's website, use of the service for a longer period of time and an improved brand image.

As an example, one can point to the implementations of the technology developed by Artificial Solutions (http://www.artificial-solutions.com/). Virtual assistants created with this technology are 'hired' by companies to help those who visit their website. The role of virtual assistants is primarily to provide information, although they are also capable of conversing on other topics. User interaction with conversational bots is mainly carried out using instant messaging embedded in websites. The design of bots often also includes elements of artificial intelligence to assist them in recognising the context of a conversation with a human.



Source: Own analysis

Figure 2: Possible Applications of Lingubots

All conversations are anonymously recorded and can serve as valuable material for various marketing analyses of customer preferences, tastes and expectations. Websites supported by virtual consultants carry out efficient

provision of information about commercial offers to customers [Kieltyka, 2020). The virtual salesperson, thanks to their extensive commercial knowledge, 'patience' and friendly interface, encourages and assists in concluding transactions. By leaving a positive impression on the user, it creates an opportunity for repeated contact. However, the role of the virtual advisor does not end with providing information on the details of the commercial offer and support during the electronic transaction. The technology is used in many related fields (Fig. 2).

An interesting solution is offered by the company Oddcast226. This is a tool called SitePal™, which is used to build animated, talking assistants - so-called avatars. The SitePal™ animated avatar is constructed using an online interface. The avatar is included in the HTML page code and implemented in Flash technology.

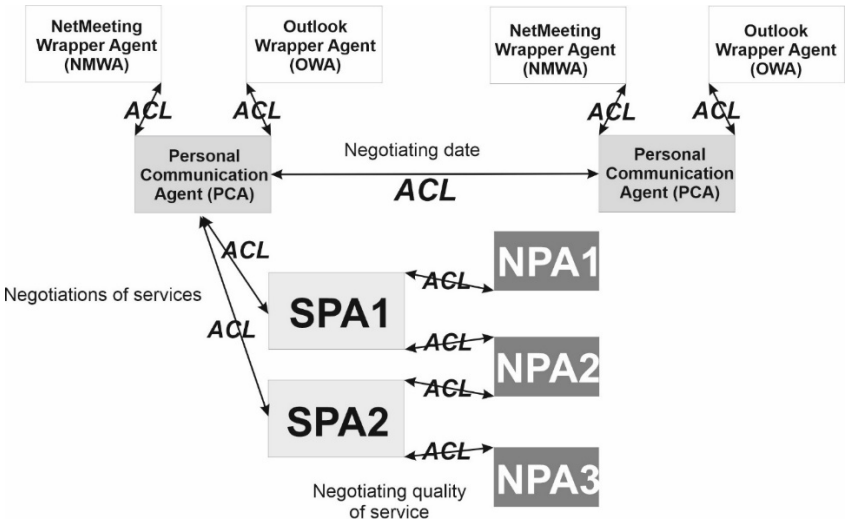
6. Knowledge Accumulated in Semantic Web

The concept of the semantic web is sometimes associated with 'machine-readable data', 'intelligent agents', 'distributed database' or 'automated infrastructure'. The Semantic Web makes it possible to systematically assign meaning to elements of web pages so that the programs that read them, called software agents, can perform complex tasks assigned to them by users. The Semantic Web is not created from scratch, but is created as an extension of the existing World Wide Web - by precisely defining the meaning of the data available in it, allowing for closer human-computer collaboration.

In order to realise the idea of the Semantic Web, a common terminology is needed for the exchange and management of information and knowledge between the various applications, describing the domain that these applications deal with. Information about the links between them is needed. Such a collection of terms and linkages is an ontology (Haliżak, 2015). Ontologies provide the terminology for the need of such a description. It can be drawn from classified domains, not necessarily dependent domains. In addition, ontologies need to define logical relationships between terms, in order to provide a deep level of analysis, as well as to improve search methods and intelligent inference by computer programmes (Gladysz, 2017).

This draws a comparison between the Semantic Web and an ontology-based knowledge management system, where ontologies provide tools for the formal description of knowledge. On the basis of such a description, computer programs can perform data retrieval and processing. It is thanks to ontologies that it is possible to integrate the huge number of heterogeneous documents currently existing on the Internet. The concept of ontologies can also be viewed in the context of a model of a fragment of reality representing the objects of interest and the relations occurring between them, as well as containing the required properties (attributes) of these objects (Śnieżko, 2015).

Setting up a videoconferencing connection over the Internet is a challenging task to build a complex distributed information system. A solution may be to implement such a system in the form of an agent system. Such a concept has been proposed by P. Faratin, N.R. Jennings, P. Buckle and C. Sierra (Fartin et al., 2001) (Fig. 3).



Source: (Faratin et al., 2001)

Figure 3: Using an Agent System to set up a Videoconference Call, Where: PCA - Personal Communication Agent, SPA - Service Provider Agents, NPA - Network Provider Agent, ACL - Agent Communication Language

Various individuals and organisations are involved in setting up a videoconference call. End users can be represented by Personal Communication Agents (PCAs). Each of the units providing services on the network - consisting in, among other things, organising videoconferences - can be represented by Service Provider Agents (SPA). In contrast, the telecommunication infrastructure through which these services will actually be transmitted can be represented by so-called Network Provider Agents (NPAs). Since applications such as NetMeeting or Outlook are not agent-based applications, it is necessary to use what is referred to in the literature as "Wrapper Software" - which converts a form of communication into an ACL (Agent Communication Language). In Figure 3, the NetMeeting Wrapper Agent (NMWA) and the Outlook Wrapper Agent (OWA) perform these functions.

The concept behind the operation of the proposed agent system is based on mutual negotiation between different types of programme agents. The PCA agents negotiate with each other in order to find a suitable date for a videoconference call. If they reach an agreement, then one of the PCA agents negotiates with the various SPA agents providing videoconferencing services. These negotiations mainly concern the cost of the call and the required quality of service. The SPA agent that wins the contract then negotiates with the various NPA agents to determine which one is able to deliver the required quality of service - at the best price. Software agents should be responsive to changes occurring in their environment. For example, an NPA agent providing network access may need to obtain additional lines from another NPA agent - to maintain the agreed quality of service in the event that part of its own network fails. Also, if there is a need to adapt to new targets when they arise - for example, two SPA programme agents may discover that they have the capacity to provide complementary services. They may therefore decide to work together to gain the capacity to provide new services. In order to set up a videoconference date or select a suitable service provider or network access entity, the software agents go out with proposals, commercial offers, make concessions - and eventually come to an agreement. The programme agents shown in Figure 3 communicate by exchanging messages in ACL (Agent Communication Language).

7. Summary/Conclusions

Based on the few areas selected in the paper, where the applicability/use of software agents has been signalled, the thought often arises that intelligent software agents will be the next revolution in computing and communication. In my opinion, this will particularly apply to the use of agents as a software development methodology. Increasingly powerful supercomputers may lead to a breakthrough of human contact with a personal computer agent. The future of software agent applications and agent systems seems promising. The way in which computers or other electronic devices are perceived increasingly resembles communication and interaction with other people. We are also increasingly dealing with applications that operate in a global environment of networked devices. The above insights open up a wide area of applications for software agents and agent systems. Therefore, when analysing the role of agent technologies in the construction of the information society, can it be assessed in terms of synergy or contradiction? In addressing the issue of agent technologies, it is important to bear in mind the general view that it is increasingly popular to replace personal human contact with contact in the form of electronic communication. New types of 'connector' are needed that more closely correspond to the natural behaviour of people contacting each other. Agent technologies are such a form of 'connector' between humans and information systems. Currently, work is still underway to build the standards needed to implement the idea of the Semantic Web. This should result in making the information available on the web processable not only at the level of individual characters in the text, but also taking into account the structure of the document and the concepts contained in the text. The aim is to create and disseminate standards for describing content on the Internet in such a way that it can be processed by machines and programs taking into account the meaning and context of the information (Folta and Stolinska, 2012). The Semantic Web is based on ontologies (Abramowicz et al., 2011) and software agents.

An ontology, as a specialised conceptual apparatus, 'is intended to support and be responsible for the efficient and unambiguous exchange of information/knowledge between its users'. The recipients of the ontology are agents operating in information systems and within the concept of the Semantic Web. The manager (human) will still make the key decisions, but agent technologies and the information systems built using them will represent them to some extent (playing an autocratic role) and will assist them in decision-making (playing an advisory role). The role of agent technologies in building an information society defined in terms of people's work should be assessed in terms of contradiction (mutual contradiction, divergence) rather than synergy (cooperation). The situation is different when identifying the role of agent technologies in building a digital society. A key issue for the development of agent technologies is the continuation of work related to the creation

of Semantic Web standards, and in particular the popularisation of ontologies as a method of knowledge representation in an information system (Niedbal, 2015).

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The Concept of a Subsystem to Support the Management of the Protection of Intangible Assets of Companies in a Behavioural Perspective

Paweł Kobis
Faculty of Management, Czestochowa University of Technology, Poland

pawel.kobis@pcz.pl

Abstract: The human factor is the biggest challenge for enterprises in providing the expected level of security, whereas the lack of educated personnel is one of the key problems in building an effective system for protection against data and information threats. A human being is a non-programmable element of the system and it is difficult to predict his or her behavior in information management processes and in the face of a specific event. Humans cannot be programmed like some security applications or hardware solutions with predictable performance. Human actions very often have a stochastic effect on the operation of the system. They can be ill-considered, haphazard, affected by emotions, and taken without due attention and adequate knowledge and experience (Pham et al., 2019). All these imperfections are exploited by those whose goal is to destroy or obtain information. According to data published by several information security companies, attacks carried out by purpose-built bots and web applications that exploit a technical factor (e.g., system vulnerabilities) are becoming increasingly rare, and are being replaced by attacks in which human interaction is a key factor. The curiosity and trust, leading well-meaning individuals to click, install, open, and send information, are being exploited by cybercriminals who are increasingly adept at using social engineering techniques. The aim of the present paper is to discuss the theoretical basis of information security issues from the behavioral perspective and to present the concept of a subsystem that implements measures to minimize the impact of the human factor on the emergence of threats to the intangible resources of a business entity. The concept is to create an information and organizational space to support the operation of the traditional information security management system in small and medium-sized enterprises. The concept is presented using the object-oriented approach which focuses on the functional elements of the system, and the subject-oriented approach, which takes into account the relationships between the various individuals who affect the security of the information system. The author's models of each approach were presented along with a description of how they work.

Keywords: Information management, Information security, Human factor, Data protection, Information security management system

1. Introduction

The concept of information security is strongly correlated with the information security management process and the established security policy (Kim and Han, 2018; Paananen et al., 2020). In the case of modern enterprises, this management occurs at the level of information systems, taking into account the security of data and computer devices themselves, software, and the security of the communication network connecting computer devices, where information is in the form of a string of bits. Information can be represented by a text, graphics, video, or a binary file in the form of a computer application. Analysis of information security in this aspect translates into an analysis of the security of the system in which the information is processed. A huge challenge for information systems today is also the excessive amount of data and information that needs to be analyzed (Jabir et al., 2022; Maroufkhani et al., 2020).

The security of digital information resources boils down to the development of a specific information security environment (Mirtsch et al., 2021; Nel and Drevin, 2019). The concept of information security is now very broad, and its dimension is proportional to the development of information systems. It should be approached as a parallel system that ensures effective and uninterrupted information management. The security system consists of certain components, with the most important including (Kobis, 2021):

- security devices;
- security software;
- procedures, regulations, ordinances, analyses, policies, etc. concerning the ways, requirements, and scope of information protection;
- humans.

The information security system represents a part of the IT system (its subsystem). It is inherent in this system and shares hardware and software resources.

2. Theoretical Background

Modern information security system considers people as the most risky element of the system (D'Arcy and Teh, 2019; Karjalainen et al., 2020). Employees of business entities are increasingly exposed to social engineering activities (Aldawood and Skinner, 2019; Salahdine and Kaabouch, 2019). It is easier for attackers to deceive people than a professionally designed security system (Al-Shanfari et al., 2020; Steinmetz et al., 2021).

How can we make the term "humans" more specific? For business organizations, we can classify human resources as employees, business partners, customers, and third parties (Figure 1). One can, of course, extend this classification, for example, to include positions held by employees, define types of business partners, etc. However, for the purpose of the present paper, the above-mentioned division was adopted. It defines specific groups of people who influence the management of intangible resources in an organization.

The employee is understood to mean any person who performs any information management activities for the benefit of an enterprise and is paid by that entity for such work. Therefore, we are talking about employees who work based on employment contracts, so-called "junk contracts," management contracts, self-employed, etc. Furthermore, the described meaning of the employee is also extended to CEOs, directors, owners, and system administrators.

The term 'business partner' defines any person or group of persons who cooperate with an enterprise on a mutual benefit basis. Therefore, these can be franchisees, all suppliers, and subcontractors.

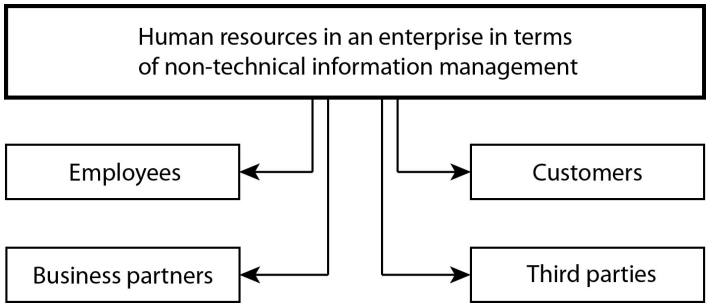


Figure 1: Human Resources in the Process of Non-Technical Information Management

Third parties that influence the management of information resources are: opinion-forming individuals that influence certain activities within the organization, and those seeking to acquire, either legally or illegally, information held by the enterprise. They can also be outsourcing entities (Benaroch, 2020; Feng et al., 2020).

The term customer refers to an entity that purchases a good to be consumed by them or for further distribution and acquires rights to its ownership. According to Encyclopedia of Management (Polish: Encyklopedia Zarządzania), customers are not only individuals but also legal entities and government entities that purchase goods and services offered on the market (Encyklopedia Zarządzania, 2023).

Analysis of human behavior in a business entity and in its closer and farther environments allows for outlining the relevant influences of the human factor on individuals, characterized by specific relationships (Figure 2). Security of information resources requires taking into consideration every person who more or less has or can have an impact on information management (Hadlington et al., 2020; Wiafe et al., 2020). This involves both positive aspects related to the experience of working with customers and business partners, and negative aspects, usually related to third parties classified as potential aggressors, employees of competing entities, individuals or groups of individuals who want to extort and destroy information or blackmail the enterprise while expecting potential profits from such acts (e.g., ransomware) (Kobis and Karyy, 2021; Masuch et al, 2021; Reshmi, 2021). Figure 2 shows feedback communications to third parties marked intentionally with a dashed line. This is because, on the level of information protection, these actions are usually defensive in nature. There is no full interaction with the potential aggressor. These are only specific responses, *ad hoc* actions, or those planned and predicted by prior risk analysis.

The various actors shown in Figure 2, despite the different scales of the human factor in both positive and negative aspects, cannot be easily classified as "good" or "bad." Anyone, whether a customer, business partner, third party, or employee, can, through certain intentional or accidental actions, contribute to both threatening and strengthening the structures of the information system. Hence, it is necessary to develop and

implement a systematic solution that, in addition to purely technical and software risks, will also take into account the behavior of humans who are the main element of the information system.

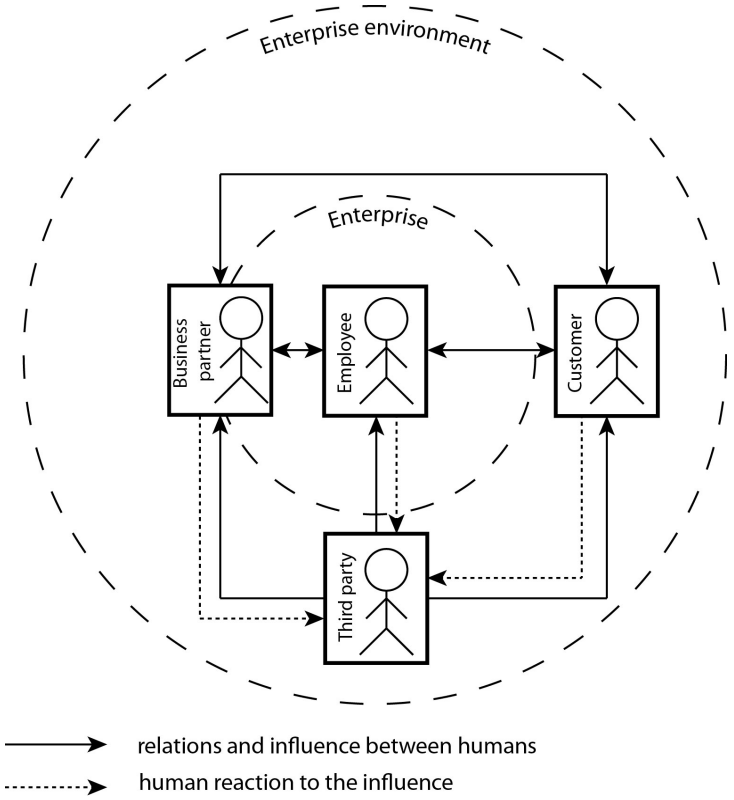


Figure 2: Possible Relationships and Influence of the Human Factor on Information Security Between Individuals

As can be seen in Figure 2, the employee is at the center of the human factor's influence. It is as much a symbol of rank-and-file employees who process certain information resources as of managers of any level, a security system administrator, an owner, or a CEO. These are the individuals with the greatest access to intangible resources, and in the event of a threat, these people are most often exposed to the potential influence of social engineering.

3. Concept of the Subsystem for the Management of Non-Technical Aspects of Information Security

3.1 General Assumptions

To counter information threats, in which humans are a key risk factor, it is necessary to develop the concept of a system solution. The solution should complement the existing information security management system (ISMS) in business entities as its subsystem. The subsystem should include all activities aimed at minimizing the risks associated with the occurrence of threats to information resources. It should include non-technical aspects of security directly related to humans. It should be positioned on the behavioral plane. The author named the system Subsystem for Management of Non-Technical Aspects of Information Security (MNTAIS subsystem). It is a proprietary solution addressing the impact of the human factor on information security. Therefore, the MNTAIS subsystem should be viewed as the implementation of activities and procedures to minimize the risk of threats caused by the human factor within the information security management system in enterprises. The MNTAIS subsystem is a supplement to the ISMS with elements concerning the impact of human beings and human groups on information security. The MNTAIS subsystem is intended to be an additional component of the ISMS, being its extension to include aspects of human impact on information security. It should be noted that modern ISMSs used in enterprises, to varying degrees, consider the human factor as a potential threat to intangible resources, tying it 'incidentally' to procedures, rules, and regulations for traditional security solutions. Thus, there is a lack of systemic solutions that would meet the assumptions of a coherent concept of information protection in an orderly manner. The subsystem presented below is a proposal to fill this gap.

3.2 Implementation and Operation at the Object-Oriented Level

At the object-oriented level, the Subsystem for Management of Non-Technical Aspects of Information Security (MNTAIS subsystem) can be defined as a set of hardware and software solutions that achieve the stated objectives of securing the information resources of a business entity against threats caused by the human factor. These solutions interfere with the information system in a certain way, minimizing the risk of an incident. Figure 3 shows a diagram of the relationship between the components of the MNTAIS subsystem and the components of the information system. The components can be characterized as follows:

- Enterprise Internal Network (EIN): a LAN computer network of a business entity, both physical (cable network) with a specific topology, and wireless, with a specific standard used for data and information exchange.
- Fixed and Cellular Telephony (FCT): all telephone communication systems used in the entity.
- Individual Information Processing Stations (IIPS): all workstations where information resources are processed. These include desktops, laptops, tablets, smartphones, and other devices that allow for processing.
- Collective Information Processing Stations (CIPS): all stations that support individual stations to a certain extent. These include file servers, database servers, application servers, email servers, and other systems with similar functions.

The above components form relationships with elements of the MNTAIS subsystem. Most relationships (except for reporting connections) are bidirectional, as there is a mutual exchange of signals, data, or information in each case. They are as follows:

- Software and hardware solutions for blocking specific services work in cooperation with three components: EIN, IIPS, and CIPS. In the case of EIN, data is collected on services being run in the internal network or computer devices being connected to the network. In the case of IIPS, data is collected on both local and cloud computing applications, and connected peripherals e.g., to USB ports (Universal Serial Bus). In CIPS, on the other hand, the component controls users' privileges of using specific resources, monitors their flow, and checks the external devices connected by employees.
- Detection of illegal actions by employees or third parties that attempt to illegally obtain information triggers a mechanism to block them immediately. This component can operate according to two scenarios, by either blocking predefined attempts or, using artificial intelligence mechanisms, making independent decisions to allow or block the service. Artificial intelligence can also be a complementary solution, similar to the way it works in some antivirus programs, which, using built-in intelligent mechanisms, recognize suspicious codes, even though officially the code is not in the signature database.

The component reports its activities in an automated reporting system.

- Remote access control systems work only with EIN by real-time monitoring connections between the global network and the LAN. They mostly concern remote workers, assigning them specific rights to access resources. At the same time, they block illegal attempts by third parties to connect to the network. It should be noted that these systems are not solutions designed to block malware and other threats automatically distributed by Internet bots. They are complementary to them and are intended to eliminate unwanted intentional or accidental human actions from the Internet. The operation of the component is reported.
- Automated control systems work with EIN, IIPS, and CIPS. They are primarily tasked with watching employees in terms of establishing proper safeguards for information resources. This includes monitoring the passwords for network devices, wireless networks, computing devices, local applications, cloud access, or monitoring users in terms of opening communication ports, etc. All human errors are reported. The reports include both the error identifier itself and detailed information about the person who made the error. Therefore, these systems make it possible to establish a base of training needs.
- Automated identification systems work with FCT and IIPS. These are the two components of the information system that allow communication with the enterprise. The systems identify the people who contact the enterprise. The operation of the component is reported to the extent permitted by law, especially under the provisions of the GDPR.

- Knowledge bases are connected only to IIPS, working simultaneously with online and artificial intelligence systems. This cooperation is expected to make it possible to search the database for information through the mechanisms of the network communicator, which is equipped with a search module. Artificial intelligence mechanisms, also equipped with instant messaging options, can be directly used by ISPI. Furthermore, artificial intelligence tools supported by a knowledge base can "suggest" specific solutions. This synergy allows employees to use a single tool when interacting with an information security supervisor, with an artificial intelligence messenger, and with a knowledge base. It also allows instant messengers to refer users to specific electronic documents during a conversation.
- Systems for controlled, targeted attacks that enable the identification of employee vulnerabilities work with all components of the information system. In the case of EIN and IIPS, they allow simulation that allows for the identification of gaps in the knowledge and experience of employees dealing with the enterprise's IT system. Indirectly, they also allow for checking the reliability of other components of the MNTAIS subsystem that provide security to EIN and IIPS.

In the case of IIPS and FCT, they are used to test the knowledge and experience of employees, especially in social engineering techniques. They allow for drawing a detailed map of training needs.

All elements, both in the information system and the MNTAIS subsystem, are monitored.

Implementation of the subsystem at the object-oriented level requires the following steps:

1. analysis of all elements of the information system;
2. adaptation of elements of the MNTAIS subsystem to the existing configuration of the ISMS system;
3. implementation of individual components.

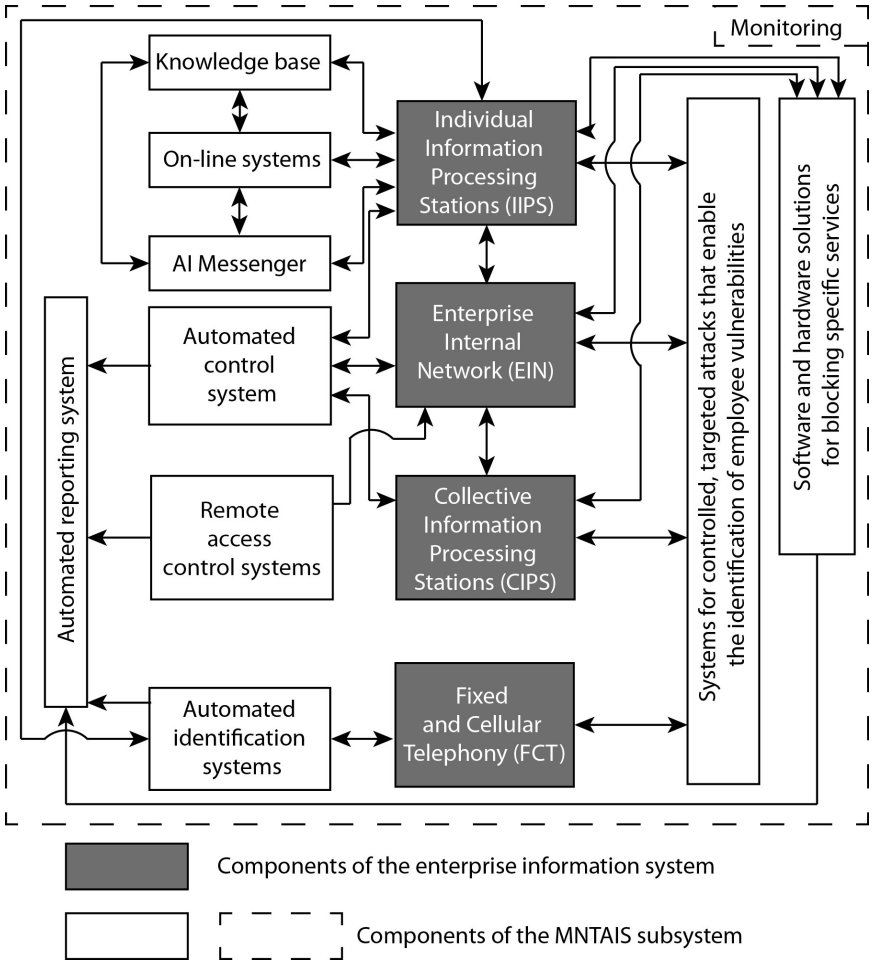


Figure 3: Components of the MNTAIS Subsystem and Relationships Between Components Of The Information System

The first step is used to determine all technical aspects of the existing system, including:

- configuration of devices in the local network;
- existing operating systems;
- existing computer software.

These aspects are necessary to adapt all elements of the MNTAIS subsystem so that data and information can be exchanged between components of the existing information system and those of the solution being implemented (Step 2). The systems for identification, control, and reporting, knowledge bases, and other parts listed in Figure 3 should function using the same communication protocols, encryption algorithms, file formats, and other technical parameters. This is the only way to achieve integrity of information.

Step three, which concerns the implementation process, should include two levels: technical implementation of the new solutions and familiarization of employees and system operators with the new functionalities. These two levels should correlate with each other. Although the individual components of the MNTAIS subsystem are autonomous (hence the order of implementation is not particularly important), their implementation without training may result in the overall deterioration of the operation of the information security system. Therefore, it is necessary to ensure systematic implementation. Each component should be implemented on two levels simultaneously, then the next one, and so on. This allows for regular learning of new solutions, thus fully utilizing the potential of the MNTAIS subsystem. In general, it is important to implement the MNTAIS subsystem into the information system in a comprehensive manner, as only by this method can a coherent and efficient information protection system be developed.

3.3 Implementation and Operation At The Subject-Oriented Level

At the subject-oriented level, the Subsystem for Management of Non-Technical Aspects of Information Security can be defined as a set of relationships between the intangible elements of the subsystem and the individuals who influence the security of the information system, and individuals pursuing the stated objectives of securing the information resources of the business entity against threats caused by the human factor.

A detailed diagram of the relationships is shown in Figure 4. The diagram presents two types of relationships: between individuals, marked by dashed lines, and between subsystem elements and individuals, marked by solid lines.

In the case of interpersonal relations, the following relationships can be defined for the prevention of threats to information resources:

- Between the person responsible for information security and other people. They are of the following nature:
    - with an employee: they concern broadly defined support for the security of processed information, analysis of the employee's actions in terms of compliance with regulations and rules of conduct;
    - with a customer: they concern the imposition of certain rules of conduct when the customer uses the enterprise system (e.g. when creating an account), the assignment of access rights to the information system, definition of customer service policies, and analysis of customer activities in the enterprise system;
    - with a business partner: they concern the imposition of certain rules of conduct when a business partner uses the enterprise system (e.g., when registering a reseller account), the assignment of access rights to the information system, the analysis of business partners' activities in the enterprise system;
    - with a third party: they concern the determination of the level of security against access to the information system, monitoring attempts to breach security, and phishing attempts using social engineering.
- Between the employee and other people, especially:
    - with a customer: they concern maintaining certain standards of customer service in terms of eliminating potential situations in which there may be a possibility of intentional or accidental disclosure of protected information and the ability to counteract social engineering;
    - with a business partner: they concern senior employees responsible for business relations. The scope of the relationships is analogous to that with customers;

- with a person responsible for information security: they concern the employee's reporting of irregularities and suspicious behavior of applications and the operating system during the performance of assigned activities;
- with a third party: they concern the ability to detect a situation in which a third party uses social engineering techniques to obtain information and the ability to counter them.

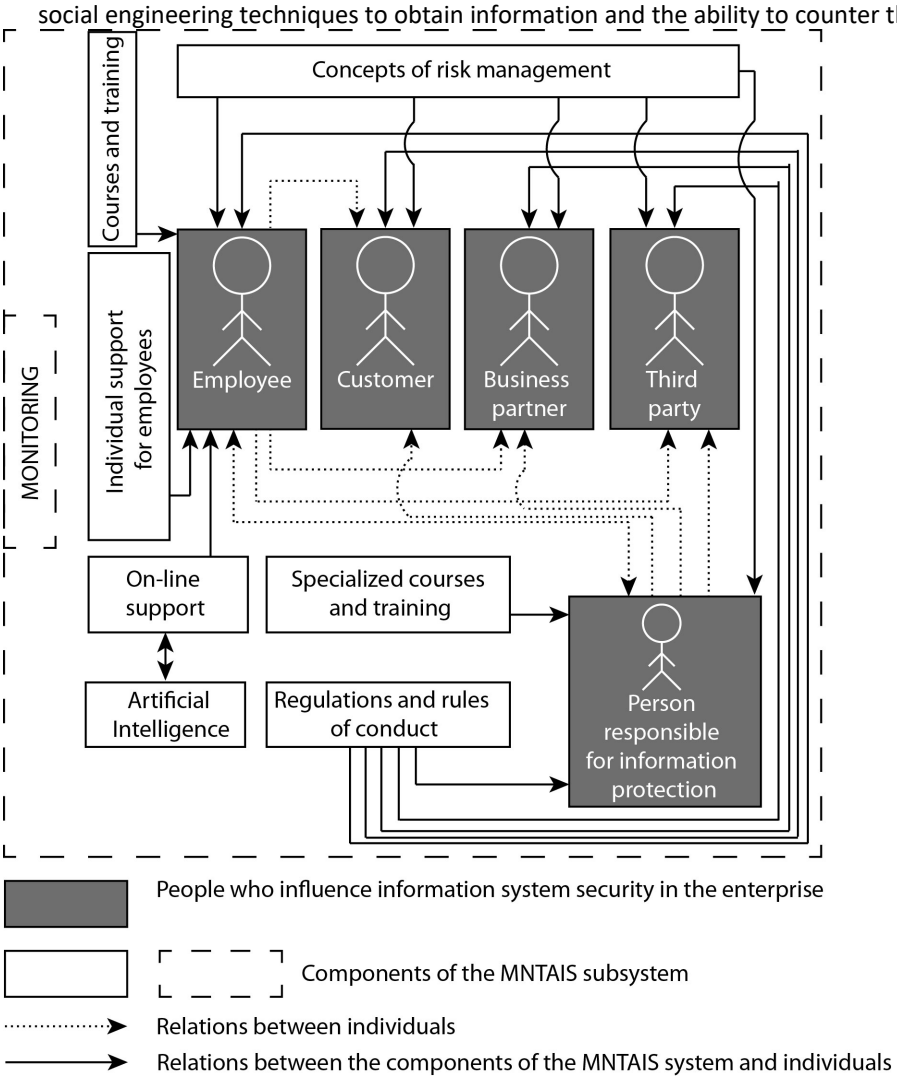


Figure 4: Relationships Between the Components of the MNTAIS Subsystem and Individuals who Influence the Security of the Enterprise Information System

Relationships between individuals in terms of the prevention of information risk are affected, among other things, by components of the MNTAIS subsystem. They influence individuals directly or indirectly. Direct actions are understood to mean performing certain actions in the presence of the person or communicating information or knowledge directly to them. Indirect actions include developing regulations, rules of conduct, and risk management concepts that apply to the person and should be followed by employees who have or may have any contact with such persons. In other words, these activities are aimed to create an area of security in dealing with these persons. Consequently, there are the following components with their respective impact as shown in Figure 4 based on the intangible components of the MNTAIS subsystem:

- Courses and training: organized periodically in the field of information security. Problems discussed can be determined by current issues presented in the literature or as a result of the operation of automated reporting systems (Figure 3). They are aimed at all employees with access to the enterprise's information resources.
- Specialized courses and training: held periodically for those involved in information security. In addition to issues directly related to the positions of these individuals, training can be extended to include human resource management in selected aspects needed to achieve the goal of adequate preparation of employees for secure information management.

- Risk management concepts: regular risk analyses and rules for dealing with risks related to the human factor, taking into account all persons who have access to information resources and those who pose a potential threat.
- Regulations and policies: these are communicated to information security officers and all employees only directly. In the case of customers or business partners, these components may affect them and be communicated both directly (e.g., through a web platform during account registration in the form of terms and conditions to be accepted) or may affect them indirectly by providing guidelines to the business entity's employees on how to contact them. In the case of third parties, there can be only indirect action.
- Individual support for employees: a component that relates to any activities aimed at providing direct support to an employee in a situation of danger or inability to cope with a given situation while processing information resources.
- Online support: a component that relates to any employee provided by an electronic communication system with an intra-organizational chat room using optional artificial intelligence solutions.

All these components are monitored. Monitoring means the supervision of the correct functioning of the subsystem, the proper execution of tasks by its various components and persons who are both part of and beneficiaries of the MNTAIS subsystem. This supervision can be the responsibility of information security professionals (in the specialized area) and managers, owners, directors, and CEOs (in the logistics area).

Subsystem implementation at the subject-oriented level is more difficult and time-consuming than that at the object-oriented level. This is primarily due to the fact that this level involves directly humans. The knowledge acquisition processes, the information contained in regulations, rules, and training are extended over time. Full implementation of the subsystem should not be expected after certain content and documents are presented to employees. Simply familiarizing with them is only the prerequisite for actually following and understanding them. The meaning of understanding refers to the employee's ability to link the acquired theory to the practice of processing information resources.

During the implementation of the subsystem, the individual predisposition of employees to acquire knowledge should also be taken into account. For example, a certain group of employees may understand certain phenomena after studying the prepared documentation and more quickly relate them to the practice, while another group, in order to understand, will have to relate them to daily work and to some extent learn from mistakes. This is inevitable and leads to an extended process of full implementation and comprehensive operation of the MNTAIS subsystem.

3.4 Comprehensive approach to the MNTAIS subsystem

The MNTAIS subsystem is intended to comprehensively encompass safeguards against all types of threats originating in human behavior. Aware of the pace of change in information management processes, the author proposed a subsystem where components can function independently. Therefore, the subsystem is an open solution to which further components (modules) can be added to protect against threats that may emerge in the following years. The only inseparable structure, according to the author, is the need for both planes to coexist (Figure 5). Only in this way, by combining human actions with tangible and intangible components that prevent the loss or destruction of information, can a comprehensive solution be achieved to minimize the risk of threat to intangible resources.

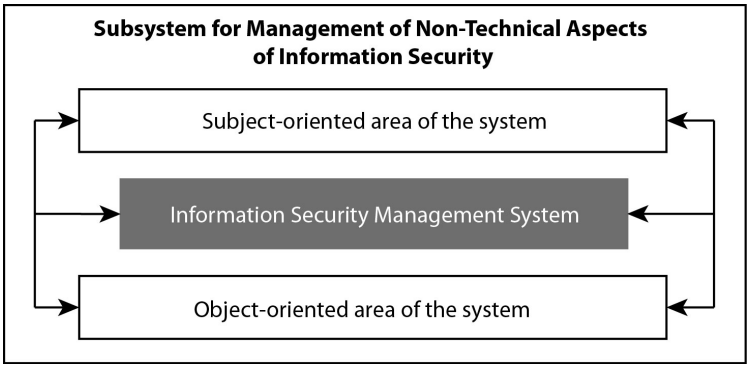


Figure 5: A Holistic View of the MNTAIS Subsystem Against the Background of the Relationships With The Information Security Management System

According to the author, very important and inseparable is the cooperation of the MNTAIS subsystem with the existing security system. This allows for the comprehensive elimination of potential incidents. Furthermore, the spectrum of modern threats is so broad that the various techniques of attacks and attempts to obtain information are beginning to intermingle. The resulting hybrid techniques can only be effectively combated through close cooperation between the MNTAIS subsystem and the ISMS.

4. Conclusion

The subsystem concept presented in this study is in line with contemporary solutions in the field of information resource protection. Its structure and operation use the mechanisms of the information security management system and are a kind of extension with components that take into account the human factor. This approach simplifies the management of the security system in the enterprise as it does not change the current state of affairs, and there is no need to build a parallel hardware and software infrastructure and structure for managing it. The synergy of these two systems allows for holistic risk management and considering potential events comprehensively: according to the existing rules of threat identification and classification, supplemented by factors related to the behavior of employees, customers, business partners, and third parties.

The visualization of the subject-oriented and object-oriented areas of the subsystem and its entirety is only a proposal. The subsystem, according to the author, is coherent and achieves the goal of minimizing risk in enterprises. It can also inspire further modernization of the subsystem or the development of a new solution.

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Awareness Level of Information Security Managers in Small Enterprises in Poland

Paweł Kobis and Grzegorz Chmielarz
Faculty of Management, Czestochowa University of Technology, Poland

pawel.kobis@pcz.pl
grzegorz.chmielarz@pcz.pl

Abstract: The security of information assets largely depends on the real level of knowledge of those managing the information system. Particularly important is the knowledge acquired on an ongoing basis through reading and analysing: new reports published by specialised intelligence services worldwide, thematic portals, industry and scientific publications. Today's rapid pace of development of information, communication systems means that knowledge of digital information security acquired a year or more ago becomes partly outdated. Although there are specific, unchangeable canons of behaviour, proceedings in the processes of information protection - they are only a foundation for building an effective system of protecting intangible resources. Special attention should be paid to the fact that information protection is not an individual activity - it is a process running parallel to all processes operating in enterprises. The global pandemic situation has had an irreversible impact on the perception of information asset security. The situation in which most business entities were forced to work remotely necessitated a new approach to information security among its managers. The relatively stable environment of business entities until the pandemic suddenly forced the use of new techniques and technologies enabling work from private, home networks. Have such conditions changed the attitudes of security managers to the need for continuous education, to expand their knowledge in this area? Did those responsible for the security of intangible assets gain more experience with information security during the pandemic? The aim of this article is to present research on the knowledge and awareness of information security managers conducted before the pandemic in 2018 and 2019 among small businesses in Poland on the real perceptions of those responsible for information security and to compare them with the same research conducted in 2022 after the pandemic.

Keywords: Information security, Small businesses, Security management, Information security awareness

1. Theoretical introduction

The human factor is currently the catalyst for most of the risks recorded in modern companies (Hughes-Lartey et al, 2021; Lin et al, 2022; Metalidou et al, 2014). There is a need to implement a number of measures to secure information assets in the area of human information management. For example, cyber-security experts advocate the need to train personnel in cyber-awareness and to become acquainted with new ways of social engineering functioning (Tayouri, 2015; Washo, 2021). Five main recommendations for reducing the risk of information security breaches can be found in the literature (Sedgwick, 2019):

- The need for pre-implementation testing of new technological solutions implemented in companies in order to avoid unwanted actions on the part of users (employees). The design of the system should take into account both the ergonomics of work and minimise the generation of accidental errors on the part of employees.
- The need to organise regular awareness training on IT security.
- Implementation of "cyber hygiene" principles in companies.
- Establishing rules of cooperation between employees and those responsible for information security. Building a support and assistance system for employees.
- Building a system to encourage reporting of information security breaches. Eliminating situations where security breaches are covered up by employees.

In order for the recommendations listed above to be implemented, they must be understood by managerial personnel of enterprises. Those responsible for information system security should be familiar with the realities of modern threats, and be able to transfer them to the operation of a particular enterprise. It is very important to understand the principles of risk management and the impact of the human factor on these risks (Shaikh & Siponen, 2023; Noga & Brzeziński, 2022). It is essential to classify the possible information security risks in the area of organisational functioning and to be able to determine their relevance to individual departments/workstations (Kobis, 2021, pp. 267-268).

2. Research Methodology

The research presented was carried out twice, in the same way, on the same number of: 287 enterprises with a time interval of 3 years. In the second survey, the majority of enterprises overlapped with those in the first

survey, and a small number were new. This was due to the fact that, between the first and second surveys, some enterprises had ceased their activities or developed from small enterprises into micro-enterprises. The research techniques adopted for the survey were the F2F (Face to Face) face-to-face questionnaire interview with the use of a computer (CAPI - Computer Aided Personal Interview), which in some cases was replaced by an interview conducted via instant messaging allowing direct, natural audio-visual contact with the respondent while adhering to the applicable rules for conducting the survey, and the CAWI (Computer-Assisted Web Interview) technique. Thus, the so-called Mixed-Mode was used. The same questionnaire was used in both techniques. The first research took place in 2018-2019, the second in 2022. The inspiration to repeat the same research was the turbulent pandemic period for companies, which, by changing the form of work provision (remote working) in many cases, significantly affected the perception of information security among business entities. Thus, it is the authors' intention to compare the findings obtained before and after the pandemic period. The people surveyed were those in entities who had the greatest knowledge of information security and who were directly involved in the processes of establishing and updating security policies in the organisation. Thus, these included such individuals as heads of IT departments, employees of IT departments, individuals specifically (full-time or part-time) involved in the security of digital information assets, presidents, directors, owners and co-owners.

The presented research results represent a slice (fragment) of the authors' research conducted in the area of the SME sector and concerning the security of information resources.

3. Research Results and Discussion

The starting point in estimating the knowledge regarding the impact of the human factor on information security among those responsible for protecting information assets is to determine its importance in the minds of respondents (Kobis, 2021, p. 268).

Table 1 presents the results of a survey showing the view of the level of effectiveness of IT security safeguards in the information system of an enterprise. These safeguards can be broadly divided into technical and behavioural safeguards. The former refer to all physical and software safeguards that hinder or, in selected cases, eliminate the possibility of an attack on information resources. Behavioural safeguards are a set of measures aimed at training and making employees aware of the principles of proper information security management, so that it does not fall into the wrong hands. It should be noted here that currently available research indicates that the human factor is mostly responsible for the loss or destruction of information in modern organisations. During the first survey in 2018-2019, as many as 57.8 per cent of the respondents said that professional software and hardware security was able to eliminate most incidents of information loss and leakage. Only 25.1 per cent of them held the opposite view. This means that only in one in four enterprises, those caring for information security were aware of the real impact of non-technical factors in reducing the risk of unwanted incidents. The situation changed slightly in 2022, with a predominance of respondents on the side of ineffectiveness of physical security (49.1%) over those in favour of it (41.5%). The percentage of those who could not decide on the question also decreased.

The pandemic period forced many entities to work remotely (Benitez et al., 2023). Thus, employees performed their duties from their homes, private networks, and public networks, often on their own, unprotected computing devices. Many of the respondents, responsible for information security in their own enterprises, realised that it was largely up to the employee to keep information resources secure or not. In remote working, many of the safeguards previously in place on the enterprise's internal network did not directly translate into security on the employee's private network. It is mainly up to the employee to ensure that the information is secure.

Table 1: Respondents' Answers to the Question: Is Professional IT Security a Guarantee of Information Security in the Enterprise?

	2018/2019 research		2022 research	
	Number	**Percentage**	**Number**	**Percentage**
Yes, physical and software safeguards are able to eliminate most incidents of information loss and leakage	166	57,8%	119	41,5%
No, physical and software safeguards do not guarantee the elimination of most threats of information loss and leakage	72	25,1%	141	49,1%
No opinion	49	17,1%	27	9,4%

Source: Own elaboration

Unfortunately, the current figure of 41.5 % is still not encouraging. Many entities believe that technical security is the most important. This mindset may contribute to a significant increase in malware incidents. It justifies the belief among cybercriminals that a more effective form of attack on information assets is through the human factor. This is a very dangerous phenomenon, given the multitude of types of solutions currently in place. In extreme cases, without proper safeguards, malware can operate in a company for months or years. An example of this is spyware, which can continuously collect certain information and transmit it without the owner's knowledge to others. Apart from using part of the hardware resources, the programme does not reveal its presence and is therefore 'invisible' to the user. In the case of modern computers with significant memory resources and high computing power, the load of a spyware programme can be completely unnoticeable in day-to-day operation.

Extending the discussion, the attitudes of enterprises in terms of combating potential risks, it is worth identifying, according to the respondents, the sources of security incidents. Table 2 shows the areas in which enterprises engage their financial and human resources to minimise potential risks.

Table 2: Sources of Possible Threats to the Information System, Together with the Percentage Level of Enterprise Involvement in Terms of Their Potential Combating

	2018/2019 research		2022 research	
	Number	**Percentage**	**Number**	**Percentage**
IT risks (software and hardware)	160	55,7%	104	36,3%
Threats related to the "human factor", social engineering activities	92	32,1%	166	57,8%
Direct physical threats (burglary, theft of equipment, documents)	35	12,2%	17	5,9%

Source: Own elaboration

In the first round of the survey (2018-2019), again, as in the previous survey, the most important area according to respondents is IT (software and hardware) threats. As many as 55.7 per cent of the organisations overall engaged their resources in combating such dangers. Only 32.1% perceived threats from behavioural activities. In the 2022 survey, there was a polarisation of indications after the pandemic. Only 36.3% of the respondents viewed the source of possible threats on the software and hardware side, compared to 57.8% of the respondents. As with the previous question, the reason for the change in view of these aspects can be found in the change in the form of work provision from stationary to remote. It was in the responsibility of the employee that security for information resources was sought.

The least involvement of enterprises (in both the first and second surveys) can be seen on the level of direct, physical threats (burglary, equipment theft). Attempts to illegally obtain information tend to be of a remote nature - via a computer network or human factors: employee bribery, business intelligence, etc. Cases of physical intrusions for the sole purpose of obtaining information are relatively rare. The loss of intangible resources in this way tends to be related to actions aimed at stealing the equipment and tangible assets on which (disks, internal memories) the information was stored.

Table 3 shows the share of companies that allow or prohibit access from computing devices to social networking sites and online chat rooms. Both before and after the pandemic period, this ratio is similar and has not changed much.

Table 3: Percentage Share of Companies Whose Information Security Policy Does or Does not Allow Access from Company Computer Devices to Social Networking Sites, Online Chat Rooms, etc.

	2018/2019 research		2022 research	
	Number	**Percentage**	**Number**	**Percentage**
Yes	222	77,4%	213	74,2%
No	65	22,6%	74	25,8%

Source: Own elaboration

Applications used to communicate over the internet pose risks that can be divided into:

- unauthorised and uncontrolled transmission of information in the form of text or files by company employees;
- accidental or intentional posting of company-related material on social networks; and
- fake news and hyperlinks sent by cyber criminals;
- other activities organised by cyber criminals using social engineering.

It is also important to note whether instant messaging is used for work-related purposes or whether it is only used for private conversations.

Transmission of text or files via instant messaging typically occurs in three cases:

1. Text and file transfer between employees - a quicker and easier path than using official tools (e.g. document exchange system).
2. Transmission of text and files to third parties by dishonest/bribed employees.
3. Text transfer to friends, family.

In the first case, the danger is limited to the transmission of an unencrypted signal (this is the default setting of most communicators) and thus easily accessible to eavesdropping by third parties. In the second case, we are talking about the easy, uncontrolled, difficult-to-monitor transmission of files with virtually no quantitative limits. In the third case, with potentially the least harm, we are talking about the possible disclosure of confidential information during a conversation and eavesdropping by third parties (Curry, 2013).

Posting company-related material on social networks usually involves publishing photos of the workplace and possible information about the nature of the work being done. This information can be used for potential social engineering activities by cybercriminals. In addition, posted photos may reveal information that was accidentally photographed, which may be potentially relevant to criminal activities.

Significant threats from instant messaging and social networking sites include fake posts, spreading information containing hyperlinks to infected sites and malware. The appearance and content of messages crafted by cybercriminals usually inspire a high level of trust among users, which increases the potential risk of the threat. The most common threats are XSS (Cross-Site Scripting), SNS (Social Networking Service) and so-called phishing to extract relevant information from users through social engineering activities (Gruber et al., 2012, p. 356).

A group of socio-technical activities also includes 'impersonation' on social networks and instant messaging sites by persons known or potentially known to a specific employee. When contacting a specific employee, for example, the cybercriminal introduces himself as, for example, "a colleague from another department of the organisation" and tricks the employee into providing certain information under the pretext of performing his duties.

As in the case of instant messaging and social networking, it is important from the point of view of information security to implement general rules for the use of the global network. The multitude of communication solutions and technologies that allow to carry out conversations or send information of virtually any size without the use of any additional programs (e.g. https://wetransfer.com/) should result in the implementation of a set of rules for the use of network resources. At present, any website (store, information portal, theme portal, auction system, etc.) can be a source of threat to the intangible resources of a business organisation.

Establishing internal regulations that normalize the rules of network use, also providing for certain sanctions for employees, can become one of the more effective tools for reducing the risk of information security breaches. According to the survey, as many as 66.9% (in 2018-2019) and 64.8% (in 2022) of enterprises have no regulations in this regard (Table 4). This is not an optimistic result and indicates the need for quick action before business entities. This is an important aspect, as the literature shows a steady increase in reported attacks through crafted and infected websites.

Table 4: Percentage of companies With or Without an Internal set of Rules for Using Internet Resources in Their Information Security Policy

	2018/2019 research		2022 research	
	Number	**Percentage**	**Number**	**Percentage**
Yes	95	33,1%	101	35,2%
No	192	66,9%	186	64,8%

Source: Own elaboration

Another threat to the security of information resources that has the hallmarks of a human factor is the use and manner in which employees use portable data storage (Pabian et al., 2020). Modern technology makes it possible to store hundreds of GB of data in a volume of 1-2 cm^3. This means that practically imperceptibly any employee with access to information resources can copy them and carry them unnoticed outside the enterprise area. Moreover, the currently popular "flash drives" are for many people the primary storage place for documents and software files used in daily work. This is due to the convenience, speed of access and versatility of such a solution. These solutions, due to their practical advantages, can also be used for private purposes. In practice, situations arise in which users store both "company" and personal materials on portable data stores in parallel. All these situations can lead to such risks as:

- using portable data storage devices to steal information;
- storing, for example, the only copy of a particular document on a memory stick (the employee edits the files directly on the USB drive);
- possibility of disclosing information to third parties, e.g. while viewing private information on the same medium;
- losing the data carrier and, consequently, the possibility of unauthorised persons intercepting the information;
- the possibility of infecting a workplace computer workstation by first connecting the USB storage medium to other (e.g. private) computer devices.

In order to prevent the aforementioned risks, it is recommended to block or review any portable data storage in business organizations. Various software solutions are used for this purpose, allowing to maintain control over these resources in any programmed way. Table 5 shows the results describing the position of the surveyed economic entities on the aforementioned issue. Only 23.3% of enterprises had developed control mechanisms in 2018-2019. Three years later, this percentage has increased very little (25.8%). This is a low result exposing the vulnerability of enterprises' information systems to relatively simple ways of losing information., Interestingly, for three years, 4.8% of enterprises have introduced regulations forbidding the bringing and carrying away of data stores, and only 2.5% have implemented their enforcement. This also shows too little interest on the part of those responsible for information security in this topic.

Table 5. Respondents' Answers to the Question: Is There any Form of Control In Enterprises Over the Bringing and Taking of Portable Data Storage by Employees (SD card, PenDrive, USB drive, CD, DVD, BR)?

	2018/2019 research		2022 research	
	Number	**Percentage**	**Number**	**Percentage**
No	138	48,1%	117	40,8%
There are regulations prohibiting such practices, but direct control is not used	82	28,6%	96	33,4%
Yes	67	23,3%	74	25,8%

Source: Own elaboration

An analogous problem in terms of minimising the risk of information loss is the use of private computing devices by employees on the company's network. The currently popular BYOD phenomenon generates a number of problems in ensuring the security of intangible resources (Barlette et al., 2021; Zahadat et al., 2015). The most important of these is the blurring of the line between the use of a computer for professional and private purposes. From the point of view of information protection (problems analogous to the studies included in Table 5), this type of practice should be prohibited. However, many enterprises calculate the gains and losses of practicing this trend and allow the use of their own laptops, tablets and smartphones in daily work. In the 3-year period under review, the usage rate increased very significantly: from 59.9% all the way up to 91.6%. This is a result of the shift to remote working, where many employees performed their duties on private computer equipment. The very short period of assimilation into remote work meant that many businesses were not prepared for this. As a result, expressing consents to the use of private equipment was a natural consequence. The results are shown in Table 6.

Table 6. Respondents' Answers to the Question: Are Employees Allowed to use Private Computing Devices (Laptop, Tablet, Smartphone) in the Enterprise Network?

	2018/2019 research		2022 research	
	Number	**Percentage**	**Number**	**Percentage**
Yes	172	59,9%	263	91,6%
No	115	40,1%	24	8,4%

Source: Own elaboration

Enterprises that allow the use of private devices in the workplace should implement appropriate systems to monitor the behaviour of these computers on the enterprise's local network. This can significantly minimize the risk of information threats, and in selected cases eliminate them. The basic idea should be to establish a policy that provides for the use of private computers as data processing devices under certain conditions imposed by a properly configured system. At the same time, the possibility of storing any information or data in the memory of these devices should be prohibited. Thus, they should only provide an interface to work on information resources located on the enterprise's server or in the cloud computing (Irsheid et al., 2022). The actual position of economic entities on this issue is shown in Table 7.

Table 7: Measures to Monitor Employees' Private Computing Devices on the Company's Local Network

	2018/2019 research		2022 research	
	n=172		n=263	
	Number	**Percentage**	**Number**	**Percentage**
No need to monitor and authorise employee equipment	135	78,5%	83	31,6%
Devices are authorized in the network, but no one monitors the transmission of information	26	15,1%	166	63,1%
Each device is authorized and monitored against transmitted information	11	6,4%	14	5,3%

Source: Own elaboration

From the research results presented in Table 7, it can be observed that with the transition of economic entities to remote work, the need to authorize employees' devices on the enterprise's local network has increased significantly (Y. Sun et al., 2023). At the same time, it can be seen that the phenomenon of monitoring these devices has not changed (in fact, it has decreased somewhat). This is directly related to the question in Table 6 - in connection with the use of private devices by employees, they should be authorized on the network. However, there are no tools for monitoring private computers. Moreover, in many countries this would be a violation of the law.

A very important aspect in the protection of information is the organisation of work in places where customers and business partners are served. Currently, we can consider these issues on two levels:

- Protection of personal data (compliance with GDPR);
- Protection of business-critical information from accidental disclosure.

Both levels require adequate preparation on both theoretical (general set of rules, regulations) and practical (preparation of premises) grounds. These measures minimize the risk of information threats, reducing the human factor in such situations as the possibility of eavesdropping on employees' business conversations, the possibility of accidentally seeing documents placed on a desk or computer screen, and more direct ones, such as attempted theft. Table 8 shows the solutions to the aforementioned problem operating in enterprises.

The survey shows that 38.7% (2018-2019) and 36.2% (2022) of enterprises receive their customers in a dedicated room. This is a good result compared to other described measures to minimize the risk of information security breaches involving the human factor. Probably also caused by the fact that the requirements of the so-called "clean desk" and "clean monitor screen" appear in the GDPR regulation, which provides for high, financial criminal penalties for violations of personal data protection. However, as many as 49.9% (2018-2019) and 54.7% (2022) of enterprises still do not have practices to counter information security breaches.

Table 8: Places to Serve Customers and Business Partners In Enterprises

	2018/2019 research		2022 research	
	Number	**Percentage**	**Number**	**Percentage**
They are received in specially prepared rooms	111	38,7%	104	36,2%
They are received in one of the rooms in which employees carry out their daily work	117	40,8%	121	42,2%
Customers/business partners can move freely between rooms/departments of the enterprise	26	9,1%	36	12,5%
Due to the nature of the business operations, we do not personally receive customers and business partners at the premises of the company	33	11,5%	26	9,1%

Source: Own elaboration

Another aspect is the allocation of those information resources to employees that are necessary for them to perform their duties. Defining the rules for the use of software and hardware solutions makes it possible to significantly reduce the occurrence of potential risks and provides a set of basic guidelines related to information management in the company. However, additional attention should be paid to the extent and scope of access to information by those who manage it to any degree. The establishment of a resource entitlement policy is, in addition to the aforementioned principles, an elementary measure to prevent the loss or destruction of information. Assigning each employee a well-defined information area ensures that even in the case of deliberate, damaging actions by an employee, only selected intangible resources are at risk. Table 9 shows the results demonstrating the approach of economic entities in terms of entitlements.

It can be seen that during the pandemic period in which employees performed their duties through remote connections, the percentage of enterprises taking care of the proper allocation of resources for each employee increased (from 73.9% to 88.9%). In the case of small enterprises, one should additionally take into account the fact that in many of them there are no separate departments with specific responsibilities, and all "matters" concerning the entity's operation in the area of digital information are handled by one employee or the owner himself, for example. He then automatically has access to all intangible resources and there is no basis for applying any authority and these entities are included in the group represented by the results of 26.1% (2018-2019) and 11.1% (2022).

Table 9: Employees' Rights to Access Company Information Resources

	2018/2019 research		2022 research	
	Number	**Percentage**	**Number**	**Percentage**
Each employee has access to a specific information resource	212	73,9%	255	88,9%
Every employee has access to all information resources	75	26,1%	32	11,1%

Source: Own elaboration

The last issue discussed for the protection of information resources involving the human factor, perceived in the literature on the subject as one of the more effective, but at the same time controversial from the point of view of ethics, is monitoring. In light of modern technological developments, monitoring can cover virtually any aspect of human activity in the process of information processing. In general, regardless of the area in which it operates, it performs three basic security activities:

- preventive - by functioning in the consciousness of employees, it can minimize the number of mistakes made and reduce potential attempts to steal or destroy information;
- in the case of monitoring e-mails, telephone conversations, it can prevent potential intrusions into the network using social engineering activities;
- in a critical situation, after a threat has occurred, it allows to reconstruct to a certain extent the actions that led to the loss or destruction of information, and thus develop effective defence mechanisms for the future.

In the research conducted, an attempt was made to answer the questions: how many enterprises use monitoring techniques, and what areas they cover. The question was multiple-choice, so that respondents could mark any number of techniques used. The results are shown in Table 10. Direct interviews with respondents also show that each monitoring technique was implemented in accordance with the laws in force in Poland and each employee affected by the monitoring was informed about it. In special situations requiring additional authorizations, the appropriate consent was given by the employee.

In 2018-2019, the most popular technique was visual monitoring implemented through a system of video cameras installed in specific locations (25.1% of enterprises). In 2022, the most popular monitoring technique is already "software monitoring of activities performed on the computer" (up from 14.3% to 32.1%), and "control of e-mail correspondence" (up from 15.7% to 28.2%). As with the previous questions, the predominant focus during remote work is control of equipment or control of data managed by the employee. A direct surveillance system in the form of cameras is no longer relevant for obvious reasons.

Table 10: Monitoring Techniques Used in Companies (multiple choice)

	2018/2019 research		2022 research	
	Number	**Percentage**	**Number**	**Percentage**
Camera system	72	25,1%	69	24,0%
Control of e-mail correspondence	45	15,7%	81	28,2%
Software monitoring of activities performed on the computer	41	14,3%	92	32,1%
Print control	34	11,8%	38	13,2%
Recording of telephone conversations	11	3,8%	10	3,5%
Monitoring techniques are not used in the company	157	54,7%	93	32,4%

Source: Own elaboration

Computer monitoring is the most extensive and advanced technique (J. Sun, 2022). The number of activities that can be monitored is virtually unlimited. Advanced software solutions can nowadays monitor practically every mouse movement and record every key pressed on a computer keyboard. In the case of installed webcams, the system has the ability to record employee behaviour (similar to security systems installed in cars). The scope of monitored activities depends on the economic entity and possible arrangements with employees, whose opinion and possible objection according to the current law are not binding on the employer anyway (Kryczka, 2019; Ostrowski, 2014).

4. Conclusion

All the research results presented dealt with aspects of information security involving the human factor. Man, as the most important element of an information system, is at the same time its weakest link in the face of ensuring an adequate level of security.

The pandemic period, like no other period of information functioning as a strategic enterprise resource, has significantly contributed to the perception of information security from both technical and behavioural perspectives. The massive "migration" of employees from a desktop form of work to a remote form, carried out in record time, posed previously unknown challenges for business entities. One of them was to provide access to information resources from outside the company's premises in the most secure form possible. As the research presented here shows, the importance of the human factor as a catalyst for many potential risks was also realized on this occasion. The migration from a relatively secure information environment such as an enterprise's internal network to private environments, completely unknown by IT departments, meant that it was in the human (employee) that the greatest hopes were placed for the secure use of intangible resources of economic entities. The research presented here documents the fact that corporate information security decision-makers have changed their attitudes over the past 3 years in terms of behavioural perceptions of information security.

The research presented also confirms that turbulent periods (relevant to the operation of businesses) directly affect the perception and performance of certain management functions. One can also venture to say that the period of the contemporary armed conflict in Ukraine will also be significant for the perception of information

security. Thus, further research can make a significant contribution to the picture of the contemporary field of information security management.

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Business Environment Institutions as a Catalyst for Knowledge and Technology Transfer

Patrycja Kokot-Stępień and Patrycja Krawczyk
Czestochowa University of Technology (CUT), Poland

p.kokot-stepień@pcz.pl
patrycja.krawczyk@pcz.pl

Abstract: Knowledge and innovation are key resources of the modern economy. Innovation, transfer, and use of knowledge determine the pace and level of economic development. The ability to transform knowledge into new technologies, products, services, marketing methods, and organizational solutions is both the basis of entrepreneurship and building a competitive advantage that increases the enterprise's chances of maintaining its market position. However, the market commercialization of new knowledge in the form of cutting-edge technological solutions or new products is a complex process with a high risk of failure, thus requiring appropriate and different competencies. Moreover, there are numerous barriers at the point of contact between the worlds of science and business that significantly impede joint work on innovative projects. Therefore, specialized entities have emerged to transfer knowledge and technology from science to the economy. These entities organize the knowledge flow from entities that have to those that seek knowledge. A professional institutional base in this regard is developed by innovation and entrepreneurship centers that partner with both private and public sectors. These centers act as a catalyst for the flow of knowledge and are responsible for building a platform for dialogue and cooperation between science and business, thereby providing conditions for improving the efficiency of knowledge and technology transfer. Their activities are aimed at meeting the needs of entrepreneurs primarily related to the development of innovation, promotion of experimental activities, technology transfer and commercialization of knowledge, and improvement of competitiveness based on new technological solutions. The aim of the present paper is to indicate the importance of business environment institutions to the transfer of knowledge and technology between science and business.

Keywords: Business environment institutions, Knowledge and technology transfer, Commercialization of knowledge

1. Introduction

One of the elements that shape the activity of entrepreneurs is the institutions that support their activities to reduce uncertainty. Over the past few years, there have been efforts in Poland to create a stable infrastructure to provide long-term support for innovation, with its foundation being knowledge. It is difficult to plan and implement any changes without adequate knowledge potential while innovations create the demand for new areas of knowledge, which are constantly developed. Being aware of these conditions, the governments of developed countries pursue a policy of supporting the transfer of knowledge and technology, using a whole range of means for this purpose.

The basis of contemporary entrepreneurship has become the acquisition of new technologies and knowledge necessary to run a modern business. Knowledge and the ability to transform it into innovations significantly affect the competitive position of the company. Unfortunately, the technology and knowledge transfer at the interface between science and the economy is a complex and multifaceted process accompanied by a high risk of failure. Its implementation requires well-defined and different competencies, which both environments sometimes lack. Specialized institutions have been created to reduce potential risks and overcome any barriers that hinder cooperation between people of science and business. They are an important element in the process of increasing the innovativeness of the Polish economy. Business environment institutions, in particular innovation centres, act as a catalyst for knowledge flow by facilitating the implementation of new solutions into business practice.

In the era of rapid technological change and dynamic expansion of innovation into the areas of services, organization, marketing, and social issues, enterprises are looking for new solutions in which the activities of innovation and entrepreneurship centers, which are a professional institutional base for knowledge exchange and its commercialization, prove helpful. The activity of business environment institutions consists primarily in supporting activities for innovation and development of enterprises in the SME sector. The paper presents the essence of the functioning of support institutions and indicates their importance in the process of technology transfer and commercialization of knowledge.

2. The Essence of Knowledge and Technology Transfer

Nowadays, the innovative development of enterprises is attributed to knowledge, which, in the era of constant competition in the market and dynamic globalization, is considered a unique resource (Wolski, 2018; Rychta, 2022). Unlike other goods, knowledge, which is a mixture of experience, values, the information set in a specific context, and expert insight that provides a framework for the evaluation and gaining new experiences and information, does not wear out (Wiśniewska and Głodek, 2015). Its resources during use do not decrease but increase due to improving skills and generating new ideas (Michalak and Zagórowski, 2017). Knowledge resources are natural assets of research centers, universities, and large corporations, but they also exist among customers and other actors in the economy (Łobejko and Sosnowska, 2013). However, knowledge should not be limited to individual entities but flow to other areas of the economy. Therefore, its dissemination is essential.

The process of knowledge transfer from an entity with knowledge (the technology donor) to an entity that needs it and is willing to apply it to its business activities (the technology buyer) is knowledge and technology transfer (Radło *et al*., 2020; Reit, 2022; Marszałek, 2022). It is composed of two components of transmission involving collecting knowledge and technology and then sending them to a potential recipient, and absorption, that is, the adoption and acceptance of knowledge and technology (Wiatrak, 2018; Stelmaszczyk and Jarubas, 2019). Knowledge transfer requires the need to understand the essence of scientific discoveries, to see the potential possibility of their commercialization and market usefulness, and to know the regulations governing their acquisition, management, and legal actions (Szewc, 2014).

Providing the knowledge and information necessary for one entity to be able to replicate the work of another is part of the commercialization process, which means all the activities related to the transfer of specific technical or organizational knowledge and related know-how to business practice. Commercialization is the process of creating value from knowledge, adapting or making it available for economic and social purposes, and transforming knowledge into competitive products, services, processes, new technologies, and organizational solutions. Commercialization is a specific case of communication and involves a whole set of events aimed at the successful marketization of knowledge, and thus the placement of products using a given technology on the market for the purpose of achieving economic benefits and building the added value of the technology (Bartoszewicz et al, 2019; Łobejko and Sosnowska, 2013; Wiśniewska and Głodek, 2015; Trzmielak and Grzegorczyk 2014; Konopka-Cypiał, 2020; Szewczuk-Stępień, 2016; Radło *et al*., 2020; Jurewicz, 2021). Commercialization is also an essential mechanism for generating innovation because of the strategic importance that innovation has for increasing economic efficiency and competitiveness.

The transfer of knowledge and technology should allow the participants in the process to achieve mutual benefits, which may be commercial (economic benefits) or social (depending on their application, these may include technological, environmental or health benefits). Knowledge and technology transfer strengthens recipients' potential and skills, as well as the conversion of research results to their own needs. At the same time, by selling knowledge and technology, the entities raise funds for the development of research and its subsequent transfer. The prerequisite for receiving each type of benefit is the interest of the recipient, supplier, and intermediary institutions in the transfer and their cooperation in the process of acquisition and application of new solutions. It is important that the knowledge received can be used by the recipient and matched to their capabilities under existing conditions. Therefore, you should prepare for the transfer, taking into account its individual phases (Trzmielak and Grzegorczyk, 2014; Wiatrak, 2018; Radło *et al*., 2020). When preparing knowledge and technology for transfer, it is necessary to determine not only the type, scope, or time of delivery but also to indicate the conditions for their use in practice. Delivery can be combined with consulting and training offered by the business environment institutions to facilitate their implementation and application.

3. Specifics of Functioning and Classification of Business Environment Institutions

Business environment institutions (BEIs) are an institutional form of support for innovative entrepreneurship and technology and knowledge transfer. They are elements of innovation potential seen as a set of characteristics of a given territorial system that foster innovative activity undertaken by business entities operating in that system. Enterprises' innovativeness can be attributed to both their organizational capabilities and their connections with other actors in the environment, while communication, cooperation and coordination are prerequisites for the creation and transfer of knowledge and technology (Golejewska, 2017).

Business environment institutions are nonprofit entities or those that use the profit to reinvest in business support activities or cooperation between the sectors of science and business. These institutions have the necessary material and technical base, appropriate human resources and competencies to provide services to the SME sector (Mażewska, Bąkowski and Rudawska, 2021; Kuchciński, 2021). Their functioning is reduced to the following aspects (Mażewska, Bąkowski and Rudawska, 2021):

- they are service-oriented entities linking businesses with entities in the sector of science, which is at least to some extent publicly funded,
- they are entities that do not operate for profit (non-for-profit) or allocate the profit obtained for statutory purposes, i.e. supporting entrepreneurship and innovation of their beneficiaries,
- they have an adequate base of both tangible (real estate and movable property) and intangible resources (knowledge and qualifications) and adequate personnel to provide services,
- their goal is to support micro, small and medium-sized enterprises at every stage of their development.

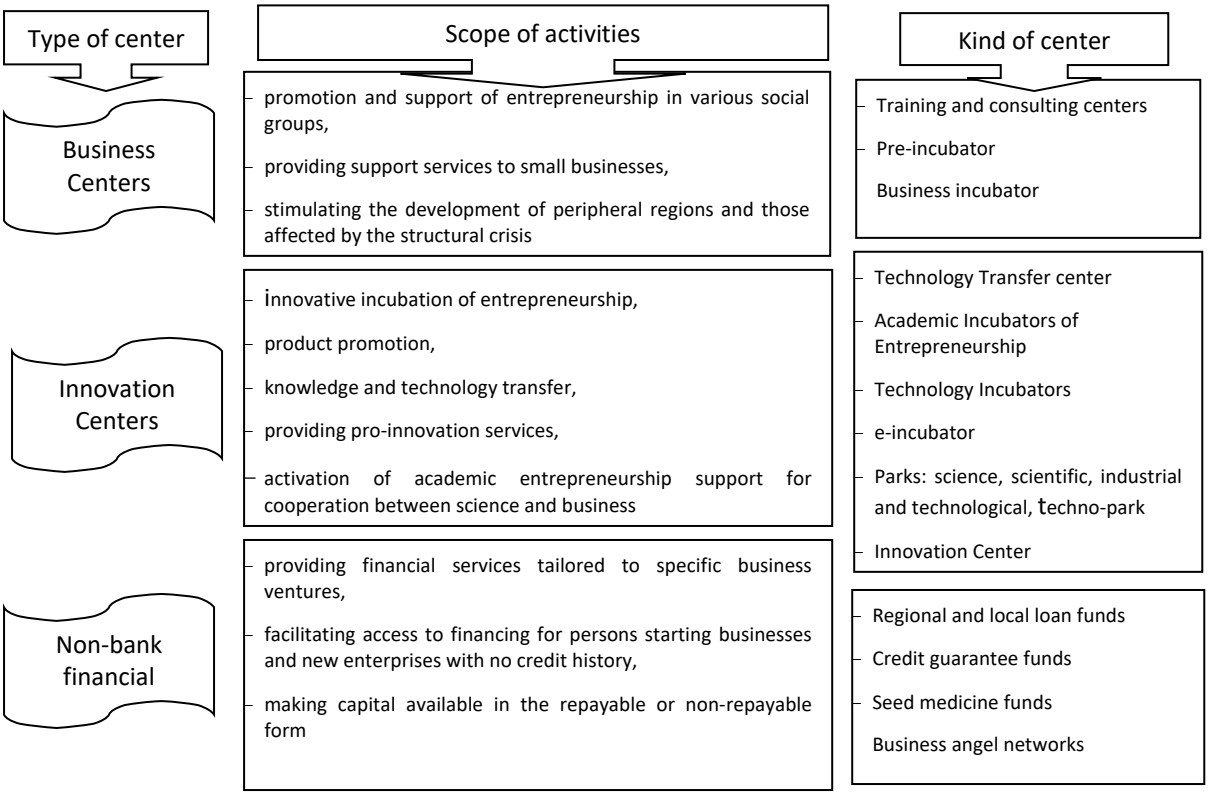
Support institutions act as specific partners of the public and private sectors, initiating a new quality of thinking and management of economic and social development. With the non-commercial and statutory orientation of business environment institutions to support the development of entrepreneurship and innovation, they provide services and create a specific network-based institutional infrastructure that allows entrepreneurs to implement their strategies and dynamize development processes. Their peculiarities and the social background of their creation make them an important element in bridging the gap between market mechanisms and public administration actions (Gródek-Szostak *et al*., 2020; Mażewska, 2015; Babuchowska *et al*., 2015; Trzmielak, 2013).

The BEIs designed to support the development of enterprises in the SME sector by providing the right infrastructure to support entrepreneurship and the transfer of knowledge and technology, thereby creating and implementing innovative ventures, are innovation and entrepreneurship centers. Regardless of the organizational and legal forms of these entities, their activities are focused on (Matusiak, Mażewska and Banisch 2011; Glabiszewski, Grego-Planer and Liczmańska-Kopcewicz, 2018; Rudawska, 2020; Gródek-Szostak *et al*., 2020):

- transfer of knowledge and technology from scientific institutions to businesses,
- creating a system of linking enterprises with scientific units and administration,
- development of flexible manufacturing systems at the interface between science and the economy,
- spreading knowledge and skills through consulting and training,
- motivation and preparation for self-employment and comprehensive advisory, technical and housing assistance supporting the start of innovative business activity,
- financial and organizational support for innovative ventures,
- creating clusters of enterprises and animating innovative environment by combining business services and various forms of technological assistance in a specific, developed area.

The activities of innovation and entrepreneurship centers consist in supporting enterprises or potential entrepreneurs in three major areas. The first area relates to financial support, the second is the provision of material (space, access to devices) or formal (legal personality) conditions for starting and running a business, and the third includes all kinds of soft services (providing information, consulting, training, support for technology transfer, etc.). Within the third area, one can distinguish a group of services that are particularly interesting from the point of view of innovation, which are referred to as bridging services, while the units providing them are termed bridging organizations. The focus of their activity is on the organization of knowledge flow from entities with knowledge to entities that seek knowledge. Such activities are referred to broadly as knowledge transfer or narrowly as technology transfer, or most generally the transfer of technological knowledge between organizations (Płoszaj 2012; Lisowska, 2016).

The product offered by the business environment institutions is specific and its special character results from, on the one hand, the needs of the units served – in most cases enterprises, and, on the other , is conditioned by the character of the institution itself. Due to the specificity and scope of activities as well as the target group of recipients, support centers can be divided into three basic groups, presented in Figure 1.



Source: Own elaboration based on (Mażewska 2015; Nowak, 2016; Lisowska, 2016; Rudawska, 2020; Mażewska, Bąkowski and Rudawska, 2021).

Figure 1: Classification and Scope of Activities of Entrepreneurship and Innovation Centers

There is no one-size-fits-all organizational or functional model for supporting institutions. They function in various organizational and legal forms, from associations or foundations to limited liability companies. profit oriented. The activities of each institution depend on: resources, adopted mission, efficiency and substantive preparation of employees, their ability to raise external funds for their statutory activities, and their reception by the local community. The effects of their activities often cannot be quantified. The simplest form is training and consulting centers, which focus only on information, advisory and training activities, while the most comprehensive support is offered by technology parks (Nowak, 2011; Wiśniewska, 2011; Matusiak, 2011).

Business environment institutions are very important part of the knowledge transfer and commercialisation. They are responsible for collecting information about scientific discoveries, evaluation of commercialisation potential of those discoveries and supporting scientists in creation and development of their entrepreneurial ventures based on knowledge they are willing to commercialise (Łobacz, 2018).

4. The Importance of Business Environment Institutions in the Knowledge and Technology Transfer Process

Cooperation between the scientific community and business is usually difficult to organize. On the one hand, scientific entities see opportunities in developing cooperation with businesses to a relatively small extent. On the other hand, there is also an apparently low willingness of enterprises (mainly SMEs) to cooperate with other partners, whereas universities and the sector of R&D as a whole are seen as difficult and demanding partners. Furthermore, operating under constant time pressure and focused on the competition in the market, entrepreneurs usually strive to achieve an economic surplus with as little expenditure as possible, somehow forgetting that knowledge and the ability to transform it into innovations allow for achieving a competitive advantage (Łobacz and Niedzielski, 2015; Dominik, 2013). The differences that exist in the approach to the tasks and the nature of work lead to a specific 'communication gap' between science and business, which is being filled by business environment institutions aimed at building the broadest possible relationship between the two worlds, the development of modern technologies and the search for ways to effectively transfer knowledge from science to industry.

The technology transfer and commercialization of knowledge are facilitated by innovation systems that offer a specific type of cooperation between various types of entities and institutions operating in the region, whose main objective is to develop innovative entrepreneurship. In this area, there are mainly activities leading to the transformation of knowledge into new products, services, organizational and marketing solutions, technologies and instruments to support the commercialization phase of an innovative idea. The most important actor in the knowledge transfer and commercialization of knowledge process is the entrepreneur-innovator, who decides to use innovation as a way to improve the competitiveness of the enterprise on the market and takes the risk of introducing it. However, enterprises have different innovative capacity, i.e. access to internal and external sources of applied knowledge, conditioned by their resources and organizational capabilities, largely human potential. In the case of small and medium-sized entities, due to their limited human, technical and financial resources as well as low quality of management, a significant gap is apparent between the innovative capacity and the enterprises' modernization and development intentions, hence the importance of transferring foreign solutions, i.e. providing the necessary information so that a given entity can duplicate the work of another (Robertson *et al*., 2012; Łącka, 2011; Stawasz 2012; Łobejko and Sosnowska, 2013; Trzmielak, 2013). Furthermore, the tasks involved in commercialization are often too complicated for the direct participants in the technology and knowledge transfer, so the efficiency of these processes depends on the operation of professional innovation and entrepreneurship centers in the region. To accelerate the implementation of new knowledge and technology and effectively follow all phases of the innovation process, entrepreneurs, especially from the SME sector, use the innovative services of support institutions, especially innovation centers, whose primary task is to bring representatives of the scientific community closer to entrepreneurs, which is expected to improve the conditions for innovative entrepreneurship of both partners and contribute to the transfer of knowledge and technology from science and research to the economy, and then their commercialization. Thus, the cooperation of key partners and functional links of technology transfer and knowledge commercialization processes is centered around these entities (Matusiak and Guliński, 2010; Łącka, 2011).

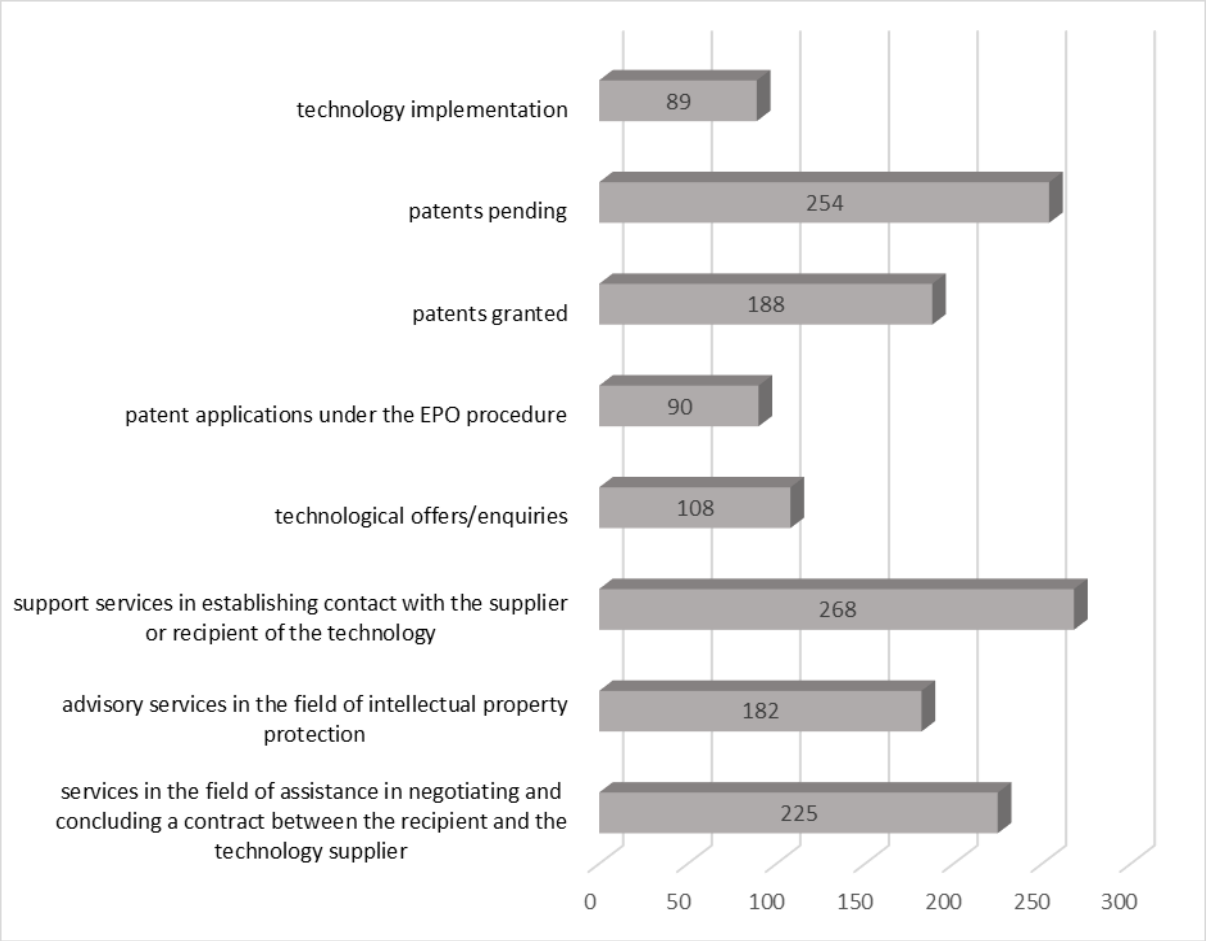
Technology transfer, as an interactive process with the interaction between suppliers and recipients, is a special type of communication process that involves various forms of absorption of innovation and technical knowledge. Designed to intensify these processes, the group of innovation support infrastructure entities is aimed at stimulating research and development activities and implementation of their results through knowledge and technology transfer from the world of science to business and activities focused on the activation of the creative potential of internal resources of enterprises (Szopik-Depczyńska and Depczyński, 2013; Dzikowski, 2015). However, effective support for innovative entrepreneurship, technology transfer, and knowledge commercialization must be integrated and comprehensive. All support for innovative ventures is aimed, on the one hand, at stimulating the creation of new technological entities and helping SMEs in their pursuit of technological restructuring. On the other hand, it stimulates research and activates mechanisms for transferring its results to the economy (Matusiak and Guliński, 2010).

Business environment institutions act as an intermediary between the providers such as suppliers of technology and knowledge, and the recipients, who seek them, acting as a catalyst for knowledge and technology transfer. Therefore, during this process, support institutions interact with both the supply and demand sides. In relations with the supply side, they are looking for opportunities to apply the knowledge provided by the institutions of the sector of science and enterprises of knowledge that (at least partially) can be put into practice. Furthermore, in contacts with the demand side, they seek the knowledge that enterprises need to strengthen their market position achieve a competitive advantage based on, among other things, more efficient production technologies or new products. It is worth emphasizing, however, that the effective operation of support organizations should not focus on efforts to control the entire knowledge flow but on the effective linking of producers and consumers of knowledge, who can continue to cooperate without the need for intermediaries or through direct contacts transfer knowledge to other actors (Płoszaj, 2012).

The demand for services of access to new knowledge and specialized advisory and training services in the field of innovation varies significantly depending on the innovativeness of enterprises. Furthermore, limited resources and low levels of management, especially in smaller business entities, and their low propensity and limited ability to assimilate acquired knowledge, are barriers to the use of consulting services. It is therefore important to differentiate the services offered by business environment institutions to different groups of enterprises. This is aimed to support the internal innovative capacity of SMEs, especially the ability to absorb foreign solutions, facilitate access to capital for innovative projects, the effectiveness of knowledge and technology transfer, and strengthen the system of innovative business institutions. Business environment

institutions mediate in contacts between SMEs and the environment and mainly support entities with a small scale of operation, younger and with insufficient knowledge of either foreign sources of innovation or services for innovation. They act as a catalyst for knowledge flow, facilitating the implementation of new solutions into business practice (Stawasz, 2012).

Most innovation centers work on the principle of providing support and advice in the area of commercialization, helping their clients in determining the right commercialization path, searching for partners for implementation, preparing market and patent analyzes necessary to plan technology transfer activities. The result of this work is the implemented new technology or transferred intellectual property. Operation effectiveness of these centers in 2021 is presented in a Chart (Figure 2).



Source: Own elaboration based on (Mażewska, Bąkowski and Rudawska, 2021).

Figure 2: The Activity of Centers Providing Knowledge Commercialization and Technology Transfer Services

However, the decreasing number of the centers themselves is worrying. In 2021, there were 280 entities carrying out the tasks of non-commercial business environment institutions and it was 3 times less than in 2012, when their number was the largest (Mażewska, Bąkowski and Rudawska, 2021). This situation results from the exhaustion of the operating formula of these entities, the change in the business model and numerous structural, systemic, awareness-cultural and competence barriers that hinder or even block the cooperation of scientific institutions with entrepreneurs (Szewczuk-Stępień, 2016; Golejewska, 2017; Kocowska-Siekierka, 2022). An important problem is also the underfunding of the science sector in Poland, low awareness and knowledge about the mechanisms of technology transfer and the principles of intellectual property protection among the teaching staff and the low "absorbency" of Polish enterprises (especially small and medium-sized enterprises) for innovative products, which is caused primarily by the lack of sufficient financial resources. In addition, the offer of business environment institutions operating on the Polish market is quite poor, and the effectiveness of their work is still low. Not without significance is also the high turnover of employees and their poor professional preparation or the lack of specialists as well as the lack of stable sources of financing (Różański and Voytovych, 2019; Gajewski et al., 2019).

5. Conclusions

Access to knowledge and other intellectual resources, especially their absorption, is becoming a key factor in the innovation of enterprises, especially those smaller. The dynamic progress of knowledge and technology as well as growing competition force even the smallest companies to introduce innovations, which have become a necessity and a necessary condition for survival on the market. Small innovative enterprises are usually unable to transform their ideas and concepts into products and services on the market. They cannot create an interdisciplinary research base. To survive, they need to cooperate with others and function in an environment where they can use the knowledge of other entities (Matusiak and Guliński, 2010).

Increasingly, the market success of not only individual enterprise, but also entire economies is determined by the ability to transform knowledge into new products, services, technologies, marketing techniques and organizational solutions. In addition to the entities of business and science, business environment institutions that create a system for supporting, shaping, and promoting innovation and entrepreneurial attitudes and supporting enterprises in knowledge and technology transfer perform a special role. They build partnerships in innovation and establish cooperation between the entities that offer knowledge and those who seek it to create the most favorable conditions for the growth of business innovation (Łobejko and Sosnowska, 2013). A professional institutional base, consisting of various centers of innovation and entrepreneurship, offers a platform linking science and the economy, with its role being to facilitate communication between these environments and provide support by improving the flow of knowledge and technology.

Business environment institutions support the activities of enterprises, affect the absorption of knowledge and innovation, favor the decision-making of location and condition the process of joint learning, thus increasing the competitiveness and innovation of the economy (Lisowska and Grabowski, 2021). However, their number is constantly decreasing, and their share in increasing innovation in Poland is insufficient. This is due to numerous barriers at the interface between science and economy, which hinder the implementation of joint work on the commercialization of knowledge. The process of creating knowledge resources and transforming them into innovations is determined by the ability of multiple actors to work together. Unfortunately, the activities of BEIs are not always professional enough and sometimes deviate from global standards. Therefore, it is important to continuously increase the potential and competencies of such entities, because only well-prepared and qualified personnel and a non-standard institutional base can effectively support innovative entrepreneurship and affect the efficiency of technology and knowledge transfer. It should also be emphasized that like other products, knowledge requires the formation of demand in the environment of its recipients, promotion, and the readiness of the scientific community to identify the demand of the market of recipients, and therefore to analyze the needs of enterprises in terms of knowledge and innovation and invest their time and resources to attract the recipient of this specific product.

The paper does not exhaust the research problem, it is only a contribution to further research on this complex process, which is the transfer of knowledge and technology in the enterprise.

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What Drives People to Share? The Relationship Between Working Style and Workplace FoMO

Edit Kővári
Management Institute, Faculty of Business and Economy, University of Pannonia, Veszprém, Hungary

kovari.edit@gtk.uni-pannon.hu

Abstract: Workplace FoMO is defined as the fear of missing important tasks, information, and knowledge. It is driven by the fear of the dread of experiencing the anger or psychological pressure, and indirect expectation of co-workers, managers or other stakeholders at the place of work. The term also refers to the loss of promising opportunities (Fear of Better Options – FoBO) and network possibilities which can lead to another phenomenon Fear of Doing Anything (FoDO) which refers to the state when someone is indecisive. After factorial analyses of the original 5 FoMO types of Alutaybi et al (2020) this study applies the following factors: *valuable information gathering, professional networking, individual contribution to work,* and *social interaction*. One of the influencing factors of FOMO is internal motivation which is connected to working style. Considering the internal motivation and attitude to work, based on Kahler's 5 positive drives (1975) Hay (2009) developed the following working styles: *hurry up, be perfect, please people, try hard* and *be strong*. This research presents the relationship between working styles and workplace FoMO based on a questionnaire filled by 201 employees of an international automotive company. Results shows that expect 'Try hard', the other 4 working styles indicate correlation with at least one of the factors of working FoMO.

Keywords: Workplace FoMO, Working style, Professional networking, Getting valuable information, Please people

1. Introduction

In the fourth industrial revolution (Philbeck & Davis, 2018), it is not a problem anymore to retrieve and exchange information in real-time. The speed and competition at work forces people to stay up to date and be proactive. The introduction of computer-mediated tools and social media platforms trigger instant communication (Hayran et al., 2020), leading to several socially related anxieties. One such anxiety is called "fear of missing out" or FOMO. Fear of missing out (FOMO) refers to the stressful feeling one perceives when excluded or socially disconnected (Budnick et al., 2020),. The distress caused by the awareness that networking opportunities are missed or relevant information is not shared refers to workplace FOMO.

2. Literature Review

2.1 FoMO and Workplace FoMO

Fear of missing out (later referred to as FoMO) as a concept was first used in the late 20th century by Dan Herman, who first formulated it in the field of marketing in relation to consumers as a motivating factor for purchase (Herman, 2000). Yet the current understanding of FoMO, and the popularization of the term itself, can be traced back to McGinnis (2004), who in an article for the Harvard school journal Harbus, described the social structure of students and the 'illnesses' that affect them. According to McGinnis, the fear of missing out on social programs leads to an over-commitment that causes students to cram dozens of programs into a short time span. Due to the novelty of the concept there are not yet many definitions of FoMO. The only generally accepted description is that of Przybylski et al (2013), who described the phenomenon as a pervasive fear of missing out on valuable experiences and good experiences that others might have that we miss out on. For this reason, FoMO is characterized by a desire to stay connected to everything that others are doing. Wiesner (2017) describes the fear of missing out as a two-sided phenomenon that can occur because of the physical inability of the individual to open an incoming message. On the other hand, those who perceive the FoMO phenomenon even when there is no new incoming information or message are unable to reduce anxiety. Focusing on the latter, Wiesner says FoMO is the feeling of missing out on something while trying to communicate with others through social media. This occurs because the individual has a constant need for fresh information or feels the incoming information is not being absorbed. In either case, the individual's goal is to satisfy the need to belong somewhere (Wiesner, 2017). Alutaybi et al (2020) classified FoMO into 5 categories:

- When Others Do Not Interact as Expected
- When Unable to Interact or Connect as Wished
- When Unwilling to Engage in Social Interaction
- When Having to or Feeling a Need to Engage in Continuous Untimed Interactions
- When an Online Social Gathering is Expected

They also listed what causes the development of each type and what countermeasures are possible.

Alutaybi et al. (2020) proposed five types of FoMO that individuals may experience in the context of social media:

- *Social FoMO*: This type of FoMO is related to fear of missing out on social events or activities. People with social FoMO may feel anxious or left out if they see their friends or colleagues socializing without them on social media.
- *Informational FoMO*: This type of FoMO is related to fear of missing out on important news or information. People with informational FoMO may feel anxious or left out if they see their friends or colleagues sharing news or information that they have not seen yet.
- *Experiential FoMO*: This type of FoMO is related to fear of missing out on exciting experiences or adventures. People with experiential FoMO may feel anxious or left out if they see their friends or colleagues sharing photos or stories of fun experiences that they were not a part of.
- *Imaginative FoMO*: This type of FoMO is related to fear of missing out on creative or artistic experiences. People with imaginative FoMO may feel anxious or left out if they see their friends or colleagues sharing photos or stories of creative projects or events that they were not a part of.
- *Object-oriented FoMO*: This type of FoMO is related to fear of missing out on material possessions or consumer experiences. People with object-oriented FoMO may feel anxious or left out if they see their friends or colleagues sharing photos or stories of new products or luxury experiences that they were not able to purchase or participate in.

These five types of FoMO can help individuals identify the specific triggers and situations that cause them to feel anxious or left out, and develop strategies for managing these feelings in a healthy way. It's worth noting that these types of FoMO are not mutually exclusive, and individuals may experience more than one type of FoMO at the same time.

These studies however, are mostly limited to social media-related measures such as setting up automatic replies or status updates.

In his research, Przybylski et al (2013) investigated the impact of FoMO on motivation and well-being, and the demographic factors that influence it. His results showed that higher FoMO scores are more common in young adults, including young men. It also confirmed what had previously been speculated or shown by qualitative studies that FoMO has a negative impact on psychological well-being. It also showed a negative correlation between FoMO and general mood and overall life satisfaction (Przybylski et al., 2013). These findings were supported by Elhai et al. (2016), who, in addition to the factors already examined, also showed an association of FoMO with depression and general anxiety (Elhai et. al., 2016).

Although FoMO is essentially a social media phenomenon, its impact can also be observed in the workplace. Indeed, the study of the phenomenon in this context and the dissemination of these findings is just beginning to take off in national and international research fields.

The first and so far only definition of FoMO in the workplace was provided by Budnick et al. (2020), who transposed Pryzbylski et al's definition to the workplace environment. They defined workplace FoMO based on promising job opportunities and comparisons with colleagues as the fear of missing out on significant career opportunities relative to colleagues if we are absent from work. These missed career opportunities can manifest in missing out on professional networking opportunities, missing out on valuable information, social gatherings, promotions, or even new technologies or tools that are being implemented in the workplace or missing out on key decisions or projects for the organization (Budnick et al., 2020).

Workplace FOMO can have negative consequences on employees' morale, productivity, and job satisfaction, as they may feel excluded, undervalued, or not fully engaged in their work. It can also lead to unhealthy competition, gossip, or resentment among colleagues, and can create a toxic work environment. Employers and managers can help mitigate workplace FOMO by fostering a culture of inclusion, transparency, and communication, by providing equal opportunities for all employees to participate in relevant activities and events, and by recognizing and rewarding individual achievements and contributions.

Budnick et al. (2020) first proposed workplace FOMO measure set up 3 types of FOMO: relational, informational, and work output exclusion. After an exploratory factor analysis, they found a two-factor scale: relational exclusion and information exclusion. Relational exclusion is an employee’s worry that their interpersonal relationships with colleagues may suffer because they cannot maintain business relations (Budnick et al., 2020). Informational exclusion refers to the fear that one has no relevant social or task information. Albers’ (2020)

factor analysis found a similar two factor structure but to some extent altered scopes. Therefore relational exclusion was renamed “opportunity exclusion” to account for the fear that relationships suffer due to missed networking opportunities.

2.2 Working Styles

Working style refers to an individual's preferred approach, habits, and methods of completing tasks and accomplishing work-related goals. It encompasses the unique combination of behaviors, attitudes, and work patterns that a person adopts in their professional life. A person's working style may be influenced by their personality traits, values, past experiences, and the demands of their job or industry (Robbins et al. 2018). Working style can include various aspects, such as: time management, communication, collaboration, problem-solving, decision-making, work-environment, and work-life balance. Understanding one's working style can help individuals optimize their productivity, leverage their strengths, and find job satisfaction (Kinicki and Fugate, 2018).

Motivation plays a crucial role in shaping an individual's working style. When individuals are motivated, they are more likely to adopt a proactive and engaged approach to their work. Motivated individuals may demonstrate a strong work ethic, take initiative, and exhibit a preference for a particular working style that aligns with their intrinsic motivations and values.

Kahler and Capers (Kahler & Capers, 1974) developer of the Process Communication Model (PCM), identified six motivational drivers that influence performance and working style. These drivers are based on his observations of personality types and communication patterns. The six drivers are inclusion, control, affection, achievement, freedom and fun. According to the theory, each person has a unique combination of these drivers, with varying intensities. By understanding these drivers in oneself and others, it becomes possible to communicate and motivate more effectively, tailor work environments, and address individual needs for optimal performance and job satisfaction.

Based on Kahler & Capers (1974) theory Hay (2009) developed the following five working styles:

- *Hurry Up:* People with this working style tend to be action-oriented and enjoy taking charge of situations. They thrive on pressure and enjoy a fast-paced work environment.
- *Be Perfect:* People with this working style strive for excellence and take pride in doing things well. They pay close attention to details and are often self-critical, with high standards for themselves and others.
- *Please People:* People with this working style focus on building positive relationships and ensuring that others are happy and satisfied. They are often team players and enjoy collaborating with others.
- *Try Hard:* People with this working style are persistent and determined, and are willing to put in extra effort to achieve their goals. They are often self-motivated and have a strong work ethic.
- *Be Strong:* People with this working style tend to be independent and self-reliant, and may be reluctant to ask for help or support. They value their own opinions and may be resistant to feedback or criticism.

Radu et al (2017) go further and summaries the advantages and disadvantages of the Hay’s 5 working styles.

Table 1: Advantages and Disadvantages of the Drive Based Working Styles (based own Radu et al. 2017:382, own editing)

Driver	Main belief	Advantage	Disadvantage
„Be strong!”	have to be strong and independent	rational decisions without emotional attachments	weak human relationships
„Be perfect!”	need to be perfect and always do the right thing	well-planned tasks and competent execution	slips due to over-planning
„Hurry up!”	need for speed and efficiency	fast turnaround	ignoring details, resulting in sloppy quality

Driver	Main belief	Advantage	Disadvantage
„Make an effort!”	need to try harder, need patience and persistence	persistence in situations where others have given up	slow decision-making, slipping deadlines
„Get pleasure!”	satisfaction of others comes first	team harmony	underestimating your own work

These working styles can help individuals identify their strengths and weaknesses in the workplace and develop strategies for working more effectively with others. However, it's important to note that everyone has a unique working style, and that these styles can change over time or in different situations. Moreover, working styles are just one aspect of a person's overall personality and behavior, and should be considered in conjunction with other factors such as emotional intelligence, values, and goals.

2.3 Workplace FoMO and Working Style

The relationship between working style and workplace FOMO can be complex and multifaceted. Different working styles can influence the extent to which employees experience FOMO at work, and how they respond to it. For example, employees who have a more extroverted or social working style may be more likely to experience FOMO in social situations, such as team lunches or after-work drinks, and may feel left out or disconnected if they are not included. On the other hand, employees with a more introverted or independent working style may be more likely to experience FOMO related to individual projects or tasks, and may feel like they are missing out on opportunities for growth or recognition (Rozgonjuk et al., 2021).

Moreover, some working styles may exacerbate workplace FOMO, such as perfectionism or competitiveness, as employees may feel like they need to be involved in everything and achieve success in every aspect of their work (Marsh et al. 2022). This can lead to burnout and stress, and can ultimately negatively impact their job performance and well-being (Gorji, 2011). Overall, it is important for employees to understand their own working style and how it may influence their experience of workplace FOMO, as well as for employers to create a supportive and inclusive work environment that values and accommodates different working styles. This can help reduce the negative impact of FOMO on employees and promote a more productive and positive workplace culture.

Hay's (2009) working styles are not directly related to workplace FOMO, which refers to the fear of missing out on social or professional opportunities in the workplace. However, it is possible that individuals with certain working styles may be more prone to experiencing workplace FOMO. For example, individuals with a "please people" working style may feel pressure to say yes to every social or professional invitation in order to maintain positive relationships with their colleagues, even if it means overcommitting themselves and feeling overwhelmed. Similarly, individuals with a "try hard" working style may feel like they need to be involved in every project or opportunity in order to prove their value and competence to their colleagues or superiors, which could lead to feelings of FOMO if they are unable to participate in everything. On the other hand, individuals with a "be strong" working style may be less likely to experience workplace FOMO, as they may be more comfortable with working independently and focusing on their own goals and priorities rather than feeling pressure to be involved in everything that is happening in the workplace (Hay, 2013).

Fear of Better Options (FoBO) and Fear of Doing Anything (FoDA) are two related concepts that describe different forms of decision-making anxiety or indecisiveness.

FoBO refers to the fear or anxiety that people may experience when they are faced with a range of options or choices, and they worry that there may be a better choice out there that they are missing. This can lead to indecisiveness, procrastination, or a sense of regret or dissatisfaction with the chosen option. FoBO can be especially relevant in contexts where there is a high degree of choice or uncertainty, such as career decisions, relationship choices, or purchasing decisions (Boyan, 2022). FoDA, on the other hand, refers to the fear or anxiety that people may experience when they are faced with a task or activity that they feel unsure or unprepared for, and they worry that they may fail or make a mistake. This can lead to avoidance, procrastination, or a sense of overwhelm or stress. FoDA can be especially relevant in contexts where there is a high degree of novelty, complexity, or ambiguity, such as new projects, job tasks, or social situations (McGinnis, 2004).

Both FoBO and FoDA can have negative consequences on individuals' well-being, productivity, and decision-making processes, and may be related to other mental health issues such as anxiety, depression, or perfectionism. Recognizing and addressing these fears can help individuals make more informed and confident

decisions, and lead to a greater sense of fulfillment and satisfaction in their personal and professional lives (Reagle, 2015).

It's important to note, however, that these are just hypothetical examples, and that everyone's experience of workplace FOMO is unique (Ashkanasy et al. 2000). A person's working style is just one of many factors that can influence how they approach their work and relationships in the workplace. Different working styles may have varying levels of susceptibility to workplace FoMO. For example, individuals with a more collaborative working style that involves frequent interaction and networking may be more prone to experiencing FoMO in the workplace. On the other hand, individuals with a more independent or task-oriented working style may be less affected by workplace FoMO (Hay, 2013). Certain working styles may prioritize constant communication, information sharing, and being up-to-date, thus potentially exacerbating workplace FoMO. Conversely, individuals with different working styles may be more focused on individual tasks or require less frequent communication, reducing the impact of FoMO. The organizational culture can play a role in shaping the prevalence and impact of workplace FoMO. Cultures that emphasize constant connectivity, socialization, and inclusion may foster a higher likelihood of experiencing FoMO. In contrast, cultures that prioritize autonomy, task completion, and self-directed work may reduce the incidence of workplace FoMO. Individual traits and mindset also play a significant role. Individuals with a greater need for external validation or a fear of missing out in general may be more susceptible to workplace FoMO, regardless of their specific working style. Personal characteristics such as self-confidence, self-esteem, and the ability to manage one's emotions can impact how individuals perceive and respond to workplace FoMO (Tandon et al, 2021). Those with a strong separation between work and personal life may be less prone to experiencing FoMO, as they are more focused on personal commitments and interests outside of work.

The research of Fridchay and Reizer (2022) indicates that individual differences in FoMO are associated with relatively low levels of job performance, thus this study does not include working style analyses. Although the number of FoMO studies are increasing there are still gap both in theory and applied research considering the relationship of workplace FoMO and working styles.

3. Research Question and Methodology

Scholars have suggested that working styles and workplace FoMO indicates some kind of link to each other, thus these implications are rater theoretical or focusing on individual traits. There is lack of understanding regarding the impact of FoMO in the workplace and on working styles. Therefore a research hypothesis is articulated:

H1: There is a relationship between workplace FoMO and drivers based working styles.

A primary quantitative research in the form of a questionnaire was carried out with an international automotive company in Hungary in 2022 winter. The study sample is 1772 employees (total number). The questionnaire first part included demographical and job-related questions. The working style part was based on work of Taibi Kahler questions categorized by Hays applying the The Padfield Partnership consultancy validated questionnaire. This contains 25 statements, where the respondent is asked to give a score between 0 and 8 for each statement. For measuring workplace FoMO Budnick et al. (2020) original questionnaire was translated, validated and completed with questions to adjust to the Hungarian respondents. Two new factors were added. The first factor, individual contribution to work, was also assessed by the researchers themselves in their study, but was dropped in the analysis, reducing the number of factors to two. Since the sample in the original study was independent of industry and company, and the sample was drawn only from the United States the questionnaire was adjusted to automotive industry. The second new factor was named social interactions. This part consists of 20 statements, where respondents indicated on a five-item Likert scale how true the statements were for them.

4. Analyses and Results

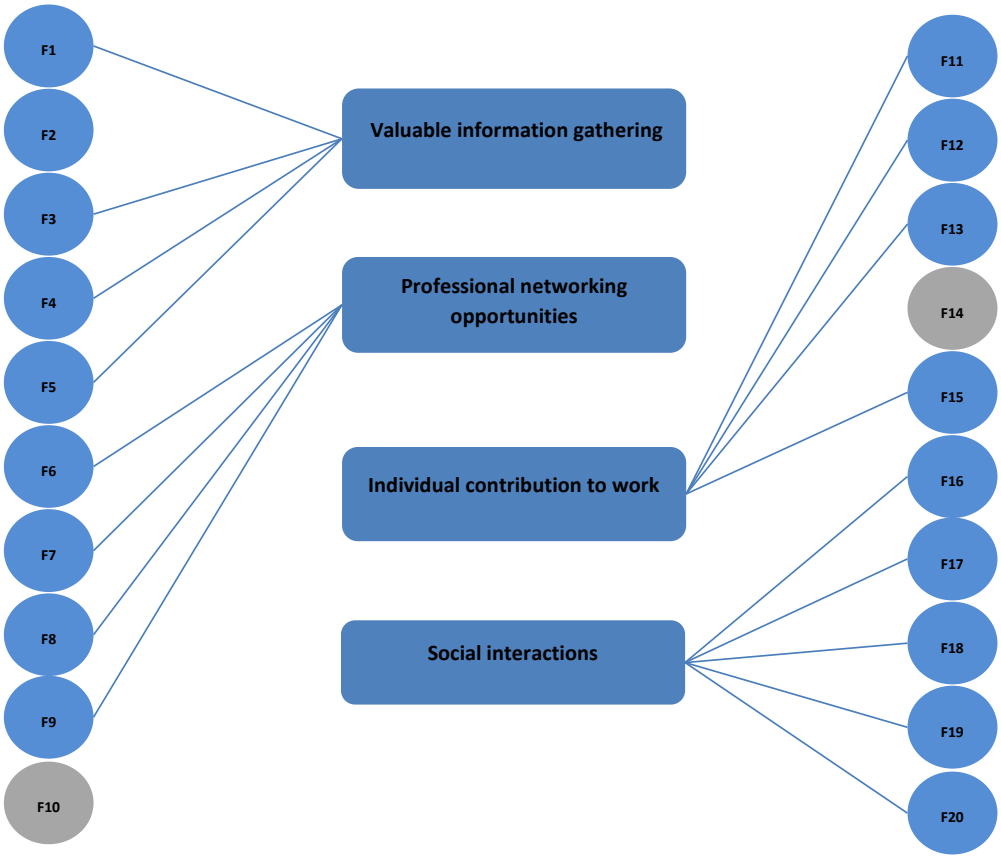
4.1 Descriptive Statistics

The descriptive analyses show that out of the 1772 employees 290 people started the questionnaire and 201 completed (148 male and 53 female) it. This is an 11.3% response rate. Regarding job occupations 132 non-managerial employees, 30 non-managerial team leaders (e.g. project managers), 20 team leaders, 16 middle managers and 3 senior managers were identified. The majority of the respondents, 74, have been working for the company for more than 10 years, 49 between 5-10 years, 47 between 2-5 years and 31 less than 2 years. This means that the 61% of the respondents have been working there over 5 years.

As the working style questionnaire was translated to Hungarian, a reliability test needed to be carried out. Based on the results of the reliability test, the Cronbach's Alpha value was 0.717, so the reliability of the questionnaire is acceptable. Regarding working styles the dominant responses were "Get pleasure!" (34.8%) and "Be perfect!" (32.3%). These were followed by "Hurry up!" (13.9%), "Be strong!" (9.5%) and "Make an effort!" (9.5%).

To measure workplace FoMO a reliability test was carried out after the translation. This resulted in a Cronbach's alpha of 0.953, which indicates that the reliability of the questionnaire is excellent. Due to the completion and translation of the questionnaire a new factor analysis had to be applied. The results of the analysis show that 4 factors explain 77% of the information content of the model. The associated KMO value is 0.921, which is associated with a Khi squared value of 284.974 with a significance level of 0. These 4 factors are: *valuable information gathering*, *professional networking opportunity*, *individual contribution to work* and *social interactions*. The first two factor names were kept from the original Budnick et al. (2020) model and the last two were named after the communality test and Goodness-of-fit results. Table 2 shows the result of the factors analyses. Two of the items (F10, F14) cannot be linked to any of the factors, therefore they are disregarded from the analyses.

Table 2: The Modified Workplace FoMO Model at Work After Factor Analysis



4.2 Relationship Analyses

The correlation analysis of workplace FoMO and demographic data shows that workplace FoMO has a weak significantly negatively relationship with the respondents' age (-0.191) and time spam spent at the company (-0.109), while there is no significant correlation with the other variables. This suggests that the younger the employee and the less time they have been with the company, the higher their perceived FoMO at work.

To test *H1, There is a relationship between workplace FoMO and drivers based working styles*, variance analysis has been conducted using dominant working styles as independent variables and principal component describing workplace FoMO as dependent variable. The resultant ANOVA shows (Figure 1.) a 0.043 significance level, which suggests that the null hypothesis that the two variables are independent of each other should be rejected. This implies that there is a significant relationship between working style and workplace FoMO.

ANOVA

REGR factor score 1 for analysis 1

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	9,743	4	2,436	2,509	,043
Within Groups	190,257	196	,971		
Total	200,000	200			

Figure 1: ANOVA Testing of the Relationship Between Workplace FoMO and Working Style

At the factorial level, it can also be stated that all other factors of workplace FoMO, with the exception of the factor of social interactions, are significantly correlate with working styles. The relationships are shown in Table 3, where the positive significant (sig. <0.05) relationships are highlighted.

Table 3: Strength and Direction of Correlation Between Workplace FoMO Factors and Working Styles

	„Hurry up!"	**„Be perfect!"**	**„Get pleasure!"**	**„Make and effort!"**	**„Be strong!"**
FoMO – Valuable information gathering	0,103 (0,035)	0,076 (0,118)	0,146 (0,003)	0,094 (0,055)	0,069 (0,158)
FoMO – Professional networking opportunities	0,127 (0,009)	0,08 (0,103)	0,136 (0,005)	0,078 (0,109)	0,165 (0,001)
FoMO – Individual contribution to work	0,013 (0,787)	0,109 (0,026)	0,119 (0,015)	0,020 (0,688)	0,061 (0,210)
FoMO Social interactions–	-0,025 (0,603)	-0,021 (0,670)	0,000 (0,999)	0,041 (0,400)	0,018 (0,714)

The Post Hoc analysis confirmed that for all factors of workplace FoMO certain working styles significantly differ from each other.

The results indicate that all working styles except "Make an Effort" are correlated with some factor of workplace FoMO. The *Professional networking opportunities* FoMO factor show correlation with 3 working styles: "Hurry up!", "Get pleasure!" and "Be strong!". *Valuable information gathering* FoMO factor has relation to "Hurry up!" and "Get pleasure!" While "Be perfect!" and "Get pleasure!" working styles display a correlation with *Individual contribution to work* FoMO factor. In contrast, the newly introduced *Social interaction* FoMO factor is not linked to any of the work styles.

5. Discussion an Implications

The result of the present study implies several ways to go further in deeper analyses. First, that employees main drives which influence their working style are either to get pleasure or to be perfect. The weak but significant relation indicates that younger and new employees experience higher FoMO which can be explained by their effort to fit in with a "Hurry up" or "Be strong" working styles. What makes people to share? It might be fear of missing out to get valuable information or professional network opportunities. Those whose working style is "Hurry up" may feel the time squeeze to gain and give information. They are action- and achievement-oriented and enjoy a fast-paced work environment. On the other hand quite large some of the respondents share information and network because they want to "Get pleasure". In other words they would like to keep positive relationships with and/or to satisfied their peers and managers. What is attention-grabbing that "Make and effort" working style is not at all connected to workplace FoMO. One of the explanation can be that that these people are consciously driven, energetic by their nature. These employees have a very strong work ethic and

the drive is not fear but flow. Nevertheless the present study is not complex enough to draw strong conclusions. Future thorough research and bigger database are needed to gain more stable assumptions.

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Relatedness and Futureness: Key Pillars for Developing Knowledge-Based Management for Sustainability

Florian Kragulj, Clemens Kerschbaum and Alexander Kaiser
Vienna University of Economics and Business, Austria

florian.kragulj@wu.ac.at
clemens.kerschbaum@wu.ac.at
alexander.kaiser@wu.ac.at

Abstract: Recently, the field of Knowledge Management has seen some movements towards sustainability and more responsible business practices. Especially sustainability has become a hot topic for almost every organization. In this paper, we try to locate the concept of sustainability in the field of Knowledge Management. We argue that lived sustainability is built upon relatedness (the holistic understanding of interdependence and interconnectedness of complex systems) and futureness (adopting a long-term perspective for the management of organizations) that together promote sustainable organizing from the inside-out. We find that in particular two streams, Responsible Knowledge Management and Spiritual Knowledge Management, have taken up ideas that potentially lead to sustainable Knowledge-based Management. Those streams emphasize various forms of non-rational knowledge as a necessary, but previously underrepresented aspect of knowledge, as a counterpart to the instrumental-calculative rationality that has become predominant in the study of organizations and organizational knowledge.

Keywords: Future of KM, Spiritual knowledge management, Responsible knowledge management, Sustainability, Tacit knowledge

1. Introduction

Sustainability has become a societal imperative that companies must meet. It is time to rethink the role of knowledge management and shift the focus from managing a stock of knowledge (Bratianu, 2011) to providing a management tool that enables doing "the right things" (Laszlo & Laszlo, 2007, p. 494).

To contribute to this endeavour, we analyse key literature on sustainability and identify relatedness and futureness as two key characteristics of the concept. Relatedness refers to the complexity of systems, which requires a holistic understanding of their "interdependence" and "interconnectivity" (Bansal & Song, 2017, p. 123). This underscores that "corporate actions [are] inherently connected to the social and natural systems" (Bansal & Song, 2017, p. 124). Consequently, "sustainable development rests on three principles: environmental integrity, social equity, and economic prosperity" (Scherer et al., 2013, p. 259). This highlights that we are not alone but related to others. We should know about our relationships, which means we should know about ourselves, 'the others' (i.e., humans, nonhumans, more-than-humans), mechanisms, and consequences.

Managing an organization sustainably also means "not just to manage resources at a point in time but manage resources across time" (Bansal & DesJardine, 2014, p. 76). Therefore, decision makers need to "fully anticipate [stakeholders'] future needs" (Bansal & DesJardine, 2014, p. 72). They have to adopt a long-term perspective that contrasts with short-termism, which can be defined as "decisions and outcomes that pursue a course of action that is best for the short term but suboptimal over the long run" (Laverty, 1996, p. 826). We refer to this characteristic of sustainability as futureness.

In this conceptual paper, we identify two avenues to knowledge-based management for sustainability. We introduce two approaches for a knowledge-based management for sustainability agenda, i.e., Responsible Knowledge Management (Durst, 2021; Rocha et al., 2022) and Spiritual Knowledge Management (Kaiser, 2023). Both address the characteristics of relatedness and futureness, thus delivering on the sustainability agenda. In doing so, we argue, knowledge management holds the potential to become a key tool for organizations to learn how to do "the right things" from a long-term perspective on sustainability.

2. Sustainability and Knowledge Management

Sustainability has become a social imperative that companies must meet. As a result, it is making its way into all levels and functions of organisations (Lubin & Esty, 2010), the backbone of which is knowledge. Knowledge management has evolved as a response to the infobesity brought about by advances in information technology (Davenport, 2015). Now that we have a solid handle on information processing, it is time to rethink the role of knowledge management in the organisation - and beyond. In other words, shifting the emphasis from managing a stock of knowledge (Bratianu, 2011) towards the question: "will KM [knowledge management] become yet

another approach to help organisations do things right, or will it be a vehicle for government, business and civil society to do the right things?" (Laszlo & Laszlo, 2007, p. 494) In this paper, we answer this question and conceptually identify two avenues to knowledge-based management for sustainability, namely responsible knowledge management (Durst, 2021; Rocha et al., 2022) and spiritual knowledge management (Kaiser, 2023).

Sustainable development has its roots in the late 1960s, although first broadly discussed in the "The Limits to Growth" report by the Club of Rome (Meadows et al., 1972). From then on, several international publications shaped the discussion on sustainability, sustainable development, and sustainable business. Among those is the World Commission on Environment and Development report "Our Common Future" (OCFR) (United Nations, 1987), that has bred the ground for the most recent global sustainability framework, the Sustainable Development Goals of the United Nations (Hák et al., 2016),

Bansal & Song (2017) argue that the OCFR adopts a systems perspective to sustainable development. This means that it regards the world "as a complex system with six interlocking challenges" (p. 123). This shifts the emphasis from "characteristics of elements to the dynamics of connectivity" (p. 124); systems are not linear but complex which makes it necessary to holistically understand "interdependence" and "interconnectivity" (p. 123). This emphasises that "corporate actions [are] inherently connected to the social and natural systems" (p. 124). Consequently, "sustainable development rests on three principles: environmental integrity, social equity, and economic prosperity" (Scherer et al., 2013, p. 259). This highlights that we are not alone, but related to others. Following the logic of systems science, all our (corporate) acting is influenced and influences the entities to which we are related; may it be others in personal and emotional spatial proximity (e.g., family, colleagues) or distances (e.g., society, future generations), the living Earth (e.g., exploitation of natural resources, climate change, pollution), or supra-physical entities (e.g., the universe, God). We should know about our relatedness, which implies we should know about us, 'the others' (i.e., humans, nonhumans, more-than-humans), mechanisms, and consequences. We term this characteristic of sustainability *relatedness*.

Among the most cited definitions on sustainable development is "[meeting] the needs of the present without compromising the ability of future generations to meet their own needs" (United Nations, 1987). It points to the inter-generational focus, reflecting the tension between the present and the future. It calls for not trading future possibilities for current demands. So, time, or more specifically future-orientation is a key feature of (business) sustainability (Kim et al., 2019; Slawinski & Bansal, 2015). Along this line, Lozano (2008) highlights the "dynamic time perspectives" that characterise sustainable development, and argues that the social, environmental, and economic aspects holistically interact with each other through time. The resulting challenge for leaders is to "not just to manage resources at a point in time, but manage resources across time" (Bansal & DesJardine, 2014, p. 76). Therefore, decision makers need to "fully anticipate [stakeholders'] future needs" (Bansal & DesJardine, 2014, p. 72). They have to adopt a long-term perspective that contrasts with short-termism, which can be defined as "decisions and outcomes that pursue a course of action that is best for the short term but suboptimal over the long run" (Laverty, 1996, p. 826). Future-oriented communications (Crilly, 2017) and a "future-time framing perspective" (Liang et al., 2018) can be key to do so. We term this characteristic of sustainability *futureness*.

Hence, we can identify *relatedness* and *futureness* as two key characteristics of sustainability and sustainable development. From a Knowledge Management, we ought to find a way to handle those ideas from an organizational knowledge perspective. In this paper, we point to Responsible Knowledge Management and Spiritual Knowledge Management as two concepts that address relatedness and futureness, and thus answer the call for sustainability and its inevitable role in Knowledge Management.

3. Responsible Knowledge Management

The existential challenges (e.g., climate change, social inequalities), that are on the sustainable development agenda, require wise answers. However, instrumental-calculative rationality and rational knowledge reach their limits in the volatile, uncertain, complex, and ambiguous (VUCA) situations we are facing (Rocha et al., 2022; Kerschbaum, 2022). Using current examples, Durst (2021) illustrates these shortcomings and calls for a new approach to knowledge management, i.e., Responsible Knowledge Management.

For this endeavour, Kragulj (2023) and Rocha et al. (2022) stress the importance of practical wisdom (phronesis). Phronesis dates back to Aristotle and can be defined as "the capacity to put into action the most appropriate behaviour, taking into account what is known (knowledge) and what does the most good (ethical and societal considerations)" (Rowley, 2006, p. 1250). Phronesis is knowledge that enables one to act towards the common good. Emphasising this direction in corporate activity recognizes the relatedness of business with society and

the natural environment, and leads to acting responsibly toward humans and other entities. After comprehensively reviewing the literature, Kragulj (2023, p. 214) characterises a practically wise person as someone who can adopt and act from six perspectives: "subjective-situative", "holistic", "temporal", "communal", and "integrative"; he thereby extends the work of Nonaka & Takeuchi (2011) on the "practically wise leader". More specifically, the "future-oriented perspective" includes both the capability to "prepare for the future" and "shape the future" by "think[ing] and act[ing] future-oriented", "adopt[ing] a broader and long-term perspective", "act[ing] for the good of the community", and "balanc[ing] conflicting interests" (Kragulj, 2023, p. 214f). Responsible Knowledge Management needs to cultivate and foster these perspectives in a way that they serve the organisation as a strategic resource.

Kerschbaum (2022), building on Kragulj, (2022) argues along the same line of reasoning and emphasizes the role of aesthetics as an additional source of knowledge to account for sustainable corporate strategies. Aesthetics in that regard describes a sort of knowledge that is highly subjective and experiential and allows for individuals to 'feel' the aforementioned issues of sustainability in a VUCA environment. As opposed to rational knowledge from instrumental-calculative reasoning, aesthetics recognizes sensorial perceptions and their felt meaning as an important source of knowledge for organizations (Taylor and Hansen, 2005).

4. Spiritual Knowledge Management

Spirituality can be considered as "a belief or value system which permeates all of a person's life, giving life meaning in the context of six basic human relationships: 1) to God, or whomever or whatever is considered ultimate reality, 2) to self, 3) to others, 4) to the environment, 5) to the past, and 6) to the future" (Hoshiko, 1994 cited in Westera, 2016, p. 6); it is the being related to something self-transcendental. Consequently, spiritual knowledge is "about the deep human concerns of our existence, and of our connection with the whole universe" (Bratianu, 2015, p. 72). In this context, the concept of "self" as an analytic tool allows for introspection and reflection on our relationship between ourselves and 'others' (Dyson et al., 1997).

Spiritual Knowledge Management can be characterized as the process of creating, capturing, distributing, and effectively using knowledge to achieve the future best version of myself as a person or the future best version of itself as an organization (Kaiser, 2023). The basic idea of this approach is the fact that a fundamental dimension and key element of spirituality, which can be found in almost all definitions and approaches of spirituality - even if they are sometimes quite different - is the self. Spirituality is connected inseparably with a continuous evolution of the self towards a fully developed and fully unfolded self. The concept of Spiritual Knowledge Management takes this into account and argues that a stepwise development takes place, which can be seen as a transformation from the current version of the self to the future best version of the self. Since the future best version of the self is not (completely) known at the beginning of this path, this process can be thought of as a process of becoming (Clegg et al., 2005) and at the same time as a deep learning process (Kaiser, 2023). During this learning process, knowledge about the very nature and shape of the future best version of the self is created, and at the same time, this knowledge shapes and clarifies not only the future best version of the self, but also the way to achieve it (Kaiser, 2023). Moreover, Spiritual Knowledge Management is informed by and results in self-transcending knowledge that allows us to act on the "relation and interaction with world and with something that is other than it-/oneself" and expands our "boundaries (of the self) and [provides a] bigger picture", including "purpose, meaning and final cause" (Kaiser & Peschl, 2020, p. 534). For its generation, methods such as "learning from the future as it emerges" (Scharmer, 2009) and "learning from an envisioned future" (Kaiser et al., 2016; Kragulj, 2014) may be used. As such, Spiritual KM bridges a gap between the individual and an organisation in a sense that it addresses personal values and beliefs which are embedded in an organisation. Thereby the study of spiritual knowledge facilitates the conscious evocation of meaning in an organisational context.

The following figure-1 shows schematically the approach of Spiritual KM as an entire system.

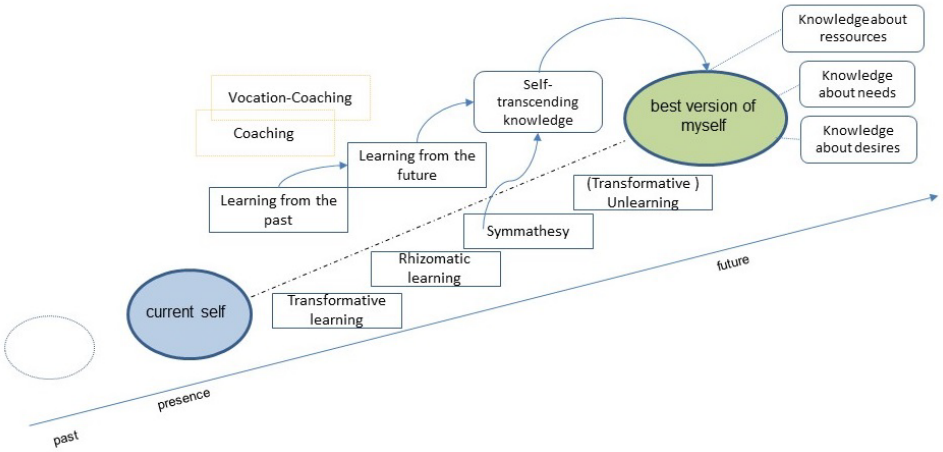


Figure-1: Spiritual Knowledge Management as an Entire System

In the following there are a few comments and remarks on this model:

- Figure 1 shows the evolution process from the current self towards the best version of oneself schematically and in a highly simplified way, since in practice it is very unlikely to be a straightforward process.
- In order to give some structure and direction to the deep learning process from the current self toward a future self, it is important to consider what specifically needs to be learned. Various authors (Kelly, 2004), (Maureder, 2004), (Kelly, 2017), (Kaiser, 2017) argue that the fulfilled self, i.e., the best version of oneself, is defined or characterized by (at least) three dimensions, namely legitimate needs, wants and desires, as well as talents, strengths, and resources. If this holds true, then we need to create knowledge about these three dimensions - knowledge about needs, knowledge about deep wishes and desires, and knowledge about resources and strengths - as part of the deep learning process.
- During this learning process, knowledge about the very nature and shape of the best version of the self is created, and at the same time, this knowledge shapes and clarifies not only the best version of the self, but also the way to achieve it (Kaiser, 2023). Following Nonaka and other scholars, knowledge can be defined as the capacity to act (Stehr, 2012), (Sveiby, 1997), (Sveiby, 2001). Accordingly, it is precisely the knowledge generated in this deep learning process that enables a person to act step by step on the way to becoming the best version of oneself. Consequently, without creating this knowledge, a person would get stuck on his or her path and would not be able to develop and grow (Kaiser, 2023). The same holds true for organizations and companies.
- To enable and support this deep learning process respectively and to bring this process in action, we assume that the methods mentioned in figure-1 (Coaching, Vocation-coaching, transformative learning, rhizomatic learning, symmathesy, (transformative) unlearning, as well as learning from the future and learning from the past, could be helpful. Whether this is really the case will be part and content of future research and investigations.

In terms of relatedness and futureness, numerous links can be identified. The core idea of the Spiritual Knowlegde Management approach is about becoming. Who you become is more important than what you are doing or what you have right now. This radical future orientation is of course not an end in itself, rather it is intended that the so-called future best version of oneself, corresponds to the principles of sustainability and wisdom better and to a higher degree. Finally, this development towards the future should have a significant benefit for all stakeholders, i.e. not only for the person him/herself, or for the company or the organization itself, but also for the (social) systems in which the person or the organization operates. It is precisely because of this that the aspect of relatedness also comes into play to a great extent. Therefore, it could be argued that spiritual knowledge management can be considered as an approach to do "the right things," which is considered one of the most important characteristics of sustainability.

5. Synthesis

What both of the presented lines of research have in common, is that they bring back the emphasize on personal experience and tacit knowledge respectively. Tacit knowledge is, indeed, a concept that has been around in Knowledge Management for decades. It has even been a substantial foundation for a large part of the field that builds on Nonaka and Takeuchi´s (1995) influential theory of knowledge creation in a company. Yet it seems that the meaning of the original idea of tacit knowledge, which was formulated by Michael Polanyi in 1966 (Polanyi and Sen, 2009), had been lost out of sight in the last years. Research in the fields of both Responsible Knowledge Management as well as in Spiritual Knowledge Management hence again emphasize the value of tacit knowledge (although from different angles) in order to address todays challenges in sustainability. It has been argued that rational knowledge alone will be an insufficient means to deal with contemporary problems, because those problems are too complex to be understood as a whole by using instrumental-calculative reasoning. Instead, these problems require practical wisdom on an individual (Nonaka & Takeuchi, 2011) but also on an organizational level (Kragulj, 2022). In its totality, they can only be perceived aesthetically and require individuals and organizations to understand themselves more as 'part of' instead of an 'entity in' the world. This necessarily implies a change in the perception of the individual and organizational self. Individuals and organizations must hence develop and understanding of who they are and what their place in the world is. That process can be understood as a quest for the *best version of one's self* and requires numerous sources of non-rational knowledge and direct experience (Kaiser and Peschl, 2020). We argue that only through recognizing the importance of, and cultivating such kind of tacit knowledge – be it wisdom, aesthetic meaning, spirituality, or else – it becomes possible to achieve true relatedness that will result in long-term oriented decision making, best described as a mindset of futureness.

For all those aspects, we see a strong connection to the field of Knowledge Management that builds on knowledge (and in that regards, knowledge must means all types of knowledge) as a source of competitive advantage (Grant, 1996; Spender, 1996). However, to be coherent, and in the light of current challenges, we shall probably reconsider the idea of *competitive* advantage towards a more conjoint notion of advantage and value-generation for society. This is, because the achievement of true sustainability will require us to move the boundaries from an individual organizational advantages-perspective to a more systemic-societal perspective of value generation. However, this is not to say that organizations will only, or should only operate towards big and noble societal goals. Rather, organizations operating on the basis of principles relatedness and futureness, will still pursue their individual purpose, yet this purpose is likely to be far more grounded in the overall system, hence leading to more and better value creation for society as a whole.

What the discipline of Knowledge Management can bring to the table in this regard is (a) great expertise and insight on individual and organizational knowledge and how to deal with such knowledge in the context of organizations, but also (b) theories and studies about the application, generation and sharing of knowledge (both tacit and explicit). What is more, Knowledge Management could (c) serve as an interface between organizational practice (daily business) and sustainable strategic planning, if it is concerned with collecting and interpreting insight about the value that an organizations seeks to create in world.

6. Avenues for Further Research

The fields of responsible Knowledge Management and Spiritual Knowledge Management are still in their infancy. Thus there are plenty of open ends that would make up for promising ends for further research. In the following, we will give some ideas where this research could go.

First, there could be more in-depth studies on the nature of tacit knowledge and its relationship to knowledge on sustainability, spiritual knowledge, wisdom, or aesthetics and how they can be cultivated and applied in organizational settings. Also, it would be worthwhile exploring, what individual skills are required to apply such forms of tacit knowledge, and also, how people can acquire such knowledge or skills. What are, for example, the implications for the education of business leaders and other decision-makers in organizations?

Second, research could examine how organizations can shift their focus from individual organizational advantages (the classical competitive advantage) to a more systemic-societal perspective of value generation. This could involve exploring how organizations can identify their purpose within the broader system, and how they can measure and communicate their impact on society.

Third, research could focus on the role of conventional Knowledge Management (e.g. KM Systems) in promoting sustainability. This could include investigating how Knowledge Management Systems can be used to capture,

share, and apply knowledge on sustainability, as well as how it can be used to support strategic planning and decision-making against the backdrop of relatedness and futureness.

Overall, there is a need for more research that integrates different disciplines and perspectives, including Knowledge Management, sustainability, wisdom, spirituality and other disciplines that are concerned with notions of non-rational knowledge, in order to address the complex challenges that organizations and society are facing these days.

7. Conclusion

Sustainability has become an essential objective that companies must meet to ensure a better future for all. The shift in focus from managing a stock of knowledge to providing a management tool that enables doing the right things has brought about a need to rethink the role of Knowledge Management. We have argued that sustainability is particularly characterized through notions of relatedness and futureness. Those are important, because they create an interface between Knowledge Management and Sustainability. On the other hand, in the field of Knowledge Management there are already some initiatives towards sustainability, namely Responsible Knowledge Management and Spiritual Knowledge Management that fit well to the ideas of relatedness and futureness and embed them in the area of Knowledge Management. A key finding in this regard is that in order to address sustainability, Knowledge Management ought to focus on non-rational forms of knowledge and tacit knowledge as a valuable counterpart to instrumental-calculative rationality.

Further research should hence address the relationship between non-rational or tacit knowledge and sustainability, spiritual knowledge and wisdom. Additionally, further research should also target individual capabilities necessary to generate or apply non-rational knowledge.

Lastly, if we adopt a mindset of futureness and relatedness as part of Knowledge Management or Knowledge-based Management respectively, we can reconsider what we understand by competitive advantage on the basis of knowledge. Our image of competitive advantage could then undergo a transformation towards a more conjoint, multidimensional notion of advantage for an organization but also value-generation for society and future generations as a whole, instead of the one dimensional advantage over competition.

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Intuition - Knowledge Over Management Science: Lesson From the Past Decades

Patrycja Krawczyk and Patrycja Kokot-Stępień
Czestochowa University of Technology (CUT), Poland

patrycja.krawczyk@pcz.pl
patrycja.kokot-stepień@pcz.pl

Abstract: The subject of intuition in management is interesting and has been discussed for decades. Repositories of scientific publications have in their collections hundreds of publications related to the use of intuition in management. It is necessary and reasonable to summarize the achievements of world science in this area. The best tool to do this will be bibliometric analyse. Bibliometric analysis is a popular method for exploring and analysing large volumes of scientific data but it`s application in business research is relatively new. A review of publications on this subject will indicate the state of this area of research. As part of the research, an analysis of the number of publications and the number of citations, and keywords statistics will be carried out. The database will be Web of Science. Zotero and VOSviever program will be the research tools. The review will be carried out following the methodology and will be divided into 5 stages, comprising: preliminary search, full search and literature acquisition, evaluation of collected documents, synthesis and analysis of results, and summary of results. The results will allow for assessing the research activity and the stage of development of the research in the field of intuition in management. A map of keywords related to the described issue will be created. What is the level of interest of scientists in this subject? Is it growing or going down? It will reliably summarise the current state of knowledge, providing information about gaps in the literature. It can also be a way to identify new research areas.

Keywords: Bibliometric analysis, Intuition, Knowledge, Management

1. Introduction

Knowledge is increasingly important in the management process in today's economy. It serves as a strategic resource of the organization (Piersiala, 2014). In this emerging management climate, one resource which is receiving increased attention in such leading publications as The Wall Street Journal, Harvard Business Review, Public Management, and The Bureaucrat is the brain skill intuition. Even leading business schools are now experimenting with a new course designed to help develop intuitive skills for decision-making.

Intuition is a feeling in which a person does not analyze what happens and why, because some other feeling tells them how to act. There is probably no other phenomenon equally important for management and less explored than intuition. Yet, intuitive thinking accompanies every manager and influences the objectives set and the way they are achieved (Laszczak, 2011). Intuition is a characteristic that can be attributed not only to individuals, but also to entire working teams.

Business decisions have always been challenging, but in last decades, as the complexities of global economy have deepened, they have become tougher than ever. The choices managers face and the data requiring analysis have multiplied, even though the time for analyzing them has shrunk. One decision-making tool - human intuition - seems to offer a reliable alternative to a painstaking fact of gathering and analysis (Bonabeau, 2003). The media space offers many articles, recordings of films convincing about this fact. This trend has been joined by the rational world of science. Scientific research should encourage managers just to trust their intuition, when facing complicated choices.

Intuition is an attribute of most living organisms, obviously including humans. On the other hand, intuitiveness is also a characteristic often attributed to technical solutions, including software. In the case of application software, an intuitive interface is just as important as extensive functionality. User satisfaction in terms of the usability of software affects their opinion on the system. Providing full functionality of technology and at the same time an attractive user interface is an uneasy task for business solutions.

One of the first definitions seems to be very accurate: intuition is an inductive skill. It is the ability to "see the big picture," to sense the possibilities and implications of any particular situation or potential decision by looking at the whole problem rather than each of its component parts. It is the ability to come up with a workable solution to a problem even when data for making that decision is inadequate or unavailable (Agor, 1985).

Article will be divided into following sections: introduction, literature revive, research methodology, results, conclusion and future work. The first part shows the intuition in management. Justifications for taking up the subject. The second part includes the overview on the writing in the field of institution in management. The third part describes the methodology of the taken research with the particular emphasis on description of the studied

samples, accepted queries. There will be indicated a tool that support the process of analysis and presentation of the collected research material. The next points presents data and calculates the level of dependence. The later phase interprets the numerical data. The presentation of numerical data in tabular form and graphs can be found in the publication. The entire study will be closed with a conclusions including: general summary of the article, its results and findings, compare to findings of other authors, recommendations for practice, research limitations and some suggestions for future research.

2. Systematic Literature Review

Intuition is a valuable sources of organizational knowledge and learning, and contribute to improved decision making in organizations (Doerfler and Ackermann, 2012; Akinci and Sadler-Smith, 2019). Intuition should be conceptualized as a multidimensional rather than a unitary construct comprised of a variety of general and specific mechanisms and processes, and primary types.

A very interesting publication, summarizing research into intuition and management is Intuition in Management Research: A Historical Review (Akinci and Sadler-Smith, 2012). In this historical review, the authors outlined the progress of research into intuition over the past eight decades. They proposed their interpretation of the chronological sequence of events that make up the history of research into intuition in management. They did not use bibliometric analysis and the research was completed in 2010. They found out that until the turn of the century, the development of research into intuition occurred mainly outside the field of management. Moreover, the concept of intuition itself was undefined or poorly defined. Within the framework of research into management, the image was sometimes confusing and contradictory.

Until the turn of the 20th century, an interest in research into intuition within the circle of management researchers was small. Today, we observe an increased interest in this area (Hodgkinson and Sadler-Smith, 2018). There were two reasons for this: intuition is the perhaps least understood aspect of managerial cognition and without understanding intuition it is impossible to develop any meaningful conceptualization of cognition (Doerfler and Ackermann, 2012). In their article they propose a provisional distinction of two types of intuition which they call intuitive judgement and intuitive insight. This distinction helps in developing a better understanding of creative intuition, which is perhaps the least understood of the various types of intuition.

In recent decades intuition researchers in management have identified different types of intuition (Gore and Sadler-Smith, 2011). These are: ‘creative intuition’, ‘expert intuition’, ‘moral intuition’, and ‘social intuition’ and spiritual intuition (Sadler-Smith and Heliot, 2021). The field of management intuition research itself may also be in something of a state of confusion on matters of epistemology and ontology.

Intuition in management is considered in connection with various areas of management, e.g., the role of intuition in employee selection (Miles and Sadler-Smith, 2014), in different industries or sectors, such as banking and finance (Hensman and Sadler-Smith, 2011), manufacturing(Tsai and Hung, 2023; Wang *et al.*, no date), healthcare (Vazquez-Ingelmo *et al.*, 2020; Mellini and Mileti, 2022), and transportation (Willumsen and Ortuzar, 1985; Chan-Chiao Lin *et al.*, 2003), with a distinction at the management level (Hodgkinson *et al.*, 2009), company size (Marzi *et al.*, 2023).

One should unconditionally agree with the statement that until recently intuition has received scant scholarly attention within and beyond psychological sciences, despite its potential to unify a number of lines of inquiry. At present, the literature on intuition is conceptually underdeveloped and dispersed across a range of domains of application, from education, through management, to health (Hodgkinson, Langan-Fox and Sadler-Smith, 2008). An attempt to organize it has been made in this study. The analysis of the literature and the initially prepared research material allows the formulation of a set of research questions:

RQ1. What are the most relevant scientific categories when it comes to intuition in management?

RQ2. In light of the data analysed, which authors/researchers are the most relevant when it comes to research on intuition in management?

RQ3. In light of the data analysed, which journals are the most relevant when it comes to publishing research results related to intuition in management?

RQ4. What does the association of keywords look like?

RQ5. Which publications should be considered the most important?

3. Research Methodology

Bibliometric analysis is a popular method for exploring and analysing large volumes of scientific data. It enables us to unpack the evolutionary nuances of a specific field, while shedding light on the emerging areas in that field. Yet, its application in business research is relatively new (de Souza Vanz and Chitto Stumpf, 2010; Chen *et al.*, 2020; Donthu *et al.*, 2021). Bibliometric methods have been used to map the fields of strategic management, entrepreneurship, innovation, and others (Zupic and Cater, 2015). The bibliometric analyses scientific publications with a set of indicators under different scopes. It is the aim to recognize scientific trends, to validate statements about scientific development and to look on actors and institutions in the scientific landscape (Tunger and Wilhelm, 2013). The latest systematic and correctly conducted review reliably summarises the state of knowledge to date, reporting any gaps in the literature and the need for new research to be conducted (Mazur and Orłowska, 2018). It is also a way of discovering new research topics. These features make systematic reviews useful in many areas of science and practice, including medicine, education, psychology, management and organisation.

For the bibliometric analysis of keywords program VOSviewer will be used. It is a software tool which can be used to conduct bibliometric analyses and create visualizations from selected databases. This software builds maps based on mathematical algorithms. It is used in other bibliometric studies (Castillo-Vergara, Alvarez-Marin and Placencio-Hidalgo, 2018; Garrigos-Simon, Narangajavana-Kaosiri and Lengua-Lengua, 2018) because it provides especially useful graphical representations with maps based on network data.

To ensure high quality of the analysis, the study will be divided into the following stages:

- Planning, defining the purpose of the review (preliminary search) including testing a few phrases to clarify the topic, testing the issue of non-financial reporting from an accounting perspective;
- Full search and acquiring literature;
- Extraction and evaluation of the evidence collected;
- Result synthesis and analysis;
- Reporting and sharing results.

At the level of Advanced Search Query Builder, various queries were tested. In the final stage, three were analyzed. The first one was TS=(intuition and management), where TS means that the following fields were searched: title, author keywords, abstract, and keywords plus. A total of 1746 publications registered in the database were indicated. However, the in-depth analysis indicated that there were some articles in the results which did not relate to the research questions posed. The second selected research sample was determined and was the result of applying the TS=(intuition) filter with refine by Web of Science Categories: Management. Search); it gave the result of 1110 records, including publications that did not relate to the research questions posed. Ultimately, a sample of 1216 publications was analysed (see Table 1), identified due to the use of the following key:

AK=(intuition AND management) or KP=(intuition AND management) or TI=(intuition AND management) OR AB=(intuition and management)

Table 1: Search Protocol

Criteria	**Reserch sample**
Database	WOS
Download date	06.03.2023
Timespan (year of first publication)	1900 - 01.2023 (1982)
Query	AK=(intuition AND management) or KP=(intuition AND management) or TI=(intuition AND management) OR AB=(intuition and management),
Sample size	1216
AK - Searches the author keywords field **KP** - Searches the keywords plus field (KeyWords Plus® are index terms automatically generated from the titles of cited articles. KeyWords Plus terms must appear more than once in the bibliography and are ordered from multi-word phrases to single terms. KeyWords Plus augments traditional keyword or title retrieval) **TI** - Searches article titles. Title refers to the title of a journal article, proceedings paper, book, or book chapter **AB** - Searches the abstract field	

Source: Own elaboration.

4. Research Results

Knowledge and intuition are two seemingly opposing issues. On the other hand, intuition can be called internal knowledge. How scientists view the role of intuition in management? The study with the help of bibliometric analysis will summarize the research conducted so far in this area.

169 categories were identified, the most numerous of which are Management, Business, and Computer Science Information Systems (see Table 2). Many articles relate to engineering. This a reflection of an increased interest in creating intuitive vehicles (Chan-Chiao Lin *et al.*, 2003), machines and devices, or software algorithms (Lee, 2018). Understanding the intuitive human factor is essential when developing technical solutions.

Table 2: Web of Science Categories

	Record Count	% of 1216
Management	283	23.27
Business	163	13.40
Computer Science Information Systems	93	7.64
Computer Science Theory Methods	82	6.74
Engineering Electrical Electronic	74	6.08
Education Educational Research	69	5.67
Operations Research Management Science	63	5.18
Economics	62	5.09
Engineering Industrial	55	4.52
Computer Science Artificial Intelligence	54	4.44
Showing 10 out of 169 entries		

Source: Own elaboration based on Web of Science data (access 06.03.23.).

Similar results are provided by the analysis of Research Areas. The articles are found in 108 categories. The three most numerous are Business Economics, Computer Science, and Engineering (see Table 3).

Table 3: Research Areas

	Record Count	**% of 1216**
Business Economics	417	34.293
Computer Science	222	18.257
Engineering	202	16.612
Education Educational Research	73	6.003
Environmental Sciences Ecology	63	5.181
Operations Research Management Science	63	5.181
Psychology	53	4.359
Social Sciences Other Topics	50	4.112
Telecommunications	36	2.961
Science Technology Other Topics	34	2.796
Showing 10 out of 108 entries		

Source: Own elaboration based on Web of Science data (access 06.03.23.).

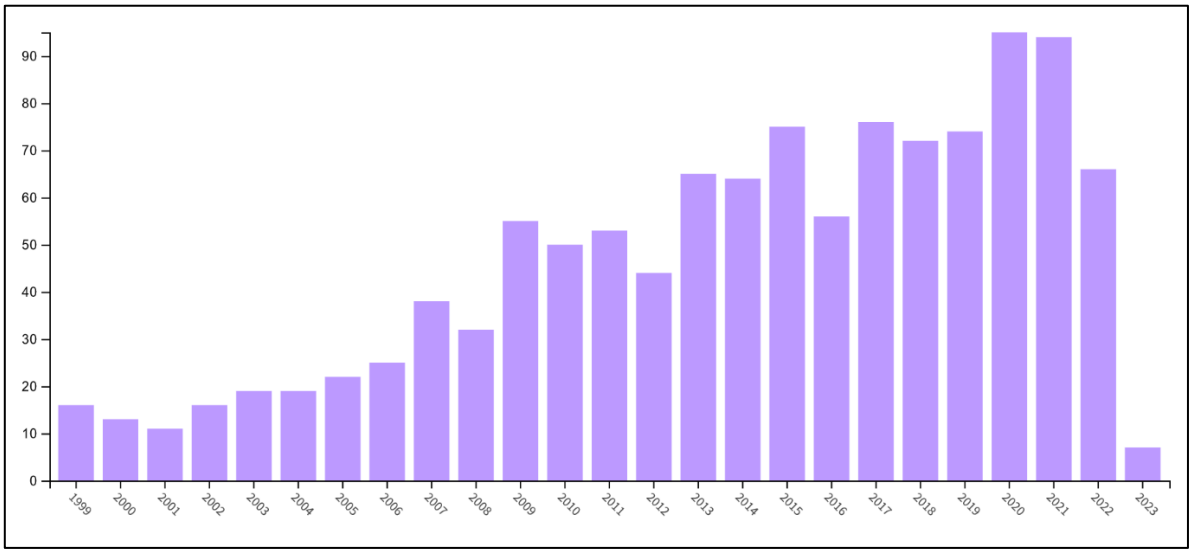
Publications on intuition in management are dealt with by researchers from various geographic areas. Scholars from the United States dominate, with over 27% of publications coming from this country. The next position belongs to England with over 11%, and the third position belongs to China (table 4).

Table 4: Publication by Countries/Regions

	Record Count	% of 1216
USA	329	27.056
England	136	11.184
China	79	6.497
Australia	73	6.003
Italy	61	5.016
Canada	60	4.934
Germany	59	4.852
Netherlands	45	3.701
Spain	41	3.372
France	39	3.207
Showing 10 out of 89 entries		

Source: Own elaboration based on Web of Science data (access 06.03.23.)

A historical approach to research into intuition in management is presented in the literature review Intuition in Management Research: A Historical Review (Akinci and Sadler-Smith, 2012). However, this work does not cover the last decade, which has seen a dynamic development of this topic. The first publication in the analyzed sample appeared in 1982 – Management guidelines - don't mistrust intuition (Raudsepp, 1982). In the period of 1982 - 1996, 35 publications were produced, with the annual number ranging from 1-7. From this period, particularly interesting publications seem to be: The road to success (Totten and Keys, 1994), The new religion of risk management (Bernstein, 1996), Intuition in organizations - leading and management productivity (Jourden, 1994). The following years saw an increase in the number of publications. The most were published in 2020 - 95 publications, and 2021 - 94 publications. Only the turn of the 20th and 21st centuries can be considered a moment when research into this topic flourished. Nowadays, many researchers from various fields, including management itself, engineering, and psychology, address this topic. The number of publications is significantly increasing. After 2020, it is already close to 100 publications per year (see Figure 1).



Source: Own elaboration based on Web of Science data (access 06.03.23.)

Figure 1: Publication by Time

The search results indicate a total of 3374 individuals who have published in this field. Most of them are co-authorship. The leader is Eugene Sadler-Smith who has published 17 papers in this area, the vast majority of which are co-authored. His most frequently cited work (193 citations) is: Intuition: A fundamental bridging construct in the behavioral sciences (Hodgkinson, Langan-Fox and Sadler-Smith, 2008). Like other publications

by this author, it is a must-read for those exploring the role of intuition in management. Another three authors have published five works each. These are: Constantin Bratianu, Said Elbanna, and Gerard Paul Hodgkinson (see Table 5.

Table 5: Name of Author who Publish Mostly

	Record Count	% of 1216
Smith, Eugene Sadler (Guildford, Surrey, England)	17	1.398
Bratianu, Constantin (Bucharest University of Economic Studies)	5	0.411
Elbanna, Said (Qatar University)	5	0.411
Hodgkinson, Gerard Paul (University of Manchester, Alliance Manchester Business School)	5	0.411
Dorfler Viktor (University of Strathclyde Business School)	4	0.329
Kim, Yukyong (Soongsil University)	4	0.329
Li, Yu (Harbin Institute of Technology)	4	0.329
Lin, Chan-Chiao (Eaton Corporation, Galesburg, USA)	4	0.329
Malewska, Kamila (Poznan University of Economics & Business, Poland)	4	0.329
Natu, Maitreya (Mumbai, Maharashtra, India)	4	0.329
Showing 10 out of 3374 entries		

Source: Own elaboration based on Web of Science data (access 06.03.23.)

The papers have been published in over 1100 different publications, which means a large fragmentation of percentage shares (see Table 6). Lecture notes in computer science surprisingly holds the top position, followed by Management decision, Academy of management learning education, and Sustainability.

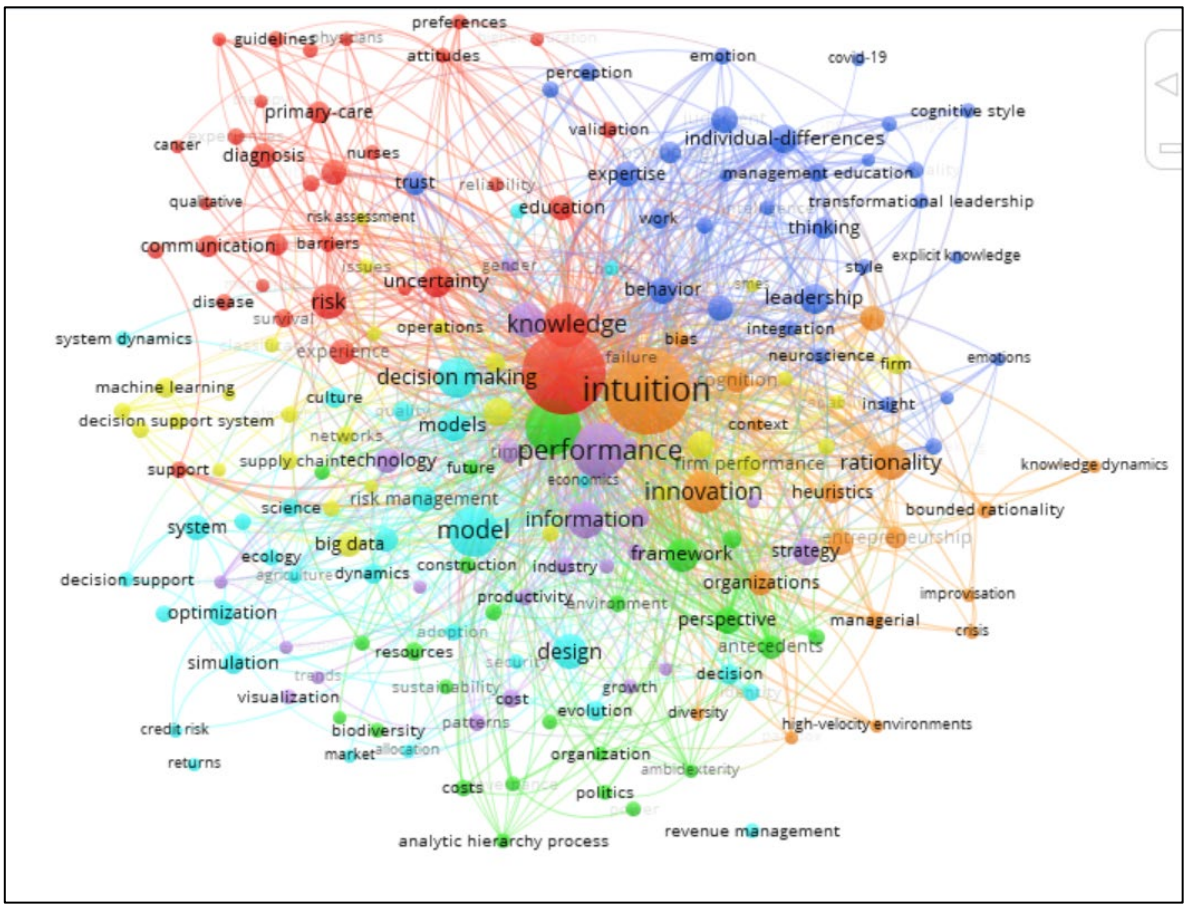
Table 6: Publication Titles

	Record Count	% of 1216
LECTURE NOTES IN COMPUTER SCIENCE	14	1.15
MANAGEMENT DECISION	11	0.90
ACADEMY OF MANAGEMENT LEARNING EDUCATION	10	0.82
SUSTAINABILITY	7	0.57
EUROPEAN JOURNAL OF OPERATIONAL RESEARCH	6	0.49
EUROPEAN MANAGEMENT JOURNAL	6	0.49
JOURNAL OF BUSINESS ETHICS	6	0.49
TECHNOLOGICAL FORECASTING AND SOCIAL CHANGE	6	0.49
INTED PROCEEDINGS	5	0.41
JOURNAL OF ADVANCED NURSING	5	0.41
Showing 10 out of 1105 entries		

Source: Own elaboration based on Web of Science data (access 06.03.23.)

The map of keywords was prepared using VOSviewer software. The map shows the connections between 193 keywords that are combined into 7 clusters, connected by 2765 lines. The paper includes the map in a general sense (Figure 2). The largest cluster, marked in red, contains 33 items, of which the most frequently repeated are: management, knowledge, risk, uncertainty, education, and diagnosis. The second cluster, marked in light blue, is almost as numerous, with 32 dominant words, such as: model, decision making, models, and design. The third cluster, marked in dark blue, contains 31 items: leadership, individual differences, behavior, judgment, tacit knowledge, and expertise. The fourth cluster, marked in yellow, has 30 items, with dominant words such as: systems, knowledge management, firm performance, big data, and supply chain management. The fifth cluster,

marked in purple, has 24 words with a dominance of: performance, information, strategy, industry, technology, and impact. The sixth cluster, marked in green, contains 24 words, including: decision making, framework, perspective, and antecedents. The last cluster, marked in orange, contains 19 items, with dominant words such as: intuition, innovation, rationality, and entrepreneurship.



Source: Own elaboration based on Web of Science data and VOSviewer (access 06.03.23.).

Figure 2. Kye wors map

H-index is 72, citing articles are more than 22 thousand with average per item more than 20. The most frequently cited items are:

- Power management strategy for a parallel hybrid electric truck (Chan-Chiao Lin *et al.*, 2003), cited 855 times;
- Thinking about u: theorizing and testing u- and inverted u-shaped relationships in strategy research (Haans, Pieters and He, 2016) cited 833 times;
- Moral Foundations Theory: The Pragmatic Validity of Moral Pluralism (Graham *et al.*, 2013) cited 826 times;
- Building theory about theory building: what constitutes a theoretical contribution? (Corley and Gioia, 2011) cited 824 times.

5. Conclusion and Future Work

Intuition and knowledge are seemingly opposite terms. Knowledge management is a discipline that has its place in management science. The term "intuition" is associated with something irrational, mystical, and is on the verge of superstition. However, there are many scientific studies contradicting this statement. Their bibliometric analysis is included in this study. In terms of knowledge management, we use our analytical capabilities to take effective decisions. However, step-by-step reasoning is not the only way of knowing. Sometimes we just ‘know’, in a moment without knowing how or why we ‘know’. Thus the knowledge arrived at by means of intuiting we call intuitive knowledge. We should remember that not so many years separate today's risk-assessment and hedging techniques from decisions guided by superstition, blind faith, and instinct .The notion that the future

rests on more than just a whim of the gods is a revolutionary idea. It is also a very young idea. More than any other development, the quantification of risk defines the boundary between modern times and the rest of history (Bernstein, 1996).

The first publications on intuition in management appeared as early as in 1938 (Akinci and Sadler-Smith, 2012). Although these were individual studies, they should be considered valuable and interesting. Only the turn of the 20th and 21st centuries can be considered a moment when research into this topic flourished. Nowadays, many researchers from various fields, including management itself, engineering, and psychology, address this topic. The number of publications is significantly increasing. After 2020, it is already close to 100 publications per year. Most publications are found in the categories of Management, Business, and Computer Science Information Systems. In the Research Areas category, the most numerous are Business Economics, Computer Science, and Engineering. In the category of geographic distribution, the most numerous publications are from the USA. The most frequently repeated keywords are knowledge, intuition, performance, model, innovation, risk, technology, rationality, and ridership. They are grouped into 7 clusters in the graphic presentation using VOSviewer.

The material presented herein provides answers to the research questions posed. It shows the moment when research in this direction began and the time when research into the issue intensified. It also presents a map of the keyword links. On the one hand, it shows the interdisciplinary nature of research.

The material developed has some weaker points. One of them is the restriction to only a selected single repository, namely the Web of Science database. This means that it does not take into account studies published in journals that were not indexed in the database. As a justification for the above, one may state that the chosen database is one of the two largest databases available. A comparison of the two largest ones, i.e. WoS and Scopus, could constitute a topic for another research. The second point that may be debatable is the choice of the search query However, in the opinion of the author, who tested various search combinations when approaching the topic, the adopted [AK=(intuition AND management) or KP=(intuition AND management) or TI=(intuition AND management) OR AB=(intuition and management)], is the most objective and authoritative one.

The study is a summary of previous research into the correlation between two concepts: intuition and management. It shows the interdisciplinary nature of the topic. For the scientific community, it can be the basis for further research into this subject matter. For management practitioners, it is a reminder that, in addition to knowledge, there is another effective tool useful in decision-making - intuition. Going further, it seems justified to distinguish a separate subcategory in knowledge management - "intuition management".

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Managing Remote Negotiation Strategies

Joanna Krzywda
Czestochowa University of Technology, Poland

joanna.krzywda@pcz.pl

Abstract: In more recent times, many business relationships have moved online and many companies are taking advantage of the opportunity to talk online with their business partners. This paper attempts to answer the question of how this fact affects business relationships. A survey method was used with 47 companies in Poland that conduct remote negotiations or remote business talks. The respondents were company managers who participate in both traditional and remote negotiations. The conceptual framework for the study was the model of negotiation as recurring events in the history of a relationship (Thomas, Manrodt, Eastman, 2015). The limitations of the study derived from the specificity of the research group: the respondents were from Poland, and the perspective of small and medium-sized companies was taken into account, whereas perhaps the perspective of large companies would have been different. The conclusion outlines the potential of remote negotiation compared to traditional negotiation and implications of conducting remote negotiations.

Keywords: Negotiations, Remote negotiations, Interorganisational relationships

1. Introduction

Negotiation is an essential part of business relationships and at the same time a frequent and relevant part of management tasks. (Saorín-iborra, M. C., & Cubillo, G., 2019) Negotiation is a key interaction in the buyer-seller and supply chain relationships (Zachariassen, 2008) and every business project - and every business relationship - is related to negotiation. Thus, it becomes apparent that negotiation is central to the relationship. If one assumes this to be the case, then it is important to establish what factors influence negotiation.

The recent years have seen an increasing number of business meetings taking place via modern technologies, in particular video conferencing. This is due to the possibilities that these technologies offer and the benefits that this brings, such as saving time, financial resources that would be spent on travel, but above all the belief that remote negotiations can successfully replace traditional face-to-face (f2f) meetings. From the point of view of interorganisational relations, this phenomenon is highly interesting and raises a number of questions about the impact of such negotiations on interorganisational relations and the nature of this type of negotiation itself, particularly in comparison to traditional negotiations.

This paper attempts to answer a number of questions that arise with regard to business relationships that are initiated and sustained by means of remote negotiation: how the fact that negotiations take place by means of videoconferencing affects the attitudes of the participants in the negotiations: their expectations and plans, and how the negotiation situation and the outcome of remote negotiations affect the business relationship.

2. An overview of the Literature

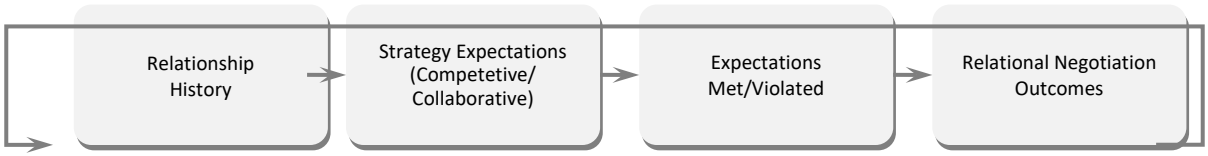
Negotiation and relationships in the academic literature are discussed from many different angles. The literature on negotiation and relationships is very rich and multifaceted. Negotiation is seen as a way of resolving conflicts, including cultural conflicts (Biesaga-Słomczewska, 2011). Cross-cultural negotiation is addressed extensively (Peleckis, 2014), but so is negotiation in specific situations such as selling real estate (Wang, Zionts, 2008) or negotiating salaries (Säve-Söderbergh, 2019). There is also a rich psychosocial current in the negotiation literature, analysing negotiators' behaviour and its socio-psychological background, e.g. face-threat-sensitivity (Miles, Schatten, Chapman, 2020), gender differences in negotiations (Mazei, Zerres, Hüffmeier, 2021; Lee, Pitesa, Pillutla, Thau, 2017), or styles and negotiations behaviours (Ma, 2007). There is also a current dedicated to negotiation tactics and techniques and their typology (Martin-Raugh et al., 2020).

Among these currents, there has also emerged one dedicated to the study of online negotiations also known as remote negotiations or e-negotiations. These are defined as 'any long-distance negotiation process, without physical contact and using audiovisual communication tools, mainly connected to the Internet, which allow immediate and technically fluent communication, but with certain limitations and differences with face-to-face negotiations' (Hernandez, Monne, Sein-Echaluce, 2022). Thus, for example, the role of humour in remote negotiation (Kurtzberg, Naquin, Belkin, 2009), advantages and disadvantages of online negotiation (Yuan, 2003) and non-verbal behaviours in online negotiations (Kazemitabar et al 2022; Holland, Taylor, 2016) have been explored. The differences between remote negotiations and traditional negotiations have also been explored.

The fact that negotiations take place online is among a large group of factors that can influence the course and outcome of negotiations. Among these, BATNA, or the best alternative to a negotiated agreement, is also considered (Fisher and Ury, 1981). There is well-known research on the relationship of BATNA with the negotiation strategy adopted by negotiators (Patton et. al, 2010; Habib et. al, 2015) and on the outcome of negotiations (McAlister et. al, 1986; Roloff, and Dailey, 1987). Other factors influencing negotiators' attitudes include cultural intelligence (Caputo et. al, 2019), psychological factors including cognitions and biases, personality, motivation, emotions and inclination to trust (Brett, Thompson, 2016), emotional intelligence (Kelly, Kaminskiene, 2016), creativity of the negotiator (De Pauw et al. 2010), need for closure, i.e. a construct that describes a motivational tendency to quickly select and prioritize information in the environment (Pietrzak et. Al, 2014) and social-environmental factors including reputation and relationship, gender, power and status, and culture (Brett, Thompson, 2016). Negotiators' attitudes may also be influenced by their religious beliefs (Richardson, Rammal, 2018), history, in particular protracted feuds that developed as a result of conflicting interpretations and invocations of history (Dezső et al. 2015), but also expectations about others' ethics (Mason, et. al., 2018) as well as the language used during negotiations (Alvarez et. al., 2017) or the way the negotiating partner speaks (Swab et al., 2011). The question raised about the differences in how the fact that negotiations take place remotely affects negotiations can hardly be found in the literature. Galin, Gross, Gosalker (2007) found that the negotiation media, as well as the negotiation sequence, barely affects the negotiation outcomes. Face-to-face negotiation was not different than e-negotiation, in terms of the final price, the number of installments for the balance and the sum of the advanced payment. However, both the negotiation media and the negotiation sequence significantly affected the main features of the negotiation process, in terms of time duration and the use of hard or soft tactics. However, there is still a research gap when it comes to the impact of remote negotiation on interorganisational relationships.

3. Conceptual Framework

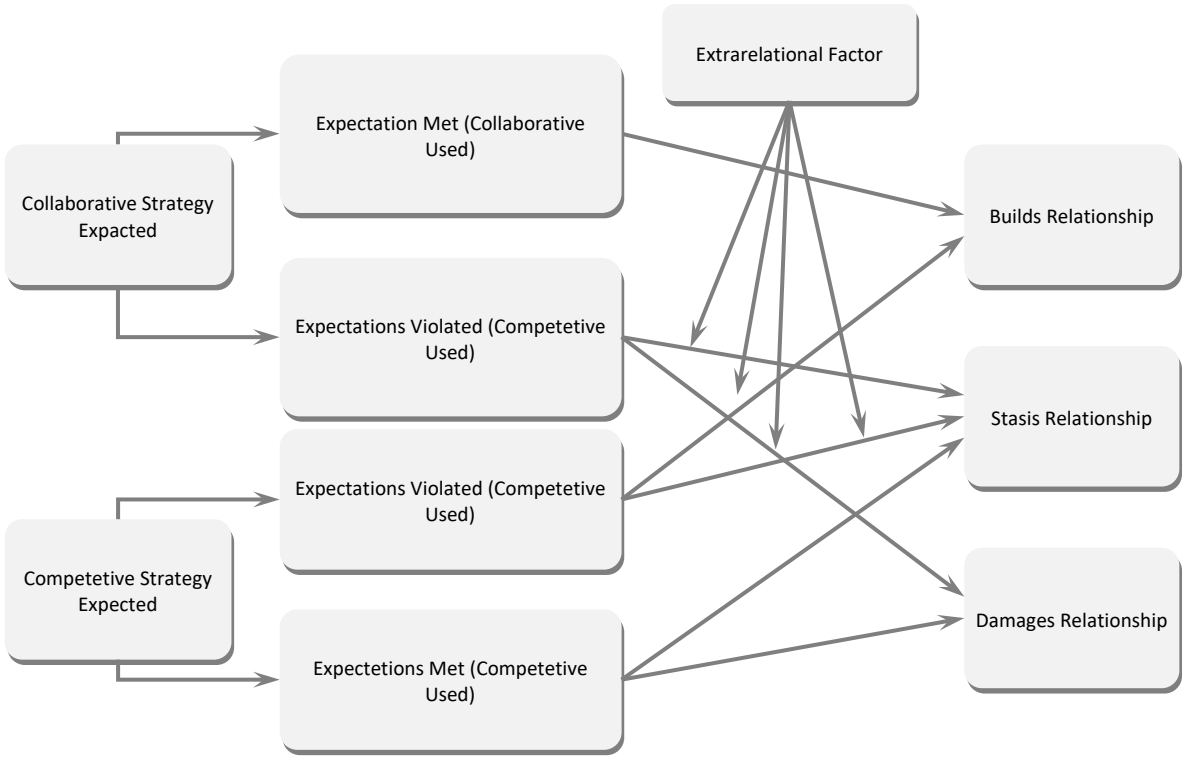
Understanding the role of negotiation in relationship formation is facilitated by an analysis of the model by S. Thomas, K. B. Manrodt, J. K. Eastman (2015). Taking a broader perspective, the authors of the model assumed that the relationship between suppliers and buyers is a key element in supply chain management practice. The model also assumes that there are two main negotiation strategies: a collaborative strategy and a competitive strategy. Different 'negotiation events' are discrete events that become part of the history of the relationship and then affect the relationship in its longer term. The relationship between the buyer and the seller is built up over a series of transactions. Each interaction contributes to the relationship history as illustrated in Figure 1.



Source: S. P. Thomas, K. B. Manrodt, J. K. Eastman *The impact of relationship on negotiation strategy expectations. A theoretical framework*, in: International Journal of Physical Distribution & Logistics Management. Vol. 45, No. 8, 2015, p. 802.

Figure 1: A Model of the Impact of Relationship History on the Outcome of the Negotiation and the Subsequent Relationship Depending on The Expected Negotiation Strategy

The history of the relationship influences the parties' expectations of the strategy expected from the other party - collaborative or competitive. The outcome of a single negotiation event influences the relationship in the future. Based on the history of previous negotiations, negotiators form their predictions about the strategy that the other party will use. If the negotiator expects the other party to use a collaborative strategy and his or her predictions are confirmed, the existing relationship strengthens. If, on the other hand, the negotiator expects his or her partner to use a competitive strategy and this expectation is confirmed, the relationship does not change or weakens if the negotiator would have preferred a collaborative relationship. If there is a mismatch between the anticipated strategy and the strategy employed by the other party, the impact of this mismatch depends on non-negotiation factors. These relationships are shown in Figure 2.



Source: S. P. Thomas, K. B. Manrodt, J. K. Eastman The impact of the relationship on negotiation strategy expectations. A theoretical framework, w: International Journal of Physical Distribution & Logistics Management. Vol. 45, No. 8, 2015, p. 803.

Figure 2 The Impact of the Expectation of the Negotiation Strategy and the Employed Negotiation Strategy on the Relationship

Non-relational factors are the final component of the model discussed above. They occur outside of the existing relationship and can help the supplier and customer understand why there has been an inconsistency as to the strategy expected and actually employed. Awareness of the reasons for this inconsistency can reduce the potential negative impact of the inconsistency on the relationship. By non-relationship factors, the authors of the model mean, for example, a general increase in commodity prices, which may cause the choice of a competitive strategy, or a weakening of the economy, such as a crisis.

The uniqueness of this model consists in the fact that it takes into account the relationship preceding the negotiation and thus does not treat the negotiation as a discrete event of a transactional nature: previous encounters create a history that influences the following encounters. Based on this model, it is assumed that the way the negotiation is conducted influences the course of the negotiation and, depending on whether the negotiation takes place in a remote mode or in a traditional mode, the participants in the negotiation have slightly different expectations of the other party's negotiation strategy, plan the negotiation event slightly differently, and behave differently and use different strategies during the negotiating stage. Accordingly, the following research hypotheses are put forward:

Hypothesis 1 (h1): As early as at the stage of expectations about the other party's strategy, there are different expectations in remote and f2f negotiations.

Hypothesis 2 (h2): As early as the stage of expectations, the parties plan slightly different strategies in remote and f2f negotiations.

Hypothesis 3 (h3): In remote and f2f negotiations, expectations of the other party's strategy more often or less often differ from the actual strategy.

Hypothesis 4 (h4): Parties change strategies more easily and quickly in remote negotiations than in f2f negotiations.

4. Methodology

A questionnaire-based opinion survey and interview method were used to collect data for analysis.

A total of 47 respondents from businesses in the Silesian Voivodeship in Poland took part in the survey. This number definitely cannot be considered as representative when considering the number of businesses in the Silesian Voivodeship, which is over 450,000. However, it should be noted that data collection is relatively difficult under Polish conditions. In Poland, managers generally cope with a heavy workload, and on top of that they receive a lot of requests to fill in different questionnaires.They are also often reluctant to fill in questionnaires for fear of disseminating confidential or competitor-relevant data (Dyduch, 2020). Therefore, the survey was supplemented with an interview method, which is used and recognised in the study of such concepts as negotiations (Thomas, Manrodt, Eastman, 2015). In this way, a certain triangulation of the study was achieved, nevertheless it could be seen as a lead-in to a larger project.

The respondents in the survey were managers of companies from different industries (trade, construction, manufacturing, insurance) whose responsibilities include negotiating with business partners and who declared experience in both remote and traditional negotiations. The questionnaire consisted of 13 questions designed to verify the study hypotheses, in which the respondents were asked straightforward questions about the phenomena under study with a request to rate them using a Likert scale, which is a measurement strategy used in survey questionnaires and questionnaire interviews to establish the extent to which the phenomena under study can be assessed. It is often employed to measure attitudes towards specific interactions, behaviours, events, objects, projects or problems. Respondents were asked to rate the extent to which they agreed with a given statement about negotiation by marking how strongly they agreed with it on a 5-point scale, where a score of 5.0 indicated the highest degree of agreement and 1.0 the lowest degree of agreement. The averaged agreement ratings of a given statement gave a picture of the respondents' perceptions of negotiation. Thus, for example, if a statement received an average score of 2.0 from the respondents, this means that they tend to disagree with the statement. The study did not use descriptive statistical methods, if only due to the limitations of the size of this study.

Interviews were additionally conducted with 15 respondents in which they commented on the questionnaire questions. Their responses were recorded in the form of personal notes, as most respondents expressed concerns about being recorded. The data thus obtained was subjected to semantic analysis, which complemented the data obtained from the questionnaire.

5. Results

Forty-seven respondents provided their answers. They were employees or owners of companies in industries such as packaging (sales and production), insurance, construction, recycling and services. All declared at least medium negotiation experience.

The first part of the survey included questions to verify the validity of the model. This part of the survey comprised 4 questions and the respondents were asked to provide answers using a 5-point Likert scale. Confirmation of the theses based on the model was obtained: 'the negotiation style depends on the relationship we have with a given company' (4.7); 'if the relationship with a given company has been successful so far, I expect it to be rather good during the next negotiation' (3.85); 'the outcome of a given interaction with a business partner affects how the business relationship is shaped' (4.085); 'there are two negotiation styles, which can be described as competitive and collaborative' (4.46). The subsequent questions included in the survey aimed to verify all four hypotheses adopted.

5.1 h1) As Early as at the Stage Of Expectations About the Other Party's Strategy, There are Different Expectations in Remote and f2f Negotiations

The hypothesis in the study was that at the stage of expectations about the other party's strategy, there are different expectations in the case of remote and f2f negotiations. It was assumed that one of the two strategies - competitive or collaborative - is expected more often by the respondents specifically due to the fact that the negotiation takes place remotely. In order to verify this hypothesis, three questions were asked in the survey. The respondents verified the validity of the statements according to which, in remote negotiations, 1) they more often expect competitive strategies, 2) they more often expect collaborative strategies, and 3) strategy expectations do not depend on whether one negotiates remotely or f2f. The table below shows the results on the adopted Likert scale:

Table 1: Expectations Regarding the Other Party's Strategy in Remote Negotiations

Statement	Validity of the statements on the Likert scale
In remote negotiations, negotiators are more likely to expect competitive strategies	2.44
In remote negotiation, negotiators more often expect collaborative strategies	3.55
Expectations about strategy do not depend on whether you are negotiating remotely or f2f	4.5

Source: Author's own compilation based on the survey

5.2 h2) As Early as the Stage of Expectations, the Parties Plan Slightly Different Strategies in Remote and F2f Negotiations

In order to verify h2), four statements were provided in the survey, which are shown in the table below with the results.

Table 2: Preparation for Negotiations and Negotiation Techniques Used in Remote Negotiations

Remote negotiation event requires slightly better preparation than f2f negotiation	3.08
Remote negotiation event require different techniques than f2f negotiations.	3.02
When preparing for a remote negotiation I am more likely to think about using competitive strategies than collaborative strategies	2.36
When preparing for a remote negotiation, I am more likely to think about using collaborative strategies than competitive strategies	4.27

Source: author's own compilation based on the survey

The survey revealed a fairly 'moderate agreement' among the respondents with the statement that a remote negotiation requires slightly better preparation than an f2f negotiation, as well as the use of different negotiation techniques. It also revealed that the preferred approach in planning is a collaborative strategy.

5.3 h3) In Remote and f2f Negotiations, Expectations of the Other Party's Strategy More Often or Less Often Differ From the Actual Strategy

The third hypothesis concerned the negotiation situation, and in order to verify it, two statements were presented to the respondents for evaluation. These related to the strategies actually used by the negotiating partner compared to the expected strategies and the negotiation techniques used in remote negotiations.

Table 3: Anticipated and Actual Strategies and Techniques Used in Remote Negotiations

In remote negotiations it happens more often than in f2f negotiations that the strategy used by the negotiating partner is different from the one I anticipated	2.0
It is my impression that in remote negotiations the parties are more likely to 'switch' techniques rather than in f2f negotiations	2.12

Source: Author's own compilation based on the survey

Both statements received a low average score on the Likert scale, indicating that the respondents 'only partially' agreed with the statements presented.

5.4 h4) Parties Change Strategies More Easily and Quickly in Remote Negotiations Than in f2f Negotiations

The fourth hypothesis addressed the change in strategy over the course of the negotiations and the chosen strategy versus the predicted strategy. To verify hypothesis h4), the respondents were asked to evaluate two statements.

Table 4: Changes in Negotiation Strategies in Remote Negotiations

In remote negotiations, it is more common than in f2f negotiations for the negotiating partner to change the negotiation strategy.	1.89
In remote negotiations I am more often positively surprised by the attitude of the other party than in f2f negotiations.	4.36

Source: Author's own compilation based on the survey

The statement claiming that the strategy used by the negotiating partner is different from what was anticipated received a very low score and can thus be considered as not validated. A high average score was given to the statement saying that the respondents were 'positively surprised' by the attitude of their negotiating partners.

6. Discussion

It is important to consider whether the fact that a negotiation event takes place on a remote basis is at all a factor that influences expectations and the choice of strategy, because, as we know from the model developed by Thomas, Manrodt and Eastman, the main factor is the relationship itself. As is clear from the model, there are other factors that may influence the negotiation and the strategies, and one of these factors is the fact that the negotiation takes place on a remote basis.

The verification of h1 has shown that there are some, albeit insignificant, differences in strategy expectations in remote negotiation and f2f negotiation. The highest average value was assigned to the statement that strategy expectations do not depend on whether you negotiate remotely or f2f. However, the respondents gave an average of 3.55 on the Likert scale to the statement that in remote negotiations negotiators are more likely to expect a collaborative strategy, and the statement about expecting a competitive strategy received 2.44 points on the Likert scale. Thus, it can be concluded that if there are already some expectations of strategy in relation to the type of negotiation, these are expectations of a collaborative strategy. This means that negotiators approach remote negotiations with enthusiasm, with a positive attitude and this attitude is more frequent here than in f2f negotiations. One can, of course, reflect on the reasons for this specific attitude. In some cases, the respondents explained the reasons in the conversation accompanying the survey. For some, what matters is the mere possibility of having a negotiation, albeit in a remote form, which could not take place at all in the traditional form due to cost or time. Some reported a general positive attitude towards new technologies and the opportunities that they offer. There was an opinion that with the proliferation of remote negotiations, it is possible to have many such meetings, including in the initial phase of a business relationship, and often relationships in this phase are not yet burdened with a negative history. Some also stressed that it all depends on the subject matter of the talks and there are some issues that would be impossible to address in remote negotiations.

It should be noted, however, that the belief that strategy expectations do not depend on whether you negotiate remotely or f2f gained the most points on the Likert scale. This suggests that the form in which the negotiation takes place does not have such a significant impact on the strategy expectations of the other party. In some statements accompanying the survey, the respondents indicated that if the business partner has already been met and the relationship has its history, the form of negotiation does not influence strategy expectations. This leads to the conclusion that the history of the relationship is more important, which, incidentally, is in line with the model developed by Thomas, Manrodt and Eastman.

Slightly more significant differences between remote negotiation and f2f negotiation emerged on the issue of strategy planning. Thus, h2 was successfully verified. The statement that, when preparing for remote strategies, you are more likely to plan to use a collaborative strategy yourself achieved a higher average score on the Likert scale than the statement about planning competitive strategies. When recalling the h1 validation effect, this implies that an enthusiastic attitude towards remote negotiation includes not only the expectation of a collaborative strategy, but also the planning of such a strategy. Some of the statements accompanying the survey confirmed that managers have become somewhat accustomed to remote negotiation and it has become an everyday occurrence for them. They are not a source of stress as they used to be and their level of acceptance as a form of maintaining business relationships has stabilised and is quite high. There have been some voices saying that it is simply a new form of negotiation, not inferior to f2f and even better than traditional negotiation in some respects. Hence the positive attitude and planning of collaboration strategies.

However, hypothesis h3, according to which remote negotiation and f2f negotiation differ in terms of consistency of strategy expectations, was not validated. The hypothesis assumed that, for example, in remote negotiation, negotiating partners use a different strategy than predicted, in other words, they are more unpredictable. This would supposedly mean that if we anticipated a collaborative strategy from a negotiating partner, that partner - contrary to our expectations - used a competitive strategy. The statement that "in remote negotiations it happens more often than in f2f negotiations that the strategy used by the negotiating partner is different from the one I predicted" received an average of 2.00 points on the Likert scale and this means that the respondents only partially agree with this statement. This allows us to assume that remote negotiation is not some special factor that causes negotiating partners to change their negotiation strategy. An equally low average score was given to the statement , according to which in remote negotiations the parties are more likely to 'switch' techniques than in f2f negotiations. This means that remote negotiation, or more precisely its form, does not encourage the parties to use more techniques and remote negotiation is not at all more unpredictable.

The last hypothesis focused on how easily and quickly negotiating partners change their own planned strategies to the opposite strategies. A very low (1.89) score for the sentence: "in remote negotiations it happens more often than in f2f negotiations that the strategy used by the negotiating partner is different from the one I predicted" proves that predictions about negotiation strategy in remote negotiations generally work. This is actually the key finding in the study conducted. This is because, as the model shows, the most desirable situation for building business relationships is when there are expectations of a collaborative strategy and then these predictions are confirmed. After all, this is the situation that builds the relationship. If we assume that in remote negotiations the parties are more likely to assume and expect a collaborative strategy and at the same time plan such a strategy themselves, then if both of these premises occur, we have a situation that is ideal for the relationship history and has a high potential for building a good history and a good relationship.

Even more favourably ranked on the Likert scale was the statement "in remote negotiations I am more often positively surprised by the other party's attitude than in f2f negotiations.", which scored an average of 4.36. This sentence can be interpreted as a general impression of remote negotiations, which respondents evaluate positively. It appears that remote negotiation more than satisfies the expectations of negotiators. If this sentence is interpreted in the context of the Thomas, Manrodt and Eastman model, the conclusion can be drawn that remote negotiation, or more precisely its form, can contribute to building a relationship or at least sustaining it at the existing level.

7. Conclusions

Remote conversations, including remote negotiations, are mainly characterised by the fact that the participating parties are in different locations and the conversation is made possible by modern technology. This important fact changes the very nature of the conversation. It turns out to be impossible to interact informally between people and thus to establish personal interactions. The sharing of knowledge is hindered, the range of negotiation techniques that can be used is reduced, and it is impossible to read certain information arising from the context of the conversation (e.g. body language). On the other hand, remote negotiation means saving time and financial resources and the possibility to have many conversations in a short period of time. Many of the business meetings would not have taken place at all had they not been held remotely. The answer to the question of whether remote negotiation improves interorganisational relationships is therefore complex, but overall it is positive. The study found that participants in remote negotiations are enthusiastic about them, which applies to both their expectations and their strategy plans. They rather expect the other party to choose a collaborative strategy and plan to follow such a strategy. There is also a strong belief that the form of the negotiation does not matter, which is also to be interpreted in favour of remote negotiation: it is not 'inferior' to traditional negotiation, and it is rather the history of the relationship and the topics of the talks that play a more important role.

Remote negotiation is also just as predictable as traditional negotiation and negotiators do not change techniques here differently from traditional negotiation. The most important statement, however, concerns the positive surprise of the other party's attitude that negotiators experience during remote negotiations. While this is a rather general statement, it reveals important knowledge about remote negotiations in terms of their potential for relationship development. Indeed, if we return to the model developed by Thomas, Manrodt and Eastman, what matters most in the shaping of business relationships is whether expectations about the negotiation strategy employed by the other party are confirmed. For the forming of a good relationship, the most favourable situation is when the expectations concerning the use of a collaborative

strategy are confirmed. The negotiation then becomes part of the organisation's good relationship history, building and strengthening it, which is the most favourable situation from the point of view of the relationship.

The findings also allow for the formulation of managerial implications. Negotiation is an important part of the relationship between organisations. Managers undoubtedly strive for the best possible negotiation outcome. Most managers are already familiar with remote negotiation and are willing to use it in their practice. Remote negotiation does not allow for the same degree of interpersonal relations and knowledge sharing as traditional negotiation, but it is not inferior to traditional negotiation in terms of its potential to build relationships between companies. This potential value of remote negotiation is undoubtedly the most important finding of this research and the most important feature of this type of talks. Negotiators are enthusiastic about remote negotiation and certainly managers should take advantage of both the potential of remote negotiation and of this enthusiasm, as remote negotiation can be very helpful in forming good relationships and in building a positive history. Buyers and suppliers should be made aware of the potential of remote negotiation and encouraged to use it. They should also be encouraged to develop their own paradigms for conducting these types of conversations and creating an atmosphere for meetings and making the most of the potential of modern technology.

It should also be noted that regardless of the form of negotiation, preparation is imperative, but this should take into account the slightly different nature of interaction in the case of remote negotiation and the slightly different range of techniques that can be used. Managers should sensitise negotiators to these limitations and choose an appropriate form for the talks. It is important to remember that not every talk can be held remotely because of the subject matter and that a lot depends, on the history of the relationship between the companies.

The above study had its limitations. It might have been appropriate for the research to take into account how long the relationship has lasted and the nature of the relationship, as the application of remote meetings to talks can vary depending on what stage the relationship is at and what history it has. Certainly, further research could explore the preference for remote or traditional negotiation depending, for example, on the age, gender or education of the respondents. It should also be noted that the survey was conducted among respondents from Poland. However, it seems that Polish people have a specific approach to technology, which may be different in any other country. Also, the perspective of small and medium-sized enterprises was taken into account, whereas perhaps the perspective of large companies would be different. In addition, it would be useful to take into account that in the course of carrying out the survey, many respondents provided additional explanations about remote negotiation. This broadened the perspective slightly and represents some triangulation of the survey, but at the same time suggests that future research of this type should be expanded to include interviews.

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Gender Differences and Readiness Towards Knowledge Sharing among Remote Working IT Sector Employees

Ewelina Krzyżowska
Cathedral of Applied Sociology and Human Resources Management, University of Technology, Częstochowa, Poland

ewelina.krzyzowska@pcz.pl

Abstract: The COVID-19 pandemic exerted a significant impact on various spheres of the functioning of an individual, including the area of professional functioning. One of these changes was the spread of remote working, which in turn led to the greater interest in this form of work and the search for effective solutions that support labour efficiency in these particular conditions. An important problem of remote working that is associated with the restriction of face to face communication, is the sharing of knowledge amongst the employees. The aim of the paper was to analyse the differences in the readiness to share knowledge in conditions of remote working in the IT sector between women and men depending on the chosen demographic factors and factors relating to work. The study included 112 employees from the IT industry who worked remotely at the moment of conducting the research. A self-designed survey was availed of in the research which encompassed the following: demographic data (sex type and age of those analysed, being in a relationship, number of children), variables associated with work (position held in the firm, job seniority, number of hours of remote work), while also questions relating to sharing knowledge with co-workers. In the analysed group of employees of the IT sector working remotely, a greater readiness to share knowledge was noted amongst men as compared to women. Furthermore, as the effect of intragroup comparisons, the following was noted: older women were more willing to share knowledge than younger women, raising three or more children, while also more than women who do not have children, whereas women in relationships were more willing to share knowledge than single women. In turn, in the group of men the differences were only evident in the sphere of job seniority. Longer job seniority turned out to be favourable towards the readiness to share knowledge. The research findings significantly broaden knowledge in the sphere of the individual factors influencing the effective organization of the process of knowledge management, while particularly knowledge sharing in conditions of remote working. This knowledge may be particularly useful for managers of the IT sector.

Keywords: Knowledge sharing, Gender differences, Remote work

1. Introduction

The COVID 19 pandemic virus strongly disrupted the socio-economic life of humanity worldwide. The consequences of this situation was the implementation of changes to various areas of functioning, including the professional area. Remote working started to gradually spread as the recommended form of employment even in sectors where it had not been utilized prior to this. Prior to the pandemic, it was a form of work that was rather sporadically encountered. In accordance with the data from the 2018 European Labour Force Survey approximately 10% of employees and 30% of self-employed used to work from home at least sometimes, whereas during the pandemic it spread on a wide scale - the Eurofound (2020) survey suggests that 48% of employees worked remotely at least some time in 2020 (Bertoni, 2021). Remote working during the pandemic constituted significant solutions that created the possibility of retaining employment and maintaining safe conditions for health, while simultaneously reducing the fear, as well as facilitating both family and professional commitments. One of the serious problems connected with working in remote conditions is the limitation of direct communication, or the so-called *face to face* communication. This further implies difficulties in other areas of cooperation, among others, in the sphere of knowledge sharing (KS). KS signifies the provision of information associated with the task or *know-how* in order to help others and to cooperate with others in terms of resolving problems, developing new ideas, or implementing the policies of procedures (Wang, Noe, 2010). The significance of KS for the organizational performance is leading to greater levels of interest in this process, while also the enhancement of this process, e.g. in the IT sector knowledge transfer is strengthened by extending the individual beyond the formal communication channels, such as: computer networks, electronic bulletin boards, etc. (Zheng, 2017). Apart from this type of enhancements, it is necessary to remember about the various circumstances that have an impact on the quality of KS and which are associated with technological factors, organizational factors, while also individual factors (Paroutis, Al Saleh, 2009). In this paper, an attempt has been undertaken to verify the significance of the chosen conditions of KS by way of responding to the following question: Do differences exist in terms of the readiness to share knowledge between women and men depending on the chosen demographic factors and factors associated with work?

2. Literature Review and Research Background

KS constitutes a serious challenge for enterprises functioning in times of economies based on knowledge, while also in a time affected by the COVID-19 pandemic. Unfortunately, there is still a prevalence in certain organizations of the tendency to accumulate knowledge than to share it (Ismail, Yusof, 2009). With relation to this, it is absolutely vital to improve the process of KS by means of technological solutions, but also the appropriately designed models that would take account of the various conditions of effective KS. This is particularly significant in the IT sector, which is one of the sectors where the management of information to a significant degree translates to the performance of the enterprises at hand (Wang, Chang, 2005). In spite of the fact that there is a lot of research on the conditions of KS, it would seem that relatively little attention is devoted to the demographic variables, particularly associated with gender types. In this paper, attention has been focused on analysing the significance of these actual variables in terms of the readiness towards KS amongst a group of employees of the IT sector working remotely.

Sex types condition certain differentiation which may be expressed in, among other areas, the area of social behaviour of women and men (Wojciszke, 2012). The findings of the meta-analysis of research indicates, among other things, the fact that women have a greater tendency to confide, particularly in other women with whom they have close relations, while also being better experts in the sphere of controlling the course of social interactions, as well as easing social conflicts more effectively and are more conformist in the case of pressure exerted in a small familiar group. Moreover, women are more prone to anxiety and depression as opposed to men, while also more emotionally sensitive. In turn, men indicate a decisively greater tendency towards aggression and risky behaviour. In the context of organizational behaviour, men distinguish such features as: individualism, competitiveness, as well as self-promotion (Miller, Karakovsky, 2005). In turn, women with regard to their greater emotional and social competences are more likely to support the work of other employees, while also cooperate and build a community culture within the organization (Miao, Humphrey, Qian, 2016; Al. Noor, Ishtiak Uddin, Shamaly, 2011). The differences listed may also justify different approaches to sharing knowledge by women and men. In the case of women, support and close social relationships with co-workers represent the benefits of sharing knowledge (Lin, 2006). Hence, women may display the tendency to search for and share knowledge in a way that is more direct than men (Miller, Karakowsky, 2005). In turn, men may be more engaged in KS with the aid of the latest technological solutions in this sphere (Taylor, 2004).

The conclusions from research relating to gender differences in the sphere of the readiness towards KS are not unequivocal. Some research indicates that gender type does not have a significant impact on KS (Chowdhury, 2005; Mogotsi, Boom, Fletcher, 2011; Ojha, 2005; Razmerita, Kirchner, Nielsen, 2016; Watson, Hewett, 2006), while other research confirms the differences in this area (Abukhait, Bani-Melhem, Zeffane, 2019; Boateng, Dzandu, Agyemang, 2015; Grubić-Nešić, Matić, Mitrović, 2015; Miller, Karakovsky, 2005; Lawal, Oriogu, Ogbuiyi, 2017; Lin, 2006; Pangil, Nasrudin, 2008; Tan, Trang, 2017; Taylor, 2004). The research of Lin (2006) indicated that women are more willing to share knowledge as they are more sensitive to instrumental ties and have the need to overcome traditional professional challenges. Likewise, in the research of Grubić-Nešić et al. (2015) in various Central European organizations women have acquired higher levels of indicators both in the sphere of the intention to share explicit knowledge, as well as the scale of explicit knowledge sharing behaviour. In turn, Boateng et al. (2015) proved that male teachers share knowledge to a greater degree than their female colleagues. Similarly, research findings with the participation of employees in some telecommunication companies (Tan, Trang, 2017), while also the participation of employees from the service sector (Abukhait, Bani-Melhem, Zeffane, 2019) indicate that males tend to share more of their knowledge than females.

Perhaps in the clarification of the differences in the sphere of the research findings relating to the relation of KS with gender type, a significant role is played by other variables, such as, among others, the way of sharing knowledge, or the type of sector and the significance of the behaviour associated with KS. Hence, this research tests the differences in terms of the level of readiness towards KS amongst women and men as employees of the IT sector. By taking the afore-mentioned arguments into consideration, the following research question has been formulated:

Does a difference exist in terms of the readiness to share knowledge between men and women as employees of the IT sector working remotely?

Becoming familiar with these differences among the Polish employees of the IT sector working remotely also justifies the lack of similar empirical work, at least to the knowledge of the author at hand, while conducting such research would be with the participation of such analysed groups. Thus, the findings would constitute an important supplementation of research gaps in this sphere.

3. Methodology

3.1 Participants

The research was conducted amongst the employees of one of the firms from the IT sector with its headquarters located in central Poland. The criteria of selection for the research was the prerequisite of remote work as the prevalent form of work at the moment of conducting the research. Of the employees that fulfilled the criteria of selection, consent to take part in the research was expressed by 131 people. The employees analysed received research questionnaires in a sealed envelope, which, when subsequently completed was passed on to a person designated to cooperate in the research. Ultimately, the research group enumerated 112 people (19 people failed to return the completed questionnaires): 39 women, 73 men aged between 26 and 47 (M=33,82; SD=6,95). A detailed characteristic description of the analysed group is presented in Table 1.

Table 1: Characteristics of the Study Group

		N	%
Employees	females	39	34.8
	males	73	65.2
Education	tertiary	78	69.6
	secondary	34	30.4
Workplace	IT application specialist	38	33.9
	service support specialist	16	14.3
	designer and computer systems analyst	26	23.2
	programming specialist	32	28.6
		M	**SD**
Age (years)		33.82	6.95
Average remote working time per week after the pandemic (h)		17.35	5.29

3.2 Measures

In the research a self-designed survey was availed of which takes account of the following data: sex type and the age of the person analysed, while also education, being in a relationship, number of children, as well as the position held in the firm, the number of weekly remote work hours following the pandemic, while also job seniority in the analysed firm. Likewise, the survey also encompassed a question relating to knowledge sharing as follows: *How often do you pass on your specialized knowledge to other employees (apart from situations of passing on knowledge that is the direct result of orders from a superior)?* The aforesaid question was answered by those analysed on a five-degree scale as follows: 1-never, 2-rarely, 3-sometimes, 4-often, 5-very often.

3.3 Data Analysis

Due to the fact that the assumptions of the normality of the distribution were not fulfilled, while also due to the unequal distribution of the numbers of the sub-groups compared for statistical analysis, non-parametric tests were availed of for the independent groups. For the purpose of evaluating the differences of two independent samples, the Mann–Whitney test was applied, whereas for the purpose of evaluating the differences between multiple independent groups, the Kruskal-Wallis test was availed of. The level of statistical significance was accepted as $p<0,05$. The calculations were performed by the statistical program of STATISTICA 13.3 by the Statsof company.

4. Results

The findings in terms of the comparison of readiness towards KS among the analysed women and men revealed a statistical significant difference (U=325,00; p=0,000). The average values of the declared readiness towards KS turned out to be significantly higher amongst men in comparison with women. The detailed findings of the testing are presented in Table 2.

Table 2: Comparison of Differences Between Findings for Women and Men in the Sphere of Readiness to Share Knowledge

Women				Men				
	M	Me	SD	M	Me	SD	U	p
KS	2.79	3.00	1.00	4.42	3.00	0.74	325.00	0,000

M- average, Me – median, SD – standard deviation, U – value of Mann-Whitney test.

The intragroup comparison which was also conducted revealed significant statistical differences in the sphere of the readiness towards KS between older women (≥ 35 years) and younger women (< 35 years) – the indicators of KS amongst older women turned out to be significantly higher than in the case of younger women (U=86,00; p=0,007). The statistically significant difference in the group of women also related to the following variables: being in a relationship (U=83,00; p=0,038), while also the number of children (H=18,09; p=0,001). Women who are in a relationship declared a higher level of readiness towards KS than single women. In turn, in the sphere of the varying number of children, the post-hoc tests applied revealed the difference between the group of women who have three children or more and the group of women without any children (p=0,003). The indicators for women with more children were higher than women without any children. The detailed findings of testing are presented in Table 3.

Table 3: Intra-Group Comparison of Differences of Findings for Women in the Sphere of KS By Taking Account of the Analysed Variables

		N	M	Me	SD	U	p
Age	< 35 years	24	2.42	2.50	0.65	86.00	0.007
	≥ 35 years	15	3.40	4.00	1.18		
Being in a relationship	single	10	2.20	2.00	0.79	83.00	0.038
	in a relationship	29	3.00	3.00	1.00		
			M	**Me**	**SD**	**H**	**p**
Number of children	0	18	2.33	2.00	0.68	18.09	0.001
	1	6	3.33	3.00	0.51		
	2	9	3.00	3.00	1.00		
	≥3	6	4.40	4.00	0.55		
Work position	IT application specialist	13	2.38	2.00	0.77	6.31	0.098
	service support specialist	7	2.57	2.00	1.13		
	programming specialist	7	3.57	3.00	1.13		
	designer and computer systems analyst	12	2.92	3.00	0.90		
Job seniority	≤ 5 years	23	2.83	3.00	1.03	0.23	0.889
	5-10 years	14	2.71	3.00	0.99		
	> 10 years	2	3.00	3.00	1.41		

M- average, Me – median, SD – standard deviation, U – value of Mann-Whitney test, H – Kruskal-Wallis statistical test, p – level of significance

In effect, the intragroup comparisons in a group of men with significant statistical differences (H=1,13; p = 0,047) in terms of the readiness towards KS were only revealed in the sphere of the varying job seniority. The post-hoc tests conducted revealed that men whose job seniority amounted to less than 5 years differed in the area of the readiness towards KS from the group of men who had worked between 5 and 10 years (p=0,007), while also the group of men with job seniority of over 10 years (p=0.032). The indicators of the readiness towards KS turned out to be higher than in a group of men working in the analysed firm over 5 years with relation to men with job seniority of up to 5 years. The detailed findings of testing are presented in Table 4.

Table 4: Comparison of Differences of Findings for men in the Sphere of KS by Taking Account of the Analysed Variables

		N	M	Me	SD	U	p
Age	< 35 years	43	4.42	5.00	0.76	643.00	0.986
	≥ 35 years	30	4.43	5.00	0.73		
Being in a relationship	single	26	4.46	5.00	0.65	610.00	0.995
	in a relationship	47	4.40	5.00	0.80		
			M	**Me**	**SD**	**H**	**p**
Number of children	0	26	4.46	4.00	0.65	8.87	0.061
	1	25	4.64	4.00	0.64		
	2	19	4.26	4.00	0.87		
	3	3	3.63	3.00	0.58		
Work position	IT application specialist	25	4.20	4.00	0.82	13.06	0.064
	service support specialist	9	3.89	4.00	0.781		
	programming specialist	25	4.64	5.00	0.64		
	designer and computer systems analyst	14	4.78	5.00	0.42		
Job seniority	≤ 5 years	32	2.71	5.00	0.59	1.13	0.047
	5-10 years	33	4.54	5.00	0.62		
	> 10 years	8	4.37	4.00	0.52		

M- average, Me – median, SD – standard deviation, U – value of Mann-Whitney test, H – statistics of Kruskal-Wallis test, p – level of significance.

5. Discussion

In this research, it has been proven that men as employees of the IT sector display greater levels of readiness towards KS than women as employees of the same sector. The acquired findings are in concurrence with some research projects that confirm the greater readiness towards KS among men (Abukhait, Bani-Melhem, Zeffane, 2019; Boateng, Dzandu, Agyemang, 2015; Tan, Trang, 2017). Nevertheless, the research conducted precisely within a group of Polish employees in the IT sector fills an important research gap in this field. This is of particular significance in the perspective of the widespread nature of remote work and the constant need to enhance this form of organizing work. In order to clarify the difference acquired, it is possible to refer to several arguments. Despite the fact that men are characterized by relatively greater tendencies towards competitive behaviour (Wojciszke, 2012), they can however display greater readiness towards KS in cases whereby they see clear benefits arising from such behaviour, such as, e.g. enhancement of work performance (Lin, 2006). Moreover, the specifics of the sector and the associated virtual space may be of significance for the findings acquired, in which, in the majority of cases it leads to knowledge sharing between the employees under analysis. Generally speaking, men are more connected with technologies and are more associated with them, whereas women would seem to have less experience in terms of availing of technologies (Liu, 2010). Research suggests that this dependency may also refer to the workplace (Van Slyke, Comunale, Belanger, 2002). In his research, Taylor (2004) claimed that the male employees analysed declared to have a higher level of availing of emails, data mining, knowledge repository, while also yellow page components of the knowledge management system by comparison with women. The results in this field are however unequivocal (Gefen, Straub, 1997). Furthermore, what is important is the fact that Panteli, Stack and Ramsay (1999) indicate that women are insufficiently represented in all the areas of the IT sector and refer to research in which they confirm that the IT environment is dominated by men. Albeit the participation of women in the IT sector is systematically growing, it is still a sector that for the most part employs men. According to data from Eurostat in Poland in 2020, women constituted 15% of all IT specialists, while in turn, in terms of the EU as a whole, this figure is 18.5% (Piekarska, 2022). The percentage indicators of the participation of women and men in the herein research confirm the afore-mentioned trend (34.8% women and 65.2% men). This signifies the fact that women participating in the

research described constituted a minority group, while this awareness may translate to employee relations and behaviour associated with cooperation, including the readiness towards KS. As emphasized by Ojha (2005), the team members who acknowledge themselves to be the minority with regard to their sex type, marital status or level of education are less willing to share knowledge with the remaining members of the team.

Additionally, the comparisons conducted revealed that in the group of the analysed women who were older (≥35 years), or were in relationships, while also having three or more children declared greater readiness towards KS with relation to younger women (<35 years), single women and those not having children. This would seem to be a justified description of the dependencies in the mutual ties. The conclusion indicating that older women as employees of the IT sector are more willing to share knowledge than younger female colleagues is confirmed by certain empirical evidence (Burmeister, Fasbender, Deller, 2018; Dunham, Burt, 2011). Younger people may probably be more reluctant to share knowledge due to the fact that there is a lack of sufficient motivation or abilities in this sphere. In the case of women, experiences of life may have an impact on the increase in soft competences associated with cooperation and mutual activities. Importantly, these competences may also rise with regard to motherhood and taking care of offspring. A significant factor that is stimulated by the experience of motherhood and which has a relation with KS is that of empathy. Empathy is a precursor of trust and a factor that is favourable towards the exchange of knowledge (Gurgul, Enkel; 2004). Research conducted by means of the method of illustrating the brain structures made it visible that mothers have a stronger reaction of empathy than women who are not mothers, while the researchers came to the conclusion that motherhood may have an impact on the general affective social perception (Plank et al., 2021). Furthermore, thanks to the relations with a child, a woman develops the feeling of responsibility and competences (Włodarczyk, 2012), which in turn, may translate to the motivation and readiness to adopt KS. In the herein research, the statistically significant difference was only illustrated among women who had three or more children as opposed to women who had no children, probably due to the fact that the experience of motherhood in terms of raising greater numbers of children multiplied the afore-mentioned features in women to such a point that it stimulates the readiness towards KS more than in the case of women who have only one child or two children, or none at all. These dependencies may have a relation with the difference in the sphere of KS between single women and women in relationships (in the herein research, out of 10 single women 9 had no offspring). Moreover, as illustrated by the researchers, single women are more focused on their careers, professional achievements and the pursuit of independence (Jones, Zhang, Chia, 2012; Suk Ha et al., 2018). By way of consequence, they may also be more geared towards rivalry in the workplace, while simultaneously less prone to behaviour associated with KS.

As a result of the intragroup comparisons in the group of men analysed, the statistically significant difference was only revealed in the sphere of job seniority, which signifies that the men under analysis who had worked longer than 5 years declared a greater tendency towards KS than men working in the analysed firm less than 5 years. It is possible that longer work experience is favourable towards the feeling of certainty and stability in terms of employment, which may limit the impact of the tendency of rivalry and simultaneously be favourable in terms of the readiness towards KS. The relationship between KS and job security has been confirmed by some research projects (Bartol et al., 2009; Doulani, Mohammadi, Bradar, 2020; Mehrizi, 2016), while it may be explained by, among other things, referring to the theories of the hierarchy of needs of Maslow, according to which the fulfilment of needs of the lower level (security) facilitates the fulfilment of needs of the higher level (KS) (Maslow, 2013). Furthermore, together with job seniority, professional competences grow, including those that relate to interactions and cooperation in a team, while also knowledge exchange, which is of significance particularly when knowledge exchange occurs in remote conditions. As concluded by Oye et al. (2011), work experience has a strong impact on knowledge sharing in the workplace. Importantly, in the group of men under analysis no difference was revealed in terms of KS in the sphere of age. Thus, this variable may not have such power to determine as the varying job seniority, while moreover it is not identified with it, which in turn signifies that in the analysed group there were men over the age of 35 who had worked in the analysed firm shorter than 5 years. It is also worth emphasizing that in the herein research the difference in terms of the job seniority only related to one man. Perhaps the job seniority of the analysed women who constitute a relatively smaller group in the IT sector does not have the same impact as men in terms of their feeling of job security. Furthermore, no differences were observed among the analysed men in the sphere of KS with regard to the following: the number of children, being in a relationship and job position. It is possible that the variables associated with parenthood and the creation of partnership relations are of greater significance in the case of women. In turn, in the case of the variable of the job position, differences were not noted in any of the groups analysed. This suggests that this factor is of no significance in the context of KS in the group of employees of the IT sector working remotely. A generalization of this conclusion would however require further detailed research.

6. Conclusions

The aim of the herein research was to provide an answer to the following research question put forward in this paper: Does a difference exist in terms of the readiness to share knowledge between men and women as employees of the IT sector working remotely? The research findings acquired from a group of employees of the IT sector working remotely indicates the existence of differences between women and men in the sphere of KS. The analysed men declare greater readiness towards KS than the analysed women. Furthermore. greater readiness in the sphere of KS was declared by older women (≥ 35), those in relationships and those having three or more children, while also men who had worked in the analysed firm for over 5 years. These conclusions are of significant importance in the context of the organization of work, particularly in conditions of remote working. In spite of the fact that this form of work in the IT sector was a practice that was frequently encountered prior to COVID-19, its specifics and the current requirements of the labour market force, while also constant enhancements of the solutions applied to streamline work and increase organizational performance.

The conclusions from the research imply significant practical recommendations for the managers of the IT sector:

- It is important for them to be aware of the significance of the demographic and individual variables associated with work for the course of the process of KS.
- The evaluation of the adjustment of employees (by taking account of the demographic features and variables associated with work), while also the evaluation of the appropriate use of their potential for the effectiveness of the course of KS should be conducted at the stage of recruitment.
- In the context of the readiness towards KS, particular attention should be paid to the motivation of women in this sphere, considering the afore-mentioned fact that they usually constitute a relatively smaller representative group in the environment of IT employees.

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Managing Knowledge Acquired from Smart Meters in a Distributed Advanced Metering Infrastructure

Robert Kuceba
Czestochowa University of Technology, Poland

robert.kuceba@pcz.pl

Abstract: The primary purpose of this article is to present the functional information and knowledge - acquired from smart electricity meter readings, which are a component of the Advanced Metering Infrastructure (AMI). The relations between the management of knowledge acquired from the AMI system and the new empirically identifieddecision-making processes that make the management of electricity value more efficient, both on the side of the supplier but also, which need to be emphasised, on the side of the consumer/household, often the energy prosumer (micro RES production), are indicated in it. In the first part of the article - the theoretical and cognitive part - justification has been given for the subject matter specified in the title of the paper. Attention was drawn to the dynamic digitization and automation of energy metering readings. The size of the AMI market in terms of the growth in the number of smart meters in households, as well as the size of the market, has been quantitatively described. In the context of the dynamic growth of smart electricity meters, the growth of heterogeneous knowledge on households resulting from high-frequency readings was justified, which in fact reflect not only variable energy demand but also the culture of energy demand and use. In the paper its author has structured the insights gained from the AMI infrastructure. In turn, the second - empirical - part attempts to answer two research questions: 1) What information/knowledge in addition to real-time bi-directional energy readings necessary for energy value management can be generated through the use of high-frequency clocking smart meters?; 2) How to use the acquired knowledge, manage the knowledge, acquired from the readings of the distributed AMI (smart electricity meters) infrastructure, in terms of key decision-making processes that make energy value management more effective, both on the supplier side but also on the consumer/household side, frequently the energy prosumer - micro RES production. In order to answer the above two research questions, a questionnaire survey was conducted and a brainstorming, scientific discourse with inference was carried out with a group of business practitioners, including managers of corporations and energy companies - improving their knowledge, and competences in the area of management and entrepreneurship in energy markets, including RES.

Keywords: Smart meters, Advanced Metering Infrastructure AMI, Knowledge management,Ddecision-making processes

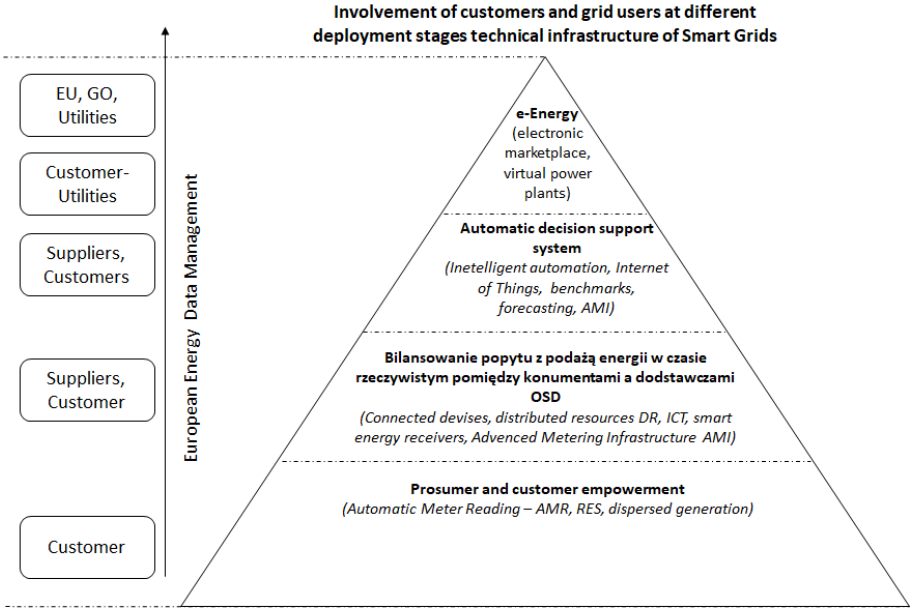
1. Introduction

The digitisation of the electricity sector is currently being dynamically implemented on the part of the final consumers of electricity also included in the household group. Directly, these activities are related to the digitisation and automation of energy metering readings, both active and reactive, in integration with the digitisation of electricity bills. This was activated through the use of high-frequency clocking smart meters - usually two-way electricity readings. This has improved communication between electricity end-users (the demand side to date) and DSOs (the supply side to date). According to Allied Market Research, the global smart meter market was valued at USD 21.13 billion in 2019. It is planned that this market could be worth USD 39.2 billion in 2027. The instruments for accelerating the growth of this market segment are financial and non-financial mechanisms, driven by government initiatives in the world's leading economies that are commonly introducing smart meters and upgrading outdated infrastructure. It is important to note that households are a priority for smart metres deployments until 2027. This is also regulated in the European Union. The EU Commission issued the document "*Benchmarking smart metering deployment in the EU-27 with a focus on electricity", jointly drafted by DG ENER and JRC, as COM(2014)356* (European Commission, 2021). The document is a report on smart meter deployments, in EU Member States, based on economic assessments of long-term costs and benefits (CBA - cost benefits analyses), of smart metering of electricity as well as gas. It was assumed that by 2020, almost 72% of European consumers will have a smart electricity meter. Of course, in reality, it can be stated by referring to the indicated scenarios for 2020, that this has been delayed. However, between 2023 and 2027, the diffusion of smart meter deployments is anticipated. In Poland, for example, 80 % of meters are expected to be replaced in 2028 and 100 % by the end of 2030.

2. Implementation of Smart Measurement Infrastructure - Economies of Scale

Smart Meters technologies implemented in Advanced Metering Infrastructure structures are analysed not only from the perspective of the end user - the consumer but also from the perspective of energy suppliers, Distribution System Operators and at the highest level in the context of: National or at the scale of European Electricity Systems (Andreadou, et al, 2016),. According to the European Technology Platform (ETP) (European Technology Platform, 2021), also hierarchically but now in the context of users, four layers can also be

distinguished. The different layers show the activities, the involvement of the different user groups of smart metering networks, taking into account the increasing value of the technical infrastructure (Figure 1).



Source: Elaborated based on European Technology Platform, 2021

Figure 1: Involvement of Consumers and Smart Grid Users in the Next Stages of Technical Infrastructure Deployment

In the first layer (Figure 1) of the end user/consumer of electricity, the infrastructure of their electricity receivers (demand side), is connected to the grid, with the functionality of automatic AMR readings. In order to strengthen the position of customers, new roles are being introduced to them in this layer, in addition to energy use/consumption, also the role of energy generation in distributed generation sources, especially in micro RES (Niedziolka, 2018). This has forced bi-directional energy flows, thus necessitating bi-directional readings in Smart Meters (Dorothy, et al, 2017). In the second layer (Figure 1), the user group includes energy suppliers, the local Distribution System Operators, in addition to consumers, frequently prosumers (Kuceba, et al., 2018) of electricity. In this layer of smart metering networks, by connecting the consumption and generation infrastructure of end users to the electricity grid infrastructure, the continuity and reliability of balancing demand with supply of electricity is ensured, obviously in real time. In this layer, DR distributed generation resources and distributed energy receivers are connected to the grid. In order to automate the management of distributed DR resources, including distributed energy receivers, in the third layer (Figure 1), Automatic Decision Support Systems are intended for consumers and energy suppliers. These systems, are responsible for controlling the technical infrastructure of Smart Meters, often on the basis of explanatory and inference models. Many times, through learning and inference capabilities, these are autocratic systems making self-learned decisions. Full automation is now also provided by the Internet of Things IoT (Abu Bakar, et al, 2019), also enabling remote control of distributed technical infrastructure Smart Grids (Rihan, 2019). The final layer of users, the fourth (Figure 1), concerns electricity suppliers, Distribution System Operators DSOs and also Transmission System Operators TSOs, at scales already macro-regional, e.g., national or EU-wide. The fourth layer is e-Energy, an electronic energy market, created primarily by virtual power plants with distributed generation infrastructure (in particular RES) and groups of distributed electricity consumers/prosumers, in cooperative networks (Kuceba, 2022). In line with the subject matter defined in the title of this article, the fundamental layer of smart metering, frequently bi-directional, is the electricity consumer/prosumer layer. From the point of view of the system approach, the management of the distributed metering structure of smart meters and, at the same time, the management of the distributed community of final consumers, the following basic modules and, at the same time, functionalities, are distinguished, which include, among others: Sumary Bills, Automated Meter Reading AMR, Demand Response, Distribution Automation, Time of Use Pricing, Advanced Metering Infrastructure, Critical Peak Pricing (Andreadou, et al, 2016). The implementation of Smart Meters in distribution networks on the low-voltage side, close to final electricity consumers, providing metering and bi-directional flow of electricity, has contributed to the diffusion of energy prosumers, who are assigned two main roles (Kuceba, et al, 2020): 1) the consumer of electricity (the demand side on the smart meter side) and 2) the producer of electricity (the

supply side on the smart meter side). Measuring and managing the bi-directional flow of electricity makes it possible to balance the non-linear daily demand for electricity with the non-linear supply of electricity generated on the prosumer side, in distributed and dispersed sources with different characteristics: daily and seasonal dispatchability (including non-linear RES). Due to the non-linear dispatchability of RES, apart from these sources of distributed and dispersed generation a fundamental part become (European Commission, 2021): Electricity Storage, Electricity Vehicles and also technologies categorised as Internet of Things IoT, including Smart Appliances and Home Automation Networks (Ahmed Qarabsh, et al, 2020). Real-time metering provides the final system energy balancing of DSOs - energy surpluses and shortfalls just on the prosumer side. The advantages of smart metering on the household side include: 1) remote reading and configuration through communication via the electricity grid or a built-in wireless communication module; 2) continuous monitoring of energy consumption and energy production at prosumer sources; 3) generation of statistics on habits and trends - the culture of electricity use by households; 4) possibility to pay bills in pre-paid or new payment models; 5) easier diagnosis of faults; 6) implemented advanced analytical algorithms (using also machine learning or deep learning), which ensure the mitigation of illegal electricity consumption; 7) optimisation of energy consumption, which translates not only into lower bills, but also has a positive impact on the environment.

When justifying the research topic in relation to the title of the present paper, it is important to emphasise that electricity meters provide high-frequency (usually clocked to take readings taken every 15 minutes) various categories of data, information and also knowledge, such as: actual meter readings of active energy taken from the DSO network (readings in kWh); actual meter readings of active energy introduced into the DSO network (readings in kWh); meter readings of active energy taken from the DSO network in peak and off-peak hours (readings in kWh), interruptions in electricity production and consumption, failures on the prosumer's side of electricity demand and supply; peaks in daily peak load and energy production on the prosumer's side. Generating a large number of readings on the prosumer side with a high clock frequency and, at the same time, taking into account the dynamic growth of smart metering in households over the last three years and the planned growth in 2023-2027, requires distribution system operators DSOs as well as commercial operators COs and commercial-technical operators CTO, to look for systemic solutions to manage big data and also to manage the acquired knowledge resources (Maurer, et al, 2011) (Shanker, et al, 2017). The foundation for the acceleration of any new solutions in this area, while at the same time taking as a prerequisite, are appropriately designed and configured knowledge bases. The aggregation of big data in knowledge bases, the definition of explanatory and inference models ensures the correct implementation of processes for the management of large amounts of data and information and, indirectly, the management of smart metering infrastructures, heterogonous electricity users, especially households, including prosumers (Fadaeenejad, et al, 2014). Thus, this paper attempts to empirically identify the decision-making processes that make knowledge management, the value of electricity, more effective, both on the supplier side but also, it should be emphasised, on the consumer/household side, often the energy prosumer (micro RES production).

3. Methodology

The identification and analysis of the activities of data and information management processes (Bylok, 2021) aggregated from smart meter levels was carried out in two research stages - 1) a questionnaire survey (focus method) conducted in a group of experts from the widely understood electricity industry; and 2) a scientific discourse panel with inference (brainstorming) conducted in a group of experts, business practitioners strictly in the areas of electricity markets, electricity trading and electricity value management. The aim of the research carried out was to answer the main two research questions, research problems, convergent with the topics identified in the article: 1) What information/knowledge, in addition to real-time bi-directional energy readings necessary for energy value management, can be generated through the use of high-frequency clocking smart meters; 2) How to use the acquired knowledge, to manage the knowledge, obtained from the readings of the distributed AMI infrastructure (smart electricity meters), regarding the key decision-making processes that make energy value management more effective, both on the supplier side but also on the consumer/household side, frequently the energy prosumer (micro RES production). In the first research part, a questionnaire survey was conducted among a group of business practitioners, including managers of corporations and energy companies - managers improving their knowledge, and competences in the area of management and entrepreneurship in energy markets, including RES (Kasaei, et al., 2017). The respondents were students of the Executive MBA-ESG programme. In total, the population in the two training groups of the surveyed energy company managers, was N=41. The lead expert was the Author of this publication at the same time - acting as an expert/lecturer leading tutorials in the areas of energy security, energy efficiency, smart grid and smart metering. In the second stage of the research, six domain experts, managers, decision-makers strictly in the area of electricity markets, and in

particular in the field of electricity trading and value management, were selected (purposive selection) from the first group of respondents. The author of this publication was also leading the panel of experts, who is an expert and practitioner in the fields of, among others, Smart Grid, Smart Metering and also virtual power plants, which meant that the population of the group of domain experts was n=7.

4. Results

The first stage of the research attempted to answer the research question: What information/knowledge, in addition to real-time bidirectional energy readings, necessary for electricity value management, can be generated through the use of high-frequency clocking smart meters? Each of the 41 respondents to the survey, using a questionnaire based on the focus method, indicated a maximum of 5 areas of information/knowledge that could be extracted from two-way electricity readings (...). The focus method adopted, limiting to 5 responses, reduced the occurrence of random responses, focusing each respondent on the relevant responses that are automatically perceived, foregrounded. This resulted in 18 relevant pieces of information/knowledge, essential for managing the sustainable value of electricity. The results obtained are summarised in Table 1. The individual information/knowledge generated from the readings from the electricity meters was assigned a percentage and a number of indications. The information and knowledge obtained from the AMI system, as the results of the research carried out, have been summarised according to the descending criterion - from the highest number of indications to the lowest. Table 1 visualises the individual categories of knowledge information identified by the survey respondents in the AMI system.

Table 1: Information and Knowledge Extracted From the AMI System (smart meters)

Information and knowledge extracted from the AMI system (smart meters)		**Number of indications**
1.	Raw metering data obtained from all metering systems of the AMI infrastructure	**92,7% (38)**
2.	Information/knowledge necessary for the generation of daily/seasonal calendar characteristics Pd=f(t), in real time: a) individual on the customer, electricity prosumer side; b) aggregated on the node, transformer, power district side	**78,0% (32)**
3.	Information/knowledge necessary for the generation of daily/seasonal integral characteristics Ed=f(t), in real time: a) individual on the consumer, prosumer side of the electricity system; b) aggregated on the node, transformer, power district side	**73,2% (30)**
4.	Information/knowledge on balancing evening peak loads by transferring loads to off-peak periods	**51,2% (21)**
5.	Information/knowledge about overloading - excessive power input from prosumer sources into the electricity grid	**29,3% (12)**
6.	Information/knowledge of actual charges as a function of daily tariffs or other prepaid payment models	**26,8% (11)**
7.	Information/knowledge about energy consumer preferences and behaviour	**21,9% (9)**
8.	Information/knowledge about the actual energy balance of the prosumer of electricity - feeding IoT applications of the control of smart energy consumers in households, for the actual on-line balancing of demand with supply on the part of the consumer group and also on the part of individual consumers/prosumers	**19,5% (8)**
9.	Information/knowledge on consumption and production at prosumer electricity sources, e.g. in 15-minute, hourly, daily, monthly modes (...)	**19,5% (8)**
7.	Real-time information/knowledge on the quality parameters of distributed electricity from prosumer RES sources, as well as information on the availability of these sources during peak and off-peak demand periods	**14,6% (6)**
10.	Information/knowledge on loads on LV networks , MV/LV (medium/low voltage) transformer stations/switches	**14,6% (6)**
11.	Information/knowledge on schedules (at intervals of e.g. 15 minutes and hours) of operation of prosumer RES sources on MV and LV networks	**12,2% (5)**
12.	Information/diagnostic knowledge about the state of electricity networks, location and causes of faults or failures, on-demand power quality control, detection of cases of illegal energy consumption	**9,8% (4)**

Information and knowledge extracted from the AMI system (smart meters) Number of indications		
13.	Information/knowledge about the utilisation rate of electrical networks, network losses, flow rates	**7,3% (3)**
14.	Information on the electrical parameters of all MV/LV transformer stations/switching points	**7,3% (3)**
15.	Information/knowledge of trading losses	**4.9% (2)**
16.	Information/knowledge on aggregate demand and supply of electricity to ensure optimal operation of SCADA systems	**4.9% (2)**
17.	Information/knowledge on distribution of MV and LV nodes	**4.9% (2)**
18.	Information/knowledge on the location of consumers and distributed prosumer sources feeding into the GIS. Full information on MV and LV networks in terms of topological data and technical parameters of infrastructure elements.	**4.9% (2)**

The results obtained provide a broader perspective on the value of electricity meter readings and, above all, in the context of aggregable knowledge and its value in sustainable electricity management. The information/knowledge extracted from aggregated smart meters can constitute, with an appropriate decomposition, a set of attributes and values that can feed heterogeneous decision-making systems, using algorithmised and also non-algorithmised methods using artificial intelligence (Deng, et al, 2015) (Tounquet, et al., 2019). The compilation of information and knowledge that can be extracted from elementary readings of bi-directional electricity flows in a distributed AMI infrastructure, according to the experts involved in the study, constitutes an aggregated tabular 'Real Consumer Behaviour Knowledge Map', which can be expanded under any heading, with the possibility of adding further information/knowledge items of course.

In the next stage of the research, in line with the assumptions made, an attempt was made to answer the second research question: How to use the acquired knowledge, manage the knowledge, obtained from the readings of the distributed AMI infrastructure (smart electricity meters), in terms of key decision-making processes that make energy value management more effective, both on the supplier side but also on the consumer/household side, frequently the energy prosumer (micro RES production). In accordance with the research methodology adopted, a panel discussion with inference (adopted as: brainstorming) was conducted at this stage, with the participation of domain experts - managers, decision-makers strictly in the area of electricity markets and, in particular, in the field of electricity trading and value management.

On the basis of the brainstorming, scientific discourse with inference, in the group of domain experts, a selection was made of key decision-making processes in which high relevance is attributed to heterogeneous information/knowledge extracted from the AMI system (smart meters). his refers to the information/knowledge summarised in Table 1, as indicated by the first group of respondents surveyed.

The domain experts, identified new decision-making processes, or significantly modified, unambiguously to be emphasised, decision-making processes that can be implemented using knowledge generated from smart meter readings in a distributed AMI structure. Furthermore, a portfolio structure of methods and tools was proposed and an attempt was made to justify its structure. These are methods and tools that can support the identified decision-making processes as well as digitise them (Deng, et al, 2015) (Tounquet, et al, 2019) using, inter alia, artificial intelligence, obviously where the source of knowledge constitute its identified areas (Table 1). Interesting from a cognitive point of view in the use of the information and knowledge identified and grouped in Table 1, was the identification by the experts participating in the study of six decision-making processes that are important in the management of energy demand and supply, especially in non-linear RES, both on the supplier side but also on the consumer/household side.

The order of the summarised decision-making processes is not random, as it was adopted according to the relevance of the knowledge information, which is determined according to the number of indications by respondents in the first stage of the research (Table 1).

The first process identified, which is accelerated by the knowledge gained from the AMI system, is:

The creation of tailored electricity supply portfolios to meet the actual needs of final consumers. This matching is linked to the scheduling and organisation of two-way transmission of electricity and information on its created value, as well as the generation of new services for heterogeneous electricity consumers. The research process

emphasises that the source of knowledge in this decision-making area is the metering data obtained from all the metering systems of the AMI infrastructure, the cumulative metering knowledge on the basis of which the calendar characteristics Pd=f(t) and the integral characteristics Ed=f(t) are generated in real time, with high reading frequencies: a) individually on the side of the consumer, the electricity prosumer; b) aggregated on the side of the node, transformer, electricity region.

The above decision-making process, based on readings in the AMI system, should be methodologically supported, according to the domain experts, by visualisation of current and cumulative (integral) characteristics in real time, analyses of energy load and supply in prosumer sources, at arbitrary time intervals, including analysis of energy production from RES on the prosumer side. Tools supporting these analyses and, indirectly, the decision-making process in the area in question were also assigned. In particular, multivariate statistical analysis systems and the generation of dynamic econometric models, e.g. classes, GARCH, were distinguished. With regard to the creation of tailored electricity supply portfolios to meet the actual needs of final consumers, the need for integration with the internal CRM system/contract registration system (contracts with customer groups) on the part of the commercial operator was identified. Due to the non-linearity of electricity production in prosumer RES sources, it is proposed to carry out appropriate analyses using Business Intelligence tools, e.g. PowerBI, as well as machine learning systems, e.g. GNU R interpreted programming language or IBM SPSS Modeler.

The second decision-making process identified by the expert team that is possible with the aggregation of information/knowledge gained from the AMI system is:

Customer relationship management with the aim of customer segmentation, acceleration of customer confidence through flexible adjustment of tariffs, new payment models to the actual preferences of electricity consumers. Indirectly, this process involves: comparing - at specific time intervals - actual loads with the daily function of tariffs, preparing price offers to encourage the use of electricity consumers during off-peak hours, personal matching of energy consumers/customers to the DSR (Demand Side Response) programme. In the context of the above decision-making process, domain experts distinguish that it can generally be improved on the basis of information/knowledge about balancing evening peak loads by shifting loads to off-peak periods, information/knowledge about the preferences and behaviour of energy consumers, as well as information/knowledge about the consumption and production of prosumer sources of electricity, high-frequency readings, e.g. in 15-minute, hourly, daily, monthly modes. Similarly to the first decision-making process, also in this scope the domain experts attribute tools to support the identified above decision-making process. In particular, they distinguish intelligent systems for matching the prosumer to electricity tariffs and other payment models, e.g. in an R or IBM SPSS Modeler (Learning Machine) environment - due to individual consumer behaviour, non-algorithmised models are proposed.

The third decision-making process identified by the expert team that is possible with the aggregation of information/knowledge obtained from the AMI system is:

Maintaining and ensuring the stability of electricity grids through the management, by the commercial operator, of the key electricity loads of heterogeneous consumers/prosumers. Indirectly, this concerns the generation of schedules (time intervals favourable to the consumer) of energy consumption based on feedback from smart electricity receivers. In this respect, the information/knowledge relates to the actual on-line energy balance of the electricity supply on the prosumer side, with the aim of balancing it by means of a consumer-AMI-integrated - consumer application - Internet of Things (IoT) to control of smart household energy receivers. In technical terms, this involves the integration of stationary/mobile smart meter applications with IoT mobile applications - control of smart energy receivers in households/on the side of heterogeneous electricity consumers (allocation by tariff groups or other payment models introduced). In terms of tools, the experts highlight the importance of implementing integrators, integration and communication hubs of smart meter applications with IoT applications.

The fourth identified area requiring improvement of existing decision-making processes, according to the experts, is:

Network condition diagnosis, fault detection and localisation, on-demand power quality monitoring, detection of illegal energy consumption, diagnosis of network disturbances, expansion of the use of network infrastructure to include distributed smart meter infrastructure, including consideration of prosumer RES penetration. Indirectly, this also includes support for on-demand monitoring of medium-voltage MV and low-voltage LV networks. In this decision-making scope, the key information/knowledge acquired from the AMI system,

concerns: information/knowledge obtained in real time about the quality parameters of distributed electricity from prosumer RES sources, as well as information/knowledge about the availability of these sources during peak and off-peak demand periods, information/knowledge about the loads of MV LV networks , MV/LV transformer stations/junctions, as well as information/diagnostic knowledge about the state of electricity networks, location and causes of faults or failures, on-demand energy quality control, detection of cases of illegal energy consumption. In this case, the analysis of metering data from smart meters in the AMI infrastructure, according to the domain experts, should be carried out using multivariate statistical analyses and dynamic econometric models, e.g. class, GARCH. In this respect, it is important to design a diagnostic model, this time based on models of deep learning libraries, machine learning and automated learning. The aim is to create and select a model that can predict the state of the network (justification of non-algorithmised methods), detect and localise faults, and control power quality. At this stage, the domain experts propose and at the same time justify the use of libraries such as KERAS, xgboost (eXtreme Gradient Boosting), randomForest (random decision forest), H2O and autoML (Automated machine learning libraries) available within the R development environment.

The fifth identified decision-making process which, in the opinion of the domain experts, can certainly be made more effective using information/knowledge gained from the AMI system is:

Real-time monitoring of commercial losses and their elimination/reduction through balancing energy demand with supply on the part of heterogeneous consumers. The relevant information/knowledge in this regard, also summarised in Table 1, includes: information/knowledge on commercial losses, information/knowledge on aggregated electricity demand and supply, ensuring, among other things, optimal operation of SCADA systems, and information/knowledge on the magnitudes of flows at medium-voltage MV and low-voltage LV network nodes. Here, the importance of a real online analysis of the relationship between electricity supply and demand is highlighted. Due to the non-linear nature of this relationship in reality, the use of a machine learning model is proposed - a model for intelligent matching of demand and energy production on the prosumer/line branch/transformer/energy district side. In this area of machine learning, the GNU R- interpreted programming language environment and also optionally the IBM SPSS Modeler system are proposed in the tool context. It was reasoned that the application of machine learning to analyse supply-demand relationships and detect abnormal behaviour can be fully implemented on the basis of historical data using libraries of automated machine learning etc. Libraries such as KERAS, xgboost (eXtreme Gradient Boosting), randomForest (random decision forest), H2O and autoML (Automated machine learning libraries) available within the R development environment can also be used at this stage.

The sixth decision-making process that can be made effective on the basis of the information/knowledge acquired from the AMI system is:

Management of the movement, switching on and off of all appliances, energy receivers, energy sources in the electricity grids covered by smart metering. In this case, the decision-making processes should be fed with all the information/knowledge that is highlighted in the previous five decision-making cases and also with information/knowledge about the location of consumers and distributed prosumer sources feeding into the GIS system (full information about MV and LV networks, in terms of topological data and technical parameters of infrastructure elements).

In this case, it was proposed to implement or expand an IT system of the GIS type, containing information on MV and LV networks in terms of topological data and technical parameters of AMI infrastructure elements, as well as information on current parameters of supply, energy consumption on the part of heterogeneous electricity consumers (breakdown by tariff groups, or other payment models).

5. Conclusion

In this paper, the cognitive focus has been on two main aspects: 1) Identification of the information and knowledge that can be extracted from the bi-directional readings of electricity (high frequency) in AMI systems, necessary to manage the value of energy both on the supplier side and, above all, on the consumer/prosumer side; 2) Identification of key decision-making processes, fed by the identified information/knowledge. Processes that make energy value management effective, both on the supplier side but also on the consumer/household side, frequently the energy prosumer (micro RES production). It was reasoned that the analytics of the large metering data sets acquired in the distributed AMI infrastructure, provide a knowledge stream for, among other things: 1) the creation of tailored electricity supply portfolios, in the context of the real needs of households; 2) the scheduling and organisation of bi-directional electricity transmission and value-created information; 3) the creation of new services for heterogeneous electricity consumers; 4) the management of electricity grid stability

on the part of the Operator; 5) real-time monitoring of commercial and technical losses and their elimination; 6) integration of smart meter applications with IoT applications - on the side of electricity consumers/prosumers - for the ongoing monitoring of electricity consumption and ongoing balancing of demand with energy produced, in households in micro RES. Referring to the future, managing knowledge aggregated in terms of knowledge and information identified in Table 1, has measurable value in the context of energy efficiency, energy security, energy conservation and also in the dimensions of sustainability and social responsibility. Future research directions will focus on defining IF-THEN learning rules that are digital representations of the six decision-making processes identified and highlighted in this paper. Learning rules relevant for machine learning.

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The KLC Cultures, Tacit Knowledge, and Trust Contribution to Organizational Intelligence Activation

Wioleta Kucharska[1] and Denise Bedford[2]
[1]Gdansk University of Technology – Gdansk TECH, Fahrenheit Universities Association, Poland
[2]Georgetown University, USA

wioleta.kucharska@pg.edu.pl
db233@georgetown.edu

Abstract: In this paper, the authors address a new approach to three organizational, functional cultures: knowledge culture, learning culture, and collaboration culture, named together the KLC cultures. Authors claim that the KLC approach in knowledge-driven organizations must be designed and nourished to leverage knowledge and intellectual capital. It is suggested that they are necessary for simultaneous implementation because no one of these functional cultures alone is as beneficial for a company as all of them are together. Moreover, there is a risk that organizations with a learning culture developed without collaboration are stuck at the individual level of learning only; and that a knowledge culture developed without a learning culture jeopardizes the organization to be stuck in a passive way where only old, multiply verified knowledge is accepted. As a result, such companies cannot grow. That extreme situation leads to the rejection of new knowledge that is usually rationalized by the need for business safety security - that is nothing more than a ruse for intellectual laziness or personal barriers of fixed-minded managers. Summing up, based on the empirical evidence (640-cases sample, composed of Polish knowledge workers; SEM method of analysis), this paper delivers empirical evidence that knowledge culture rejects mistakes acceptance component of learning culture and that the learning climate component itself is not sufficient for explicit knowledge sharing. Knowledge sharing, organizational intelligence, and innovativeness are key benefits of the synergy that offers the KLC cultures simultaneous implementation and cultivation. The results expand the former studies by Kucharska and Bedford (2020; 2023) and Kucharska (2021a-b) and expose that KLC cultures and TRUST are needed to develop tacit knowledge sharing clearly is an essential ingredient for organizational intelligence development.

Keywords: Knowledge culture, Learning culture, Collaborative culture, KLC cultures, Knowledge sharing, Tacit knowledge, Explicit knowledge, Collective intelligence, Trust

1. Introduction

Recently Kucharska and Bedford (2023) introduced the KLC cultures synergy idea that the essence is the simultaneous implementation of functional cultures of knowledge, learning, and collaboration for knowledge-driven organizations' growth. Authors claim that these cultures support and strengthen one another to develop favorable conditions for new knowledge creation and utilization that impact the organizational ability to create change (innovativeness) and to adapt collectively to externally induced changes (organizational intelligence), „ The KLC cultures are so powerful together, thanks to their tremendous contribution to tacit knowledge-sharing behaviors that are focal for human and relational capital development.

Understanding company culture's contribution to its performance is particularly critical in today's hyperdynamic knowledge economy. Culture will always dominate strategy (Bedford and Kucharska, 2020), „ However, it can play an even more significant role in the knowledge economy, where knowledge is the primary form of capital and the most critical intellectual production factor. To thrive and survive in the knowledge economy, managers must "see" their company culture's power to shape the company's course and learn to gain and sustain knowledge, learning, and collaboration cultures synergy. Nowadays, hyperdynamic business reality requires intelligent actions. When managers "see" their cultures as assets, they can shape and use them for the company's best (Kucharska and Bedford, 2023), „

This study aims to deliver a piece of empirical evidence supporting the KLC culture's powerful impact on knowledge-driven organization ability to create knowledge (explicit and tacit) that matters for organizational intelligence and innovativeness development.

2. Conceptual Framework

KLC cultures

The focal point to clarify the KLC culture approach to knowledge-driven organizational culture introduced by (Kucharska and Bedford, 2023) is the clarification of the key characteristics of each of them as well as the exposition of their relations.

A culture of knowledge dominates in knowledge-oriented organizations that focus more on static knowledge exploitation (Kucharska and Bedford, 2023; Van Wijk et al., 2012), whereas learning culture dominates in organizations that focus more on dynamic, constantly breaking 'the status qu.' Furthermore, knowledge culture is a base for learning culture. To expose the difference between these cultures the easiest way is to compare the effects of such a different organizational focus. It is easy to predict that if any organization is stuck in the knowledge-orientation stage, then it exists in a reality where static exploitation of knowledge and control dominates, and the new knowledge is rejected. In such organizations, old, proven methods of cultivating acting are more appreciated than new solutions seeking, and any risk is rejected; consequently, mistakes tied to this risk are avoided. Organizations based chiefly on proven knowledge often prefer to "keep things as they are" - and that "safe, well-known routines control-oriented" organizational attitude might block these organizations' development.

In contrast, a learning culture leads to constant, dynamic knowledge acquisition provoked by "intelligence in action" (Erickson and Rothberg, 2012), „ A pervasive and persistent learning culture is essential to the development and growth of learning organizations in the current economic climate of continuous change (Maes and Van Hootegem, 2019; Rass et al., 2023), „ An organizational learning culture can facilitate the creation and sharing of and discourage the hoarding or hiding of tacit knowledge (Kucharska and Rebelo, 2022a-b; Weinzimmer and Esken, 2017), „ By itself, a knowledge culture does not have this effect, though it is a basis for fostering curiosity and exposing knowledge gaps that lead to learning. This finding is consistent with the research of Webster and Pearce (2008), who highlighted the importance of situational learning, which is essential to active learning. Situational learning is aligned with the current context. It is especially relevant today in a dynamic and rapidly changing business environment. Acting in such a dynamic business environment might naturally cause many mistakes. Moreover, the lack of mistakes acceptance component of a learning culture can block learning from them at the organizational level. Therefore, a learning culture without developed mistakes' acceptance component is an illusion of learning culture (Kucharska and Bedford, 2020), „ Based on the all above, the hypotheses are given below:

H1a: Knowledge culture positively influences the learning climate component of learning culture.

H1b: Knowledge culture negatively influences the mistakes acceptance component of learning culture.

A culture of learning is an organization's ability to create, acquire, and exchange knowledge, modify its behaviors and choices, and integrate that new knowledge and insights into its organizational knowledge (Garvin, 1993), „ Moreover, Kucharska and Bedford (2020) empirically proved that this organizational ability depends on two dimensions: learning climate and mistakes acceptance and that the climate component influences the mistakes acceptance component. Therefore, the hypothesis is added as below:

H1c: Learning climate component of learning culture positively influences the mistakes acceptance component

Moreover, if an organization is seen as a group of people coordinated to achieve the aim non of them can achieve alone – then collaborative culture is an essence of any organization's existence (Kucharska and Bedford, 2023), „ Learning requires collaboration. Collaboration supports learning that is a source of new knowledge (Kucharska and Bedford, 2020; Nugroho, 2018), „ Collaboration is then the core competency that enables knowledge organizations to create relational knowledge capital. Based on this, the hypothesis is given below:

H1d: Collaborative culture influences the learning climate component of learning culture positively

H1e: Collaborative culture positively influences the mistakes acceptance component of learning culture

Based on the Kucharska (2017) study, it is empirically proved that knowledge culture and collaborative culture are correlated and that both foster knowledge sharing, especially tacit. Therefore the hypothesis is added:

H1f: Knowledge culture and collaborative culture are correlated

Moreover, Alavi et al. (2005) and Yang (2007) studies indicated that knowledge sharing is motivated by collaborative culture; therefore, the additional hypothesis is formulated as below:

H2: Collaborative culture influence positively the explicit knowledge sharing

Knowledge sharing

Knowledge is recognized today as the most critical company resource that can provide organizations with a sustainable competitive advantage (Barney, 1991), „ Therefore, it's sharing among workmates is equally critical for this competitive advantage creation and implementation. The culture of learning supports knowledge dissemination (tacit and explicit) across the company (Lucas, 2006; Schmitz et al. 2014; Kucharska and Bedford, 2023), „ Therefore, the hypotheses are formulated below:

H3a Mistakes acceptance component of learning culture influences positively explicit knowledge sharing

H3b: Mistakes acceptance component of learning culture positively influences tacit knowledge sharing.

H3c: Learning climate component of learning culture positively influences tacit knowledge sharing.

H3d: Learning climate component of learning culture positively influences explicit knowledge sharing.

Moreover, following Islam et al.'s (2015) statement that knowledge culture supports the flow of knowledge throughout the organization and relying on Kucharska's (2021a) empirical evidence, it is assumed that knowledge culture might motivate knowledge workers to share their newly discovered thoughts and ideas. Thus, the following hypothesis is formulated:

H4: Knowledge culture influences tacit knowledge sharing positively.

All knowledge is rooted in tacit knowledge, as Polanyi (1966) stated. Following him, the hypothesis is given below:

H5: Tacit knowledge sharing fosters explicit knowledge sharing.

Organizational development

Change is a characteristic of the current economy. In the knowledge economy, creating and adapting to change are what organizations and individuals do to exist and create value (Rass et al., 2023), „ Existing in a fast-changing environment requires making change a part of daily organizational routines. How organizations deal with the adaptability need and respond to surrounding change determines their survival and development. For improving innovation and business performance, developing a robust knowledge management (KM) strategy is a pivotal step for many firms today (Lai et al., 2022), „ In line with this, the hypothesis is developed below:

H6 Explicit knowledge sharing fosters market innovations

Knowledge is a vital asset of the current economy because it is essential to company intelligence development (Rothberg and Erickson, 2007), „ Feuerstein et al. (1979) defined intelligence as the ability to adapt to change. Following him, the organizational capacity to adapt to change is seen as its intelligence. Tacit knowledge sharing among workmates fosters adaptability to change (Kucharska and Rebelo, 2022); therefore, hypotheses have been given below:

H7: Explicit knowledge sharing fosters organizational intelligence (change adaptability), „

H8: Tacit knowledge sharing fosters organizational intelligence (change adaptability), „

Organizational adaptability reflects how an organization responds to change by managing stress and uncertainty, exposing flexibility or resilience, and supporting those who tackle problems to face the change (Reupert, 2020), „ Martin et al. (2013, p. 1) defined adaptability as 'appropriate cognitive, behavioral and/or emotional adjustment in the face of uncertainty and novelty.' Change is a characteristic of today's economy that places companies in a permanent learning and development mode related to adjusting and gaining market advantage and creating value through constant innovativeness (Kucharska and Rebelo, 2022), „ Bearing in mind all above, the hypothesis is formulated as follows:

H9: Organizational intelligence (change adaptability) fosters market innovations.

Trust

TRUST impacts knowledge sharing (Kmieciak, 2021; Rutten et al., 2016), „ Trust among co-workers ensures successful collaboration and vice versa; both increase knowledge sharing, team creativity, and performance (Kucharska, 2017), „ At the same time, knowledge sharing supports trust-building among knowledge workers

(Thomas et al., 2009), „ Therefore TRUST, it is included in this study as a control variable (CV), „ CVs imputation enables including extraneous variables that are not the focal point of the thorough research but remain theoretically important (Carlson and Wu, 2012; Nielsen and Raswant, 2018), „ Based on the former studies of Kucharska (2017), Kucharska et al. (2017), and Kucharska and Kowalczyk (2016), TRUST is a critical facilitator needed for tacit knowledge sharing. It is why the hypothesis is added below:

H_{cv}: Trust positively impacts tacit knowledge sharing.

Figure 1 below, based on the all above, summarizes the conceptual framework of the planned empirical research visually.

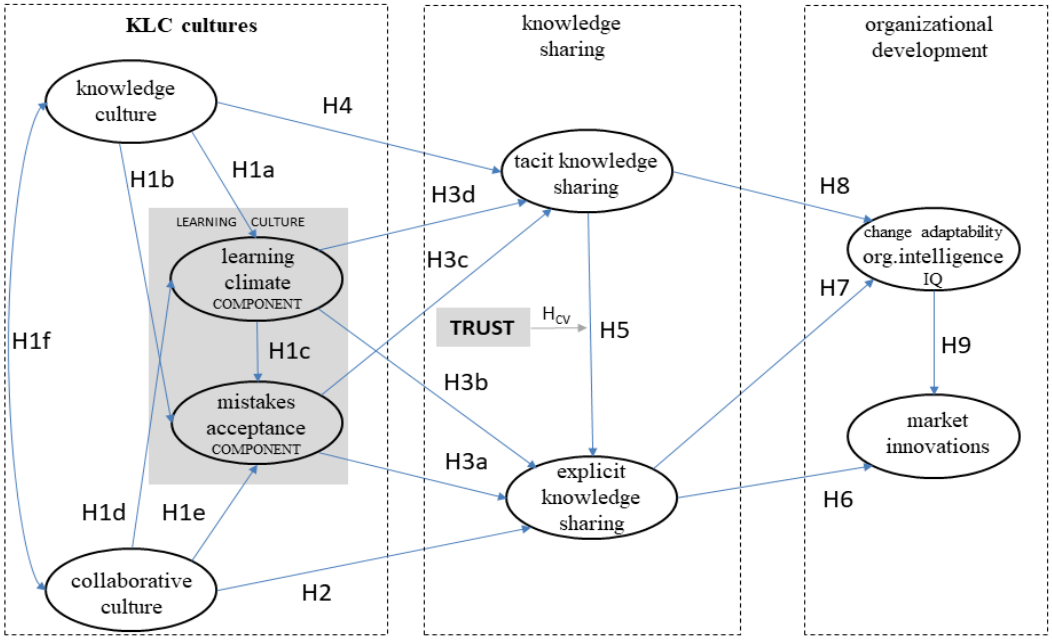


Figure 1: Conceptual Framework

3. Methodology

Sampling procedure: this study was targeted at Polish knowledge workers; therefore, qualified respondents declared that their work's first input and output is knowledge. Moreover, to secure the respondents' familiarity with their organizations' issues, we qualified only those who worked a minimum of one year for their current employer. Data were collected in March 2023 by applying the CAWI method by Biostat® Poland. Sample characteristics: sample is composed of 640 Polish knowledge workers: 306 specialists and 334 managers; 329 women and 311 men representing mostly private (77%) companies from different sectors to illustrate the general view on Poland (dominating sectors: production and knowledge services 19% each), „ Measures: respondents referred to the majority of questions using a 7-point Likert scale. Appendix 1 presents measured constructs scales and their sources. Obtained reliabilities are given in Table 1. Additionally, Appendix 2 presents the Cross-Loadings Matrix. It is because two of the nine used scales (the organizational Trust and the organizational IQ) were invented and validated by authors. The Cross-Loadings Matrix exposes that the used scales do not overlap. Control variable (CV): Trust was input into the model as CV; to do so, the composite variable was created based on the scale measures.

Method of analysis: structural equation modeling (SEM) with the use of SPSS Amos 26 software (Byrne, 2016), „

Sample quality: Kaiser–Meyer–Olkin (KMO) test: .957, the total variance extracted: 75% and Harman one factor test: 44% justify the good quality of the sample.

Table 1: Basic Statistics, Obtained AVE Root Square, and Correlations Between Constructs

	Mean	SD	AVE	CR	Cronbach alpha	T	CC	KC	LCc	LcM	TKS	EKS	IQ	InnE
T	3.59	2.01	.57	.79	.80	**.753**								
CC	3.68	2.09	.56	.86	.83	.677	**.752**							
KC	4.23	2.52	.71	.88	.88	.499	.657	**.845**						
LCc	3.74	2.15	.57	.79	.83	.586	.846	.693	**.753**					
LcM	3.12	1.7	.80	.94	.94	.437	.651	.398	.608	**.894**				
TKS	3.61	.07	.66	.85	.87	.637	.69	.606	.718	.543	**.813**			
EKS	3.56	1.98	.55	.79	.78	.668	.902	.642	.719	.692	.719	**.742**		
IQ	3.64	1.98	.59	.85	.85	.592	.75	.567	.708	.58	.786	.742	**.765**	
InnE	3.59	1.96	.54	.78	.77	.557	.738	.535	.678	.567	.697	.722	.758	**.732**

Note: n=640 KC-knowledge culture, LCc-learning culture climate component, LCm-Learning culture mistakes acceptance component, CC-collaborative culture, TKS-tacit knowledge sharing, EKS-explicit knowledge sharing, T-trust, IQ- organizational change adaptability, InnE – market (external) innovations

After the positive assessment of the sample and scales reliability, the structural confirmatory factor analysis (CFA) model was developed to ensure that the scales performed appropriately. The evaluation of the model quality was initially conducted based on constructs measurements consistency tests such as the average of variance extracted (AVE), composite reliability (CR), and Cronbach's alpha. AVE exceeded 0.54 for all constructs, which was acceptable (Hair et al., 2017), „ Cronbach's alpha test was used to confirm the consistency of the construct measurement model. The alpha coefficient was greater than 0.77 for all constructs, which was adequate (Hair et al. 2017, pp. 112), „ The CR was greater than 0.78 for all loadings, which was more than the required minimum of 0.7 (Hair et al., 2017), „ The square root of each construct's AVE exceeded the correlations between any pair of distinct constructs except CC-LCc and CC-EKS (bolded in Table 1), „ It means that there is a strong interdependency between collaborative culture, learning climate, and knowledge sharing in Poland. On the one hand, this interdependency may cause little bias; on the other hand, it exposes how focal is collaborative culture for knowledge spreading in Poland.

4. Results Presentation and Discussion

Obtained results exposed (Table 2; Model A and B comparison) that TRUST is next to KLC cultures synergy, a focal company facilitator of knowledge-sharing processes in the knowledge-driven organization. The entire model quality was strengthened thanks to the trust (CV) imputation.

Moreover, results show that knowledge culture supports the learning climate component of a learning culture (H1a), but it is negatively related to the mistakes acceptance component (H1b), and the climate component supports the mistakes acceptance component (H1c) – as was indeed assumed by the KLC cultures approach by (Kucharska and Bedford, 2023), „ On the contrary, collaborative cultures support both components of learning cultures (H1e, H1f), „ That next supports knowledge sharing except for the fact that the hat learning climate itself (H3b) is not sufficient for explicit knowledge sharing. It might be that it is mediated by tacit knowledge sharing or by mistakes acceptance component of the learning culture. These assumptions require further profound verification. Nevertheless, it altogether exposes why knowledge culture itself is not enough for knowledge-driven company development. Knowledge, learning, and collaborative culture (KLC cultures) support one another and together deliver to the organization the expected benefit of smooth knowledge sharing (H2; H3a,c,d; H4; H5), „ Finally, knowledge sharing fosters organizational intelligence (H7; H8) that matters of innovations (H6) creation that is a potent source of the expected competitive advantage.

Table 2 below presents hypotheses verification details supporting this view.

Table 2: Hypotheses Verification

Model A with TRUST CV			**Model B without CV**		
Hypothesis	**significance**	**verification**	**Hypothesis**	**significance**	**verification**
H1a	.24***	sustained	**H1a**	.27***	sustained

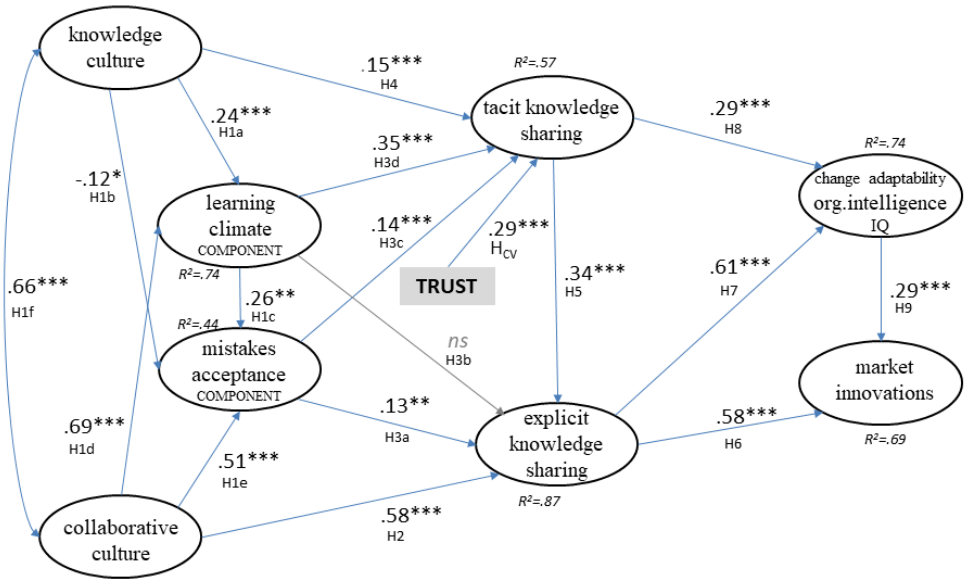
Model A with TRUST CV			Model B without CV		
Hypothesis	**significance**	**verification**	**Hypothesis**	**significance**	**verification**
H1b	-.12*	sustained	**H1b**	-.17***	sustained
H1c	.26***	sustained	**H1c**	.30***	sustained
H1d	.69***	sustained	**H1d**	.68***	sustained
H1e	.51***	sustained	**H1e**	.44***	sustained
H1f	.66***	sustained	**H1f**	.67 ***	sustained
H2	.58***	sustained	**H2**	.50***	sustained
H3a	.13**	sustained	**H3a**	.13***	sustained
H3b	.01(.899)	**rejected**	**H3b**	.12(.15)	**rejected**
H3c	.14***	sustained	**H3c**	.11*	sustained
H3d	.35***	sustained	**H3d**	.61***	sustained
H4	.15***	sustained	**H4**	.11(.68)	**rejected**
H5	.34***	sustained	**H5**	.30***	sustained
H6	.58***	sustained	**H6**	.56***	sustained
H7	.61***	sustained	**H7**	.61***	sustained
H8	.29***	sustained	**H8**	.28***	sustained
H9	.29***	sustained	**H9**	.30***	sustained
H_{CV}	.29***	sustained			

Note: MODEL A n=640, ML; χ2=1043.45(331) CFI=.941 TLI=.933 RMSEA=.059 Cmin/df=3,15; *p<.05 **p<.01 ***p<.001

MODEL B n=640, ML; χ2=1016,34(307) CFI=.939 TLI=.931 RMSEA=.060 Cmin/df=3,31; *p<.05 **p<.01 ***p<.001

ns-not significant result

Table 2 compares the obtained results for two models: Model A, run with TRUST as CV, and Model B, run without it (Aguinis and Vandenberg, 2014; Becker et al., 2016), „ The model with TRUST fits better with the data. So, it supports the theoretical justification given to input TRUST as a CV to the study. Therefore, all the subsequent analyses and visualizations (Figure 2) are presented for the model with TRUST.



Note: n=640, ML; χ2=1043.45(331) CFI=.941 TLI=.933 RMSEA=.059 Cmin/df=3,15; p<.05 **p<.01 ***p<.001

ns-not significant result

Figure 2: Results

The presented results expand the former studies by Kucharska and Bedford (2020; 2023) and Kucharska (2021a-b) and expose that KLC cultures and TRUST are needed to develop tacit knowledge sharing, which clearly is an essential ingredient for organizational intelligence development.

5. Limitations and Implications

The key limitation of this research is that it bases on data collected in only one country. The second important limitation is the identified strong interdependency between collaborative culture, learning climate, and knowledge sharing in Poland. This interdependency may cause little bias, but at the same time might be it exposes how focal collaborative culture is for knowledge spreading in Poland – to be sure how to interpret it, further studies are needed. Moreover, the presented results expose only direct relations. No mediated or moderated effects are included. So, further studies can explore these relations more in-depth.

6. Practical Implications

Practical implications are direct, KLC cultures facilitated by TRUST drive organizational intelligence. Therefore, KLC cultures are worth to be implemented simultaneously. Moreover, there is a risk that organizations with a learning culture developed without collaboration are stuck at the individual level of learning only; and that a knowledge culture developed without a learning culture jeopardizes the organization to be stuck in a passive way where only old, multiply verified knowledge is accepted. As a result, such companies cannot develop. That extreme situation leads to the rejection of new knowledge that is usually rationalized by the need for business safety security - that is nothing more than a ruse for intellectual laziness or personal barriers of fixed-minded managers. Similarly, knowledge culture itself rejects the mistakes acceptance component of learning culture that makes entire learning problematic. Can we learn without mistakes? Obviously, we cannot. So, knowledge culture itself – without learning and collaboration also jeopardizes organizational development. There is no development without learning. Moreover, the learning climate component of learning culture is not sufficient for explicit knowledge sharing, and collaboration is needed to make learning and sharing happen. So, knowledge sharing, organizational intelligence, and innovativeness are key benefits of the synergy that offers the KLC culture simultaneous implementation and cultivation. TRUST strengthens this effect.

Summing up the practical perspective of the obtained results: those managers who care about developing knowledge-driven organizations in the hyperdynamic conditions as observed today need to build a collective intelligence to do so, they must implement KLC cultures and build TRUST.

7. Conclusion

Knowledge sharing, organizational intelligence, and innovativeness are key benefits of the synergy that offers the KLC cultures simultaneous implementation and management. TRUST strengthens this effect. So, those managers who care about developing knowledge-driven organizations in the hyperdynamic conditions observed today need to build collective intelligence; to do this efficiently, they should implement KLC cultures and build TRUST. The presented results expose that KLC cultures and TRUST are needed to develop tacit knowledge sharing, which clearly is an essential ingredient for organizational intelligence development. Collective intelligence, understood as a network of knowledge workers brilliant minds' that collaborate smoothly, is a severe organizational potency that needs to be activated. KLC cultures' synergy facilitates it significantly.

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Appendix 1: Scales and Their Sources

Knowledge culture (Kucharska and Bedford, 2020)	All employees perceive knowledge as valuable resource. We have a common language to support knowledge exchange. We are encouraged to share knowledge, ideas, and thoughts. We care about the quality of knowledge that we share.
Learning culture (Kucharska and Bedford, 2020)	Learning climate component All staff demonstrates a high learning disposition. We are encouraged to engage in personal development. We are encouraged to implement new ideas every day. We are encouraged to engage in seeking new solutions. Mistakes acceptance component People know that mistakes are a learning consequence and tolerate it up to a certain limit. Most people freely declare mistakes. We discuss problems openly without blaming others. Mistakes are tolerated and treated as learning opportunities.
Collaborative culture (Kucharska and Bedford, 2020)	My company supports cooperation between workers. Cooperation among the different duties, teams, and departments was encouraged. Co-workers volunteer their support even without being asked. People support each other.
Tacit knowledge sharing (Kucharska and Erickson, 2023)	I share knowledge learned from my own experience. I have the opportunity to learn from the experiences of others. Colleagues share new ideas with me. Colleagues include me in discussions about the best practices.
Explicit knowledge sharing (authors' own scale)	There is a formal policy encouraging knowledge sharing at my place of work.

	Knowledge is shared among people in my team and division. Other teams and divisions share knowledge with us. We share our knowledge with other teams and divisions.
TRUST (authors' own scale)	I trust people at work. People in my team trust one another. People in my division trust one another. People in my entire organization trust one another.
Change adaptability (org. intelligence - IQ) (Kucharska and Bedford, 2020)	We are flexible to changes. We can adjust ourselves to changes. We adapt to changes easily. We used changes.
External, market innovations (Kucharska and Erickson, 2023)	We provide competitively superior innovations to our clients. Our innovations are perceived positively by our clients. We are better than our competitors at introducing innovations. I am proud of our innovations.

Appendix 2: Cross-Loadings Matrix

	1	2	3	4	5	6	7	8	9
KC1			***.917***						
KC2			***.925***						.103
KC3			***.705***				.152		
LCc4			.135		.245		***.403***		-.143
LCc3					-.150	.277	***.548***		.119
LCc2							***.820***		
LCc1					.174		***.694***		
LCm3	**.831**								
LCm4	**.895**								
LCm2	**.947**								
LCm1	**.903**								
C2				.128	.292	***.537***	-.127	-.113	-.140
C3					-.244	***.897***			.124
C1						***.686***			
C4						***.487***		.115	
EKS1				.172	.143	.121		***.451***	-.152
EKS2						.180		***.435***	
EKS3								***.898***	
TKS3				***.667***	.315				
TKS2				***.864***					.111
TKS1				***.931***	-.124				
TKS3			-.111	***.639***		-.122		.135	
IQ1					***.899***	-.241		-.132	.213

IQ2					***.597***	.115			.495
IQ3				.106	***.632***				.303
IQ4					***.673***				.235
InnE1	.118			-.156	.172	***.566***			
InnE2					.213	***.418***	.104		.184
InnE3					.173	***.444***	.121	.122	
T1		***.899***							
T2		***.556***	.123		.155				-.102
T3		***.878***			-.148				
T4		***.785***				.116			

Loadings extraction method - Maximum Reliability. Rotation method - Promax with Kaiser normalization.

Collaborative Structures in WikiProjects: Wikipedia Users' Activity Case Study

Katarzyna Kukowska
Czestochowa University of Technology, Poland

katarzyna.kukowska@pcz.pl

Abstract: The research presented in the article concerns the development of organizational and cooperation structures from interpersonal interactions in virtual communities sharing knowledge. It is assumed that the activity of communities functioning on the Internet reflects the organization of human communities in the offline space. The main aim of the research was to characterize the structures of cooperation groups that are formed around WikiProjects. The research question was: what is the structure of activity of Wikipedians in WikiProjects in chosen language versions of Wikipedia? The method used in the research is the content analysis method. The author calculated data thanks to the Wikipedia xTools. The numbers of participants involved in WikiProjects were analysed by referring to the Dunbar number concept and the cultural determinants of cooperation, thus referring to the masculinity index (MAS) according to Hofstede. Research has shown that WikiProject members show similarities to the layered community formation proposed by Dunbar. The sizes of groups of active editors are closer to these values. As the WikiProjects group grows, the ratio of declared participants to active participants decreases. The production of value in virtual communities, the ability to work together as a team in physical isolation, is becoming increasingly important. The results of the research may be significant to the knowledge management specialists and virtual communities practitioners.

Keywords: Dunbar's number, Collaboration in WikiProjects, Cultural dimensions, Knowledge management, Virtual communities

1. Introduction

Participation in the creation of a global knowledge exchange system by presenting one's intellectual skills is an attractive alternative activity for many people. Pro-social motives may create a sense of moral obligation to share knowledge for community development. By sharing knowledge with others, people fulfil their own altruistic needs while experiencing pleasure (Yu et al., 2010) and with the IT infrastructure in place, people are willing to share knowledge with others (Ruppel and Harrington, 2001). This is evidenced by the uninterrupted development of the global encyclopaedic project, namely, Wikipedia, for over 20 years. The spontaneous behaviour of individuals in editing activities leads to the formation of collaborative structures. Their form is difficult to predict. The foundations of the Wikimedia Movement, which unites Wikipedians, are freedom of expression, freedom to learn, social activities, and activities related to Wikimedia projects (‘Ruch Wikimedia’, 2021). In the view of the author, the phenomenon of Wikipedia is an interesting subject of research due to the spontaneously emerging structure of cooperation in the spirit of volunteering. Despite the lack of governance structures, the system works. On the one hand, the structure of the project is becoming increasingly hierarchical, but hierarchy is intertwined with horizontal structures (Arazy et al., 2018). It is indicated that its effectiveness in terms of durability and productivity is due to the fact of a kind of independence of the project's activists. The freedom to join and leave, with the effect of a high turnover of members, as has been written about by, among others (Chen et al., 2010) has not shaken the permanence of this structure.

WikiProjects are groups of Wikipedians working in teams to improve Wikipedia. WikiProjects may be dedicated by topic and coordinate a specific type of task (‘WikiProject’). The subject of the research undertaken by the author remains the collaborative structures of WikiProjects, with relation to the number of participants and their correspondence to Dunbar's number, as well as the cultural dimension of collaboration with relation to the Masculinity Index (MAS) according to Hofstede. The conclusions presented in this article are the result of an in-depth research process on WikiProjects that was commenced in 2022. The first stage of the research showed that according to the acquired data, WikiProjects show similarities to the layered community formation proposed by Dunbar (Kukowska, 2022). The second stage of the research involved updating the data and including a new indicator: the number of WikiProject members active in the last three months was extracted. Determining the number of active members with relation to the declared participation more accurately reflects the true picture of community structures and the level of cooperation in general terms.

2. Literature Review

The structural complexity of social systems determines the efficiency of the functioning of groups and individuals in social life. The structuring of groups, their stability and the dynamics of change within them have

certain social consequences. Regardless of the context of the groups' activities, micro-level processes merge into macro-level structures. The forces of attraction and disintegration, the cohesion of groups that consolidate cooperation, while also the formation of boundaries all remain the subject of research by representatives of various sciences (Dunbar and Sosis, 2018; Stadtfeld et al., 2020).

Dunbar in his research demonstrates that the layers that define the closeness of relationships in traditional hunter-gatherer communities of primitive tribes is also reflected in contemporary structures of interaction (Dunbar, 2010; Dunbar, 2014). Moreover, it matters little whether they are set in real or virtual space. Their foundation remains the networks of interaction that bind the links together. Social populations are characterised by a high degree of sustainability, although the size of these populations is of course variable. Every day we spend about 2 hours on social interactions. In addition, we spend nearly 50 minutes on interacting with the 5 closest people. These are usually the people we live with. Another layer is the 15 people with whom we are in direct or mediated contact through digital media and telephony. Those who do not belong to layer 5, receive approx. 20% of our attention. A further 35 people in layer 50 receive an average of 0.4% of our time each day. Nowadays, this can be applied to colleagues who are not part of our support group. For layer 150, one person receives enough attention to fill one actual appointment per year (Gamble et al., 2014). Ties in the subsequent layers vary in terms of their strength and quality (Dunbar, 2012; Skolik and Kukowska, 2022). The growth, or loss of members of a layer over time can lead to its disintegration. The numbers defining layers 50, 150 and 500 are the optimum points around which the population sizes oscillate. The greater the deviation, the greater the risk of disintegration of the community in question. Natural dividing points differentiate organisations in terms of their size, while representing optimal values of cohesion and relative stability over time (Dunbar and Sosis, 2018).

The social nature of human beings triggers the desire to create networks of relationships with qualitatively diverse ties. It seems that the size of the communities in which we operate may condition the tendency to seek mutual similarities. Simply belonging to a social collective can be an important tool for creating bonds. Sharing common traits, e.g., cultural identity, may be enough to induce a sense of closeness with a stranger. In the persistence of the different layers of the collective, homophily plays an important function, which Launay and Dunbar present from the perspective of innate tendencies towards social behaviour and group categorisation. Evolutionarily speaking, we may show a drive towards intimacy with certain communities or groups with which we identify with common labels, such as interests. The exclusivity of the group in question plays an important role in this regard (Launay and Dunbar, 2015).

Dunbar numbers referred to in algebraic analyses of group sizes by Kurokawa (Kurokawa, 2022). Kurokawa and Ihara prove that the evolution of cooperation becomes more likely as the size of groups increases, as long as the goods they produce are public goods. When goods are common goods, the evolution of cooperation is less likely as group size increases (Kurokawa and Ihara, 2017; Kurokawa, 2021). The characteristics of Wikipedia's functioning are part of the afore-mentioned conditions. Furthermore, large-scale collaboration may be explained by the direct reciprocity, which is found in WikiProjects.

The research addressed in the WikiProjects collaboration was conducted, among others, by Forte et al. (2012) based on the English version of Wikipedia. The authors demonstrated the validity of WikiProjects as groups to coordinate work in different forms of support. In addition to their commitment to creating and improving the thematic content posted, WikiProject members also support each other by, for example, providing places to find contributors. Solomon and Wash conducted an analysis of WikiProjects in the context of their development by referring to the concept of critical mass. They proved, among other things, that the collective contribution of small actions in the early stages of establishing a WikiProject is more valuable to its sustainability than the participation of advanced editors. In addition, building a large membership early on has a greater impact on future community activity than accumulating many contributions (Solomon and Wash, 2014).

Qin et al. measured the effectiveness of WikiProjects by the amount of work done by its members. This used comments on WikiProject discussion pages to identify communication networks. Using the social network theory, the authors examined the structural properties of these networks and concluded that the moderate level of connectivity and internal consistency of the communication network could positively influence the efficiency of the project. The same is true for the longer membership period at WikiProjects on average (Qin et al., 2015).

Online communities are subject to the same rules and norms as in the offline world. Thus, the analysis of these social structures provides valuable characterisations of the determinants of organisation in both spaces (Lu et

al., 2014; Vesa et al., 2017; Dunbar, 2021). Studies of virtual communities have shown that the increased turnover of participants may increase interest in these groups. Communities with a high turnover seem to be potentially more attractive and people are more likely to join them. Changes in the composition of members make interactions more dynamic, thus creating the impression of activity and commitment. This recovery catalyses the level of group participation (Dabbish et al., 2012). At the same time, it has been suggested that such communities may be more sustainable than communities with a relatively fixed membership (Farzan et al., 2011).

The issue of group cohesion in the dynamically changing membership of the Wikipedia community was addressed by Benkler. Horizontal structures are characteristic of Wikipedia's structure, but users are partly constrained by the rules adopted by the community. User contributions are controlled by those with greater authority. They are awarded to committed individuals who enjoy the trust of the community. The existence of procedures and inequalities of power allows for greater efficiency, thus maintaining quality and also maintaining consistency. This gives the site a better chance of survival (Benkler, 2006).

Knowledge sharing is influenced by psychological and organisational culture factors Yu et al. (2010). The motivation to work for the public good may therefore be fuelled or extinguished depending on the values embedded in a given culture. Research citing Hofstede's analysis of cultural dimensions in the context of cooperation and collaboration in Wikipedia was undertaken, among others, by Konieczny (2009). The author describes Wikipedia's decision-making processes by identifying the determinants of their control and relating them to the development of power in Wikipedia. Wikipedia's organisational culture is aligned with power distance, avoidance of uncertainty, while also individualism and collectivism. Hara et al. (2010) argued that the cultural dimensions according to Hofstede allow for the interpretation of differences between eastern and western Wikipedia. The polite behaviour of Eastern Wikipedians was explained by a greater respect for the hierarchical structure of society and a preference for teamwork. Western Wikipedia editors showed less power distance. Petrushyna et al. (2014) analysed European and Asian Wikipedias. User edits were compared to analyse differences in knowledge construction. Reference was made to the cultural dimensions according to Hofstede and Schwartz considering power distance, rootedness and egalitarianism of cultures. Samoilenko et al. (2016) used data on the co-occurrence of edits in different language versions of Wikipedia to explore cultural similarities. They concluded that the linguistic versions represent a common point of view when there are linguistic similarities. They explain the similarity of editorial interests by the number of bilingual people and the similarity of languages. It was discovered that cultural similarity as defined by dimensions according to Hofstede also applies to language. Usman and Yennita (2018) compared Italian and Indonesian Wikipedias with each other on the basis of a survey. Differences were shown regarding the relationship between members' interactions and community promotion and knowledge sharing. In the collectivist Indonesian culture, with greater interaction between members, there was more willingness to share knowledge and more promotion of one's own community. The interactions of members of the individualistic Italian culture did not promote community, and community participation did not ultimately lead to knowledge sharing.

Research on the diversity of Wikipedia's language version community due to IDV and MAS was also carried out by the author of this article together with her team. IDV has been shown to correlate with the activity (number of edits per page). In individualistic cultures, activities on Wikipedia are relatively less regulated, and user activity may indicate a greater boldness in editing others' content. In collectivist cultures, less assertiveness and a greater degree of regulation of actions can have an inhibiting effect on knowledge sharing (Kukowska and Skolik, 2021). With regard to the MAS research, a method of content analysis and analysis of the user activity log was adopted as follows: showing accolades, expressing thanks for contributions to Wikipedia content, manifesting one's gender as a Wikipedia user and participating in the Women in Red project. Cultures with a high MAS place high value on achievements and symbols of success, while nurturing relationships and appreciation, concern for individual needs and quality of life are closer to female cultures. According to the study, in cultures with lower MAS, there was more acknowledgement of contributions and cooperation, and gender marking was less important. In cultures with high MAS, decorations and symbols of success were important and more prominent (Karczewska and Kukowska, 2021).

3. Methodology

This study was based on a measurement of WikiProjects membership and user activity frequency. The original 2021/2022 study analysed the number of all enrolled participants in 55 randomised WikiProjects from a selection of 36 language versions of Wikipedia (Kukowska, 2022). The research was developed more

profoundly in late 2022 and early 2023. The criteria for selecting a particular language version in both parts of the study was to have a minimum of 300 active Wikipedians. As a result, the following language versions were selected: English, Arabic, Bengali, Bulgarian, Chinese, Croatian, Czech, Danish, Finnish, French, Greek, Hebrew, Spanish, Dutch, Indonesian, Japanese, Korean, Lithuanian, Malay, German, Norwegian, Persian, Polish, Portuguese, Russian, Romanian, Serbian, Slovak, Slovenian, Swedish, Thai, Turkish, Ukrainian, Hungarian, Vietnamese and Italian. WikiProjects were related to various scientific, cultural and technical issues.

The method used was to analyse the activity records of the number of WikiProjects participants. Participants were counted from WikiProjects pages or their subpages. A similar method of sampling the membership based on lists of enrolled participants on WikiProjects was used in the study of Chen et al. (2010), among others. The study looked at the impact of group diversity on the amount of work done and on drop-outs from WikiProjects. In this study, the tool (gadget) "Who is active?" was used to check the activity of Wikipedians in most language versions. This made it possible to measure the actual number of users involved in individual WikiProjects. The numbers of enrolled and recently active users (i.e., active in the last three months) differed significantly, especially in the large WikiProjects. The analysis of enrolled and active WikiProject users helped to reduce the number of WikiProjects surveyed compared to the first phase of the study. While 55 WikiProjects were studied in the first phase, there were 33 in the second phase.

The first hypothesis was adopted in order to contrast the result with the conclusions obtained from the first stage of the research, in which only declared participation in WikiProjects was considered. The variable of editing activity in the last 3 months was assumed to be a more precise indicator for measurement.

> *H1: WikiProjects as groups of Wikipedians show a similarity to the layering of communities according to Dunbar's 'rule of three' numbers (5, 15, 50, 150, 500). The sizes of groups of active users (editors in the last 3 months) are closer to these sizes than in the case of groups of declared users.*

The optimum number of a staff team, depending on the author, oscillates between three and 25 people, subject to slight modifications. Teams of 5 to 12 people are considered to be most effective (Robbins, 2002), or from 3 to 8 people (Gellert Manfred and Nowak Claus, 2008). Therefore, it is to be expected that small numbers of users will be the most active, regardless of the total number of users enrolled in WikiProjects. This justifies the second hypothesis.

> *H2: The ratio of active users to all WikiProject participants decreases as the number of WikiProjects participants increases.*

As MAS had previously been correlated with the activity of Wikipedians (Pfeil et al., 2006; Karczewska and Kukowska, 2021), it seems reasonable to also correlate it with the activity of WikiProjects participants. It is noteworthy that the focus of activity in Wikipedia is primarily on individual action, close to the cultural dimensions described as masculine.

> *H3: The ratio of active users per language version to the total number of users enrolled in projects correlates with a lower Masculinity Index (MAS).*

To verify the afore-mentioned hypotheses, statements of the following variables were prepared:

- The number of total participants enrolled in the individual WikiProjects in the language versions studied;
- The number of active WikiProjects participants in the last 3 months;
- The number of active WikiProject users as a proportion of the total number of enrolled users per language version;
- The number of WikiProject domains - the number of WikiProjects from the selected knowledge domains from a pool of 33 WikiProjects that occurred in the language version;
- MAS - masculinity versus femininity.

4. Research Results and Discussion

4.1 Size of the WikiProjects Editorial Community vs. Dunbar's Number

The study verified user activity through their participation in WikiProjects. For a better illustration and a certain level of smoothing of the high-variability data, the calculation used in the study involved the average measured for the k (equal to 5, 7, 9 and 11, respectively) of the consecutive user groups. The boundary value

for the test (for two mean values) is equal to 1.64. A very clear change in the number of participants is observed for WikiProjects with group sizes of 14-20 participants (depending on the length k from t∈{-1.80 : 5.88}, for each t p < 0.036), with their dynamics only decreasing around groups of 35. Another clear change starts for projects with 45 participants and slows down around 51 (for the 11-period series 69) participants with an incidental point of 59 participants. The last statistically significant decrease in active WikiProjects users in the studied range (up to 200 participants) includes counts for 112 participants. As k = 11, we still register significant drops in the number of participants at 120-129. However, we also observe statistically significant increases for 39 (t = 2.200; p = 0.014) participants, 52 (t = 2.157; p = 0.015) participants and 106 (t = 2.449; p = 0.007) participants. Each of these groups is significantly higher (in terms of numbers) relative to its neighbours (Fig. 1).

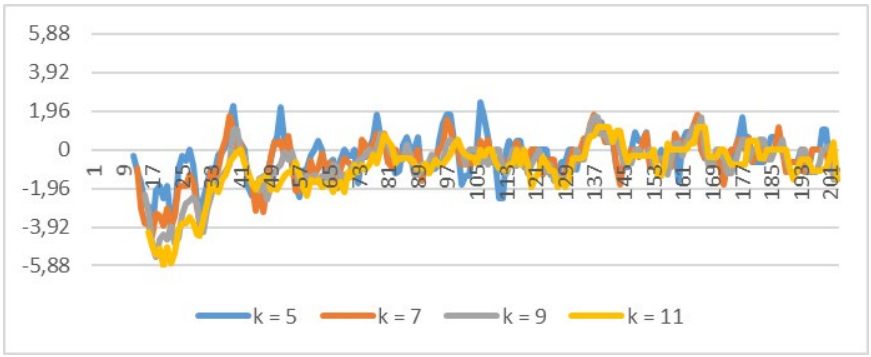


Figure 1: Average Test Values for the Number of WikiProjects with a Given Number of WikiProjects Participants Depending on Their Size

The results show significant changes in the number of WikiProject participants primarily in the layer referred to by Dunbar as the support group, whose numbers include approx. 15 people. These groups form strong bonds and in this group, the individual may receive support in daily activities. The next layer is the so-called good friends, whose numbers are approx. 50 people. In the case of WikiProject participants, the groups and the changes in them number counts between 35 and 45 are visible. The size of the groups of Wikipedians involved in WikiProjects show a similarity to the layering of communities according to Dunbar's number. It may therefore be assumed that H1 has been positively verified.

In H2, it was assumed that the ratio of active users with regard to all WikiProject participants decreases as the number of WikiProjects participants increases. There is a weak, yet statistically significant negative linear correlation (r = -0.097; p = 0.008) between the number of people subscribed to WikiProjects and the percentage of active users. As WikiProjects teams grow, the ratio of those enrolled with regard to active participants decreases.

4.2 Masculinity Index (MAS) of Individual Language Versions and the Activity of WikiProjects Participants

The study assumed that the ratio of active users in each language version with relation to the total number of users enrolled in the projects correlates with lower MAS according to Hofstede (H3). The results did not support (r_s = 0.115; t = 0.677; p = 0.503) this hypothesis (Fig. 2). This may be due to the fact that there is very little representation of women both in the different versions of Wikipedia and in most WikiProjects.

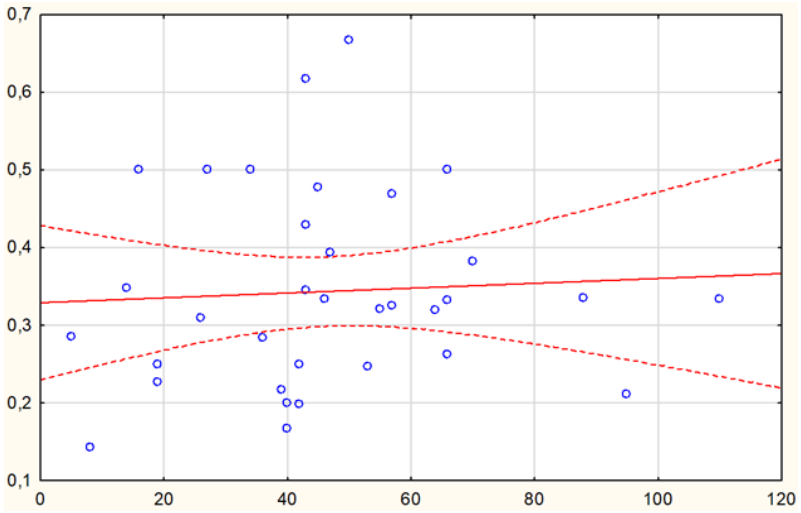


Figure 2: Relationship Between the size of MAS and the ratio of Active WikiProjects Members to Total WikiProjects Subscriptions

WikiProject structures develop in a spontaneous process, with the impetus for their creation coming from topics in various fields. The studied WikiProjects were characterised using Ward's clustering method. This gave control over the resulting number of groups, allowing the most natural clusters of survey elements to be presented (Szajt, 2014). For the 2021-2022 data, it seems clear that there are two main clusters, the first more numerous and the second far less numerous. In the former, a close proximity is observed between medical science, whereas sport in the latter – biographies, flying, films, football aside, as it were. Data from 2022-2023 with the same indicators (WikiProjects in selected language versions) and little change in the number of participants yielded a different result. For the 2022-2023 data it seems reasonable to divide it into three main clusters, the first and second more numerous and the third far less numerous comprising only biographies, flying, films, football (isolated earlier) and anime & manga, while also computer games. In the first focus, the previously observed close proximity between medical science and sport extended to music and musicology. WikiProjects are seemingly grouped together regardless of subject matter. However, in the right-hand side of both graphs (Fig. 3 and 4) are the very popular WikiProjects related to the sphere of mass culture. Biographical topics, on the other hand, cover a large part of Wikipedia and heated disputes often erupt around them. Aviation, on the other hand, gathers disproportionately more hobbyists than other technical and military issues.

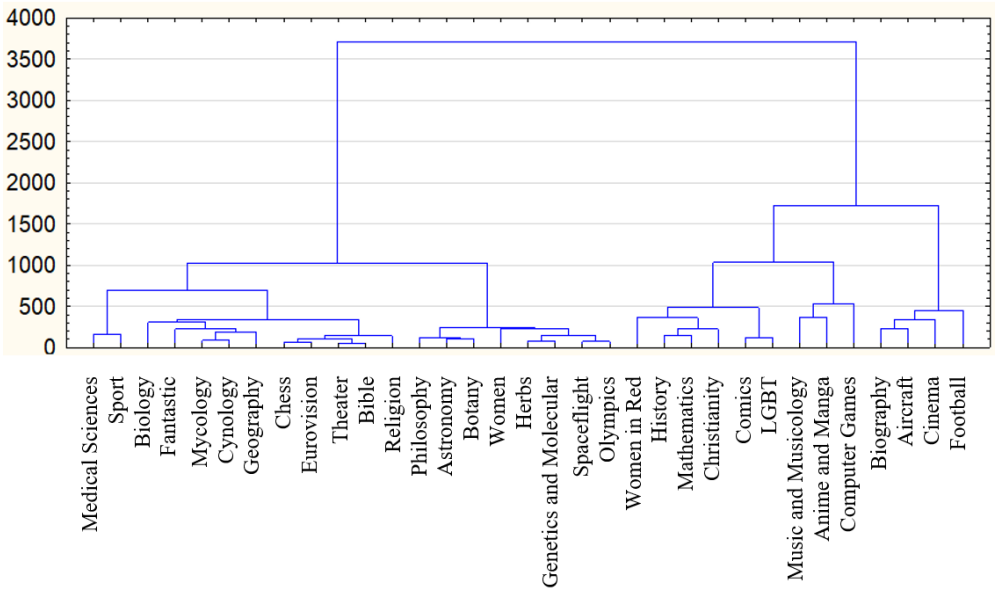


Figure 3: Ward Cluster Analysis Graph (Euclidean distance) for WikiProject in 2021/2022 by Popularity in 34 Language Groups

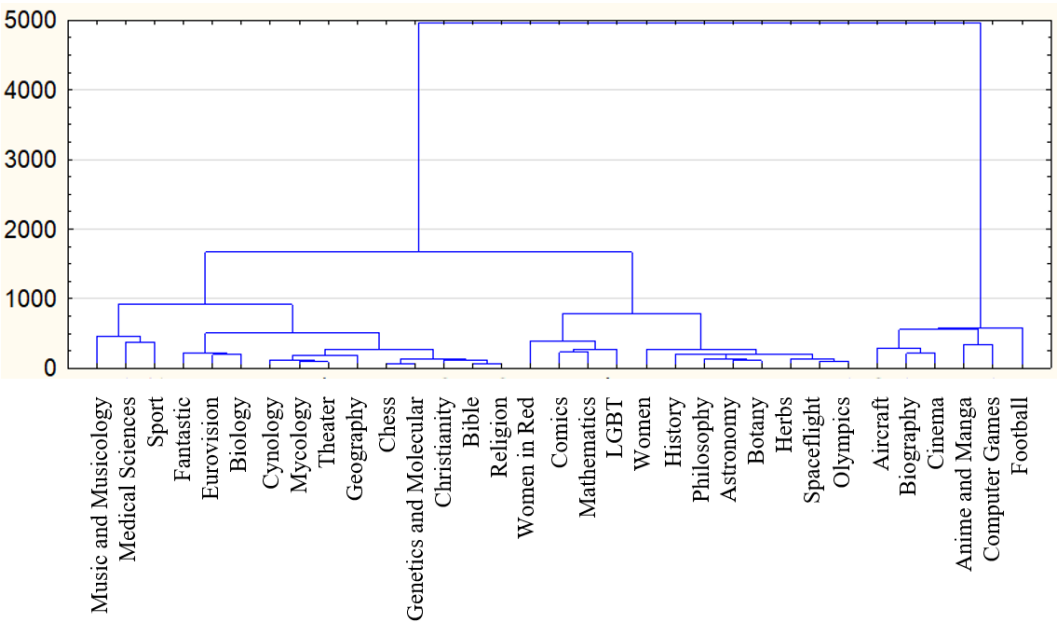


Figure 4: Ward Cluster Analysis Graph (Euclidean distance) for WikiProject in 2022/2023 by Popularity in 34 Language Groups

5. Conclusions

Measuring membership in WikiProjects and measuring the productivity of these communities has been cited as one of the significant difficulties associated with studying WikiProjects (Solomon and Wash, 2014). A practical contribution to the research so far is the presentation of the ratio of declared participation in WikiProjects to actual commitment to work for the improvement of Wikipedia. The "Who is active" tool used in the study simplified the data counts and made it possible to scan this work as a single source. Counting only the declared participation in a given WikiProject in advance was fraught with the falsification of participant activity. The fact that the majority of efforts to make content public are made by a vast minority of individuals was pointed out by Peddibhotla and Subramani (2007) and Raban and Rabin, (2009). The characterisation of online group structures based on the actual activity of their members facilitates a better description of the communities studied. In the future, expanding the research to include more WikiProjects and more language versions of Wikipedia would enable more accurate conclusions.

It seems that with the organisational changes brought about by the global pandemic, the theme of the emergence of spontaneous collaborative structures in online communities has become even more cognitively attractive. The safety and security crisis has changed perceptions of the determinants of online group activity and thus the specifics of their functioning and effectiveness. The production of value in social interactions in the online sphere, the ability to work together as a team in physical isolation, is becoming increasingly important. The conditions surrounding these processes are therefore worth exploring.

6. Limitations

The method used to measure participation in WikiProjects from lists of their participants was not possible in every case. This is because it is not a universal way of declaring participation in WikiProjects. In several cases, the count required searching for participants on directly inaccessible WikiProject subpages. Despite the care taken in mapping the data, the values of which are often small in terms of recently active members, there remains a margin of error that is difficult to estimate. A different issue also highlighted by Morgan et al. (2013) remains the contribution to the WikiProjects of individuals who do not explicitly declare their affiliation.

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Distinguishing the Dimensions of Learning Spaces: A Systematic Literature Review

Rosaria Lagrutta[1], Daniela Carlucci[1], Francesco Santarsiero[1,2], Giovanni Schiuma[2] and Antonio Lerro[1]

[1]University of Basilicata, Potenza, Italy

[2]LUM University, Casamassima (BA), Italy

Rosaria.lagrutta@unibas.it
Daniela.carlucci@unibas.it
Francesco.santarsiero@unibas.it
Schiuma@lum.it
Antonio.Lerro@unibas.it

Abstract: Nowadays, public and private organisations appear increasingly committed to fostering the skills necessary to deal with the challenges of the current scenario. From this perspective, public and private organisations are developing new spaces for learning. The notion of learning space draws its origin and main application in educational institutions. However, it constitutes a distinctive concept for all the organisational contexts in which the creation and management of knowledge and learning dynamics are enabling factors that support innovation and growth dynamics. Although several studies have already discussed the features characterising a learning space or a learning environment, the literature is fragmented and does not provide a comprehensive, fresh view of the learning space, its components, or its impact on learning processes and knowledge dynamics. This is particularly true in management literature. The research results synthesise data and knowledge gathered from the systematic literature review, providing researchers and practitioners with an integrative picture of the definitions of "learning space" and "learning environment" in the management literature and producing a descriptive framework that highlights the relevant dimensions that influence learning processes and knowledge dynamics.

Keywords: Learning environment, Learning space, Knowledge dynamics, Management, Systematic literature review

1. Introduction

Nowadays, public and private organisations appear increasingly committed to fostering the skills necessary to deal with the challenges of the current scenario by enhancing their learning capacity. The current scenario is increasingly complex and characterised by uncertainty and volatility; therefore, organisations need to develop innovation capacity, considered a key driver for survival, competitiveness, and long-term growth and success (Hamidi et al., 2019). Innovation capacity refers to the organisation's ability to develop new ideas, products, services, or processes that foster new value for the organisation, its stakeholders, and the surrounding environment. It involves the ability to recognise and respond to changes in the business environment, as well as the ability to leverage internal and external knowledge and resources to create new opportunities (Yildiz et al., 2021).

A range of factors influence it, and most are related to the processes of learning and knowledge. In fact, for an organisation, learning and knowledge processes and dynamics represent the engine for developing the capabilities for sustainability in the new business age (Nonaka and Takeuchi, 2019; Hamidi et al., 2019).

In such a perspective, several researchers emphasised the importance of learning orientation, knowledge sharing, and the learning environment as critical determinants of innovation capacity (Yildiz et al., 2021).

Individuals with a strong learning orientation are more likely to expose themselves to new knowledge and have a higher capacity to recognise, assimilate, and exploit it. Knowledge management is a driving force for innovation because it allows identifying, collecting, sharing, and applying knowledge and turning knowledge capital into real outcomes. Therefore, effective knowledge management practises, including knowledge sharing, can contribute to the development of innovation capacity. Moreover, a learning environment or learning space refers to the physical, social, and cultural context in which learning occurs. In this vein, according to the literature, in the last few years, new spaces to foster innovation and boost learning and knowledge dynamics have increasingly become key objectives for public and private organisations (Yildiz et al., 2021; Morris, 2020; Hamidi et al., 2019).

The literature suggests that learning spaces are places where knowledge is created, shared, and applied; they may be described as spaces of interaction between individuals, their behaviours, and the external environment.

Despite their growing importance, the literature is fragmented, and there is a gap concerning a comprehensive and holistic view of the distinguishing dimensions of learning spaces (Csizmadia et al., 2022; Cheng, 2015).

In this regard, this study aims to identify dimensions and features that characterise effective learning spaces and may support innovative capacity development.

The research is carried out through a systematic literature review answering the question, "What are the dimensions of a learning space that influence learning and knowledge dynamics?" aimed at providing an integrative picture of the evolution of the concept and definition of "learning space" and "learning environment" in the management literature, producing a descriptive, theoretical framework that supports the identification of the relevant dimensions that should be managed and evaluated. Specifically, it aims to guarantee and enhance the effectiveness of a learning space.

2. Research Methodology

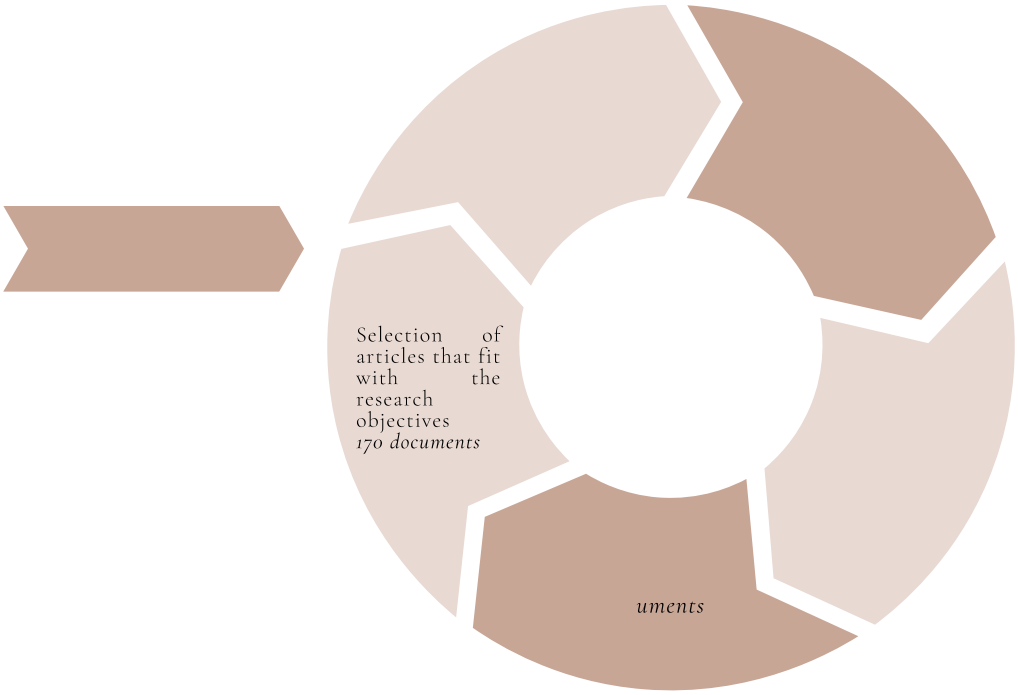


Figure 1: Steps of the Research Process and Number of Selected Papers

The management literature provides a vast amount of data and articles, and analysing them is a challenging task. (Crossan and Apraydin, 2010). One of the responses is to undertake an extensive analysis of the contributions in the literature. The adopted approach proposed by Tranfield et al. (2003) is a scientific and transparent process reported in sufficient detail to permit replication (Tranfield, 2003). With a SLR approach, insights and evidence from the literature have been found, synthesised, and evaluated.

Tranfield et al. (2003) proposed three main phases: i) planning the review; ii) conducting an inspection; and iii) reporting and disseminating.

The first step, concerning the planning phase, was conducted by defining keywords and searching terms to carry out the SLR. The search strings were defined according to the research question, derived from a first scoping review: "What are the dimensions of a learning space that influence learning and knowledge dynamics?". Initially, the research strings chosen were "learning space" AND "dimensions". However, formulating a query considering only these two keywords resulted in being too specific; indeed, given the plurality of terms used interchangeably to refer to learning spaces and dimensions, a broader selection requirement has been adopted to include all the significant studies, adding to the query other terms with "OR". In consequence, the selected research strings were "learning space" OR "learning environment" AND "dimensions" OR "components" OR "characteristics" OR"features". The search strings chosen are wide enough to understand the level of knowledge and contributions in this field and identify the areas to explore. The following steps concern the conduct of the inspection. With the scope of building a holistic and comprehensive understanding of the dimensions of learning

spaces, the approach concerning using multiple databases has been adopted. Specifically, the multiple databases considered were Web of Science (WoS) and Scopus, acknowledged as complete databases for academic papers (Falagas, 2008). The final set of works to be considered has been defined, identifying all relevant articles and removing duplicate papers.

In this case, predetermined criteria were chosen to decide what literature to include or exclude. Filters were applied to include articles already published in journals from 2009 to 2023 to focus on the most recent developments.

The research field of interest was Business, Management, and Accounting. Conference papers, articles not written in English, book chapters, and special issue editorials were excluded. All duplicate papers from different sources were identified and removed.

Titles, abstracts, and keywords of the remaining articles were analysed to include contributions aligned with the aims and focus of the analysis.

In fact, other exclusion criteria are chosen after a first scan of the essential article source information and concern the consistency between the article topics and the research questions. Specifically, contributions in fields disconnected from business, management, and economics were dismissed.

As a result of the research strings, after applying the selection criteria, 373 documents have been selected: 297 results from Scopus and 76 from the Web of Science. The documents were opened into a spreadsheet, and the duplicates were removed.

Then, reading the title, keywords, abstracts of identified papers, and full text, the essential documents for the research's purpose were selected. The notion of learning space has been approached from several perspectives and in diverse dimensions. Thus, the critical articles selected were 170.

3. Analysis of the Results

3.1 Distinctive Dimensions of a Learning Space

The concept of learning space emerges in the educational field within the socio-constructivist paradigm of learning, described as the result of the interaction between individuals and the environment.

Generally, an educational learning space may be recognised as a virtual location or a physical place, such as a classroom, a laboratory, a lecture room, or a workshop, where knowledge is created, shared, and applied (Morris, 2019).

The notion of learning space has its origins and main application in educational institutions. However, in the current scenario, the development of learning spaces or learning environments based on active methodologies and the use of new advanced technologies constitutes a distinctive concept for all the organisational contexts in which the creation and management of knowledge and learning dynamics are enabling factors that support innovation and growth dynamics. A learning space is a multi-dimensional space that includes different factors, characteristics, and dimensions. It can be formal or informal, and it can take place in a variety of settings, depending on the context of the application, such as classrooms, libraries, museums, online platforms, knowledge management systems, innovation laboratories, creativity rooms, co-working spaces, innovative workplaces, educational spaces, and lecture rooms (see, e.g., Nonaka and Takeuchi, 2019; Jung et al., 2018; Gonzalvez et al., 2014).

According to Kuokkanen and Van der Rest (2022), a learning space is not neutral but may significantly impact the learning process and outcomes. Learning spaces enable and facilitate the creation and sharing of knowledge and learning by managing tangible and intangible components. Although several studies have discussed the features of learning spaces, especially in educational contexts, there is still a gap regarding a comprehensive and holistic view of the distinguishing dimensions of learning spaces. This is particularly true in the management literature (Csizmadia et al., 2022; Mueller & Strohmeier, 2010).

In this context, this study aims to identify dimensions and features that characterise effective learning spaces and support and influence successful learning and knowledge activities and dynamics. The connections between all the dimensions of a learning space can be subtle and powerful for learning and knowledge dynamics. In sum, identifying a learning space's key dimensions would help better manage and assess its performance. In such a prospect, the study attempts to answer the following research question: "What are the dimensions of a learning space that influence learning and knowledge dynamics?"

A critical analysis of the extant literature suggests that it is possible to identify some distinguishing dimensions and components of learning spaces. These different dimensions are interrelated and mutually influence each other in defining and characterising a learning space. According to different researchers, the critical infrastructural components and dimensions are: i) the physical environment; ii) technological tools; iii) organisational resources; iv) actors and interactions; v) culture and atmosphere (see, e.g., Bindhu & Manohar, 2015; Csizmadia et al., 2022). Through a systematic literature review, this study analyses the dimensions of learning spaces more in depth, describing the elements and items included in every dimension. Each sub-dimension has a different weight and contributes differently to the development of a learning space. In the following, each sub-dimension will be analysed and discussed.

Table 1: Theoretical Framework: Learning Space Structural Dimensions

	Sub-dimensions	**References**
Physical Setting	*Virtual (e.g., individual space characteristics)* Hybrid *and physical (furniture, lights, colours, decorations, dynamic space, flexibility and adaptability, layout of the class, spaces and arrangements, study spaces, collaboration spaces).*	(Christensen et al., 2023; Jens and Gregg, 2022; Berbegal-Mirabent et al., 2021; Sasson et al., 2021; Dleikan et al., 2020; Sankari et al., 2018; Osorio et al., 2017; Lancaster and Milia, 2015; McLaughlin & Faulkner, 2012; Heiskanen & Heiskanen, 2011).
Technological resources	*Supporting and basic technologies (e.g., platforms, tablets, smartphones, webcams, projectors, digital whiteboards, platforms, headphones, digital watches, etc.)* *Advanced and 4.0 technologies (e.g., artificial intelligence, virtual reality, 3D printers, augmented reality, metaverse, big data, internet of things, additive manufacturing, machine learning, smart factories, etc.)* *Software*	(Abdalina et al., 2022; Ali et al., 2022; Ghani et al., 2022; Lee and Tan, 2022; Lu, 2022; Reyes-Mercado et al., 2022; Hines and Netland, 2022; Upadhyay and Khandelwal, 2022; Safdar et al., 2022; Snieder and Zhu, 2020; Eisenbardt, 2021 Renz and Valdova, 2021; Renz & Vladova, 2021; Akdere et al., 2021; Sasson et al., 2021; Delgado et al., 2020; Hliouli et al., 2020; Latrous & Khadraoui, 2020; Rasheed et al., 2020; Marta, 2019; Borge et al., 2018; Gdanetz et al., 2018; Aouf et al., 2017; Lau, 2015; Mahenge & Mwangoka, 2014; Olsen et al., 2011; Huang et al., 2010; Jurasaite-Harbison, 2009;
Organisational Resources	Methods, processes, and activities Systems of practises and procedures that providers use to support and enrich the learning processes and knowledge dynamics *(e.g., project- or problem-based learning, design thinking, storytelling, collaborative communities, web-based videos, narrated stop-motion animation, modelling, gamification, simulation, flipped classrooms, content-driven processes, etc.)* The topics, themes, concepts, and facts, often grouped into subjects, that are expected to be learned (e.g., economics, entrepreneurship, digitalization, STEM subjects, etc.) Economic resources	(Yan et al., 2022; Nashaat et al., 2022; Mojtahedi et al., 2020; Wannapiroon & Petsangsri, 2020; Zakaria et al., 2019; Xu et al., 2018; Corney, 2018; Song et al., 2018; Filippou et al., 2018; Aggarwal, 2017; Dai & Bal, 2009; Jurasaite-Harbison, 2009; MacNeil et al., 2009)
Actors and interactions	*Knowledge providers (e.g., teachers, professors, researchers, mentors, entrepreneurs, facilitators, etc.)*	(Lee and Tan, 2023; Abuhassna et al., 2022; Ching Lee and Yian Tan, 2022; Müller and Wulf, 2022; Toiviainen et al., 2022; Bianchi & Vignieri,

	Sub-dimensions	References
	Learners (internal or external: e.g., learners, students, organisations, managers, employees, staff, etc.) *Internal* *i. Horizontal (e.g. workgroup, peer relationships)* *ii.Vertical (e.g. scaffolding, supporting relationships, mentoring, leadership, etc.)* *iii.External (e.g. partnerships; coaching)*	2021; Delgrado et al., 2020; van Riesen et al., 2019 Sankari et al., 2018; Lancaster and Milia, 2015; Elmadani et al., 2015; Esichaikul et al., 2013; Mihalca et al., 2011; Jurasaite-Harbison, 200;
Culture and Atmosphere	*Culture and Atmosphere (e.g., open-minded culture, routine culture, flexible mindset, positive environment with* trust, cooperation, safety, risk-taking support, and equity, *formal or informal atmosphere, motivating and engaging environment, creative atmosphere, friendly atmosphere, academic atmosphere, active learning atmosphere, etc.)* KM culture *(the willingness to transfer, create, and share knowledge from tacit to tacit, tacit to explicit, and explicit to explicit)*	(Abuhassna et al., 2022; Csizmadia et al., 2022; Lee and Tan, 2023; Black & Mischel, 2023; Montiel-Ruiz et al., 2023; Gupta & Priyanka, 2023; Lazzari, 2023; Erdoğdu and Akrolu, 2021; Akhmetshin et al., 2019; Burusic, 2019; Maheshwari & Seth, 2019; Jung et al., 2018; Karkoulian et al., 2013).

3.1.1 The infrastructure of a learning space

As already mentioned, learning spaces enable and catalyse knowledge and learning dynamics, supported by tangible and intangible structural dimensions that foster open, honest, and receptive interactions among the stakeholders involved (Delgado et al., 2020). The dimensions are specified in Tab. 1 and further discussed in the following:

3.1.2 Physical setting

Learning spaces emerge as places where learning and knowledge dynamics are activated and supported. The management literature has highlighted the influence that the physical setting has on dynamics, interactions, and processes, as well as on individuals' skill development and behaviour definition. Consequently, attention to detail is essential to positively impacting the learning space's effectiveness.

The physical setting of a learning space refers to the physical and virtual space or spaces in which learning happens (Sankari et al., 2018).

The physical setting includes individual and common spaces. Scholars have discussed some key characteristics of such spaces: furniture, seating arrangements, lighting, temperature, decorations, and acoustics (Sasson et al., 2021). Furniture that facilitates the interactions between actors, tools, and the environment is preferred. At the same time, the quality of the air, luminous colour, and light can help develop a favourable and stimulating learning space (Dleikan et al., 2020; Jens and Gregg, 2022).

Generally, an effective learning space design favours engagement, creativity, and collaboration with a high level of comfort and flexibility. All the design elements characterising the space must merge into a synergistic whole.

Researchers pointed out that learning spaces are oriented and designed towards the learner and the learning and knowledge processes and are characterised by flexibility, functionality, participation, and empowerment in emerging and innovative spaces (Heiskanen & Heiskanen, 2011).

3.1.3 Technological resources

The technological resources dimension contemplates a combination of technological tools and infrastructures that enhance learning and knowledge processes and dynamics. Different technological tools can foster or prevent impacts on the learning process. Consequently, the design and management of a learning space must

be associated with choosing the appropriate tool to exploit their potential and maximise the value added (Delgado et al., 2020).

According to the literature, the technological dimension is considered a key factor in the success of learning spaces, as it enables learners to access a wide range of educational content and resources and to engage in active, experiential, and collaborative activities. They provide individuals with means for representing knowledge in multiple ways (Sasson et al., 2021).

The literature discussed the use of various technological tools, in particular supporting and basic tools, advanced and 4.0 technologies, and software. Examples of basic technological assets and software supporting learning and knowledge dynamics are platforms, computers, mobile phones, tablets, projectors, e-readers, 3D printers, headphones, digital watches, digital whiteboards, etc. (Latrous & Khadraoui, 2020).

More advanced technologies can contribute to the enrichment of learning by enhancing the learning strategy and institutionalising continuous learning and the protocol for sharing and transforming knowledge. Some representative examples pointed out in the literature are: Artificial intelligence, the Internet of Things (IoT), augmented and immersive reality, digital platforms, the metaverse, sensors, algorithms, adaptive learning platforms, and other smart technologies that facilitate interaction and collaboration in the learning process (Abdalina et al., 2022; Diaz Tito et al., 2021).

However, different researchers also acknowledge the limitations of technology, such as the need for effective data processing and the potential for technology to create a sense of isolation and disconnection among learners. In this vein, the individuals involved in a learning space must best integrate the technologies into the functioning mechanisms of the space (Snieder and Zhu, 2020).

3.1.4 Organisational resources

This dimension includes the tangible and intangible resources that support learning processes and knowledge dynamics within a learning space.

Specifically, it includes methodologies, contents, materials, and resources available to support learning. Learning methodologies are systems of practises and procedures that providers of knowledge employ to develop a learning process. Some examples of methodologies may be project- or problem-based learning, design thinking, storytelling, collaborative communities, web-based videos, narrated stop-motion animation, modelling, gamification, simulation, flipped classrooms, content-driven processes, etc. (Filippou et al., 2018; Maheshwari & Seth, 2019).

According to the literature, a key aim for developing new learning spaces is to understand what methodologies support and favour the introduction of technologies.

On the other hand, topics are themes, concepts, and facts, often grouped into subjects, that are expected to be learned (e.g., economics, entrepreneurship, digitalization, STEM subjects, etc.) (Aggarwal, 2017; Akhmetshin et al., 2019).

Schobel & Scholey (2012) identify other important organisational resources: economic resources and, specifically, the financial strategies adopted. The authors argue that learning spaces with well-defined financial strategies are linked to positive outcomes and are well-positioned for success.

3.1.5 Actors and interactions

The success of a learning space strongly depends upon the actors, how they are engaged within the facility, and how they interact with each other.

The nature of the people or users involved in learning spaces is vast. According to the literature, two types of knowledge actors can be identified in a learning space: providers of knowledge and learners. Learners can be an internal or external target; some examples are students, managers, organisations, employees, and staff. They are considered central actors, seen as active developers of their own learning, engaged in authentic learning and knowledge processes. On the other hand, providers are people who support learners, acting as coordinators who facilitate interactions and the exchange and development of knowledge. They assume great relevance and act as facilitators of the learning process. This role may coincide with that of teachers, professors, transformative leaders, innovation managers, researchers, mentors, entrepreneurs, facilitators, organisers, etc. (Stern et al., 2020; Pawlowsky et al., 2020; Nonaka & Takeuchi, 2019; Sankari et al., 2018).

Further studies state the importance of the prior knowledge and skills of the actors involved in obtaining a successful performance. Prior knowledge, which may cover several contents and skills, interacts with other variables to influence learning outcomes and can be further enhanced through a culture oriented to knowledge and the interactions among actors (Mihalca et al., 2011).

The actors' interaction concerns the system of interactions between internal and external actors that take place in the learning environment. According to the literature, the design of the learning space has to promote positive relationships and a sense of belonging (Abuhassna et al., 2022).

The actors' interaction concerns the system of interactions between internal and external actors that take place in the learning environment. According to the literature, the design of the learning space has to promote positive relationships and a sense of belonging to enhance motivation and engagement.

Learners and providers continuously engage with each other and with the learning space. The interactions can be horizontal, vertical, or external. Horizontal and vertical interactions can take various forms, such as verbal communication, written communication, scaffolding, collaboration activities, feedback, and reflection. In a physical setting, interactions may occur through face-to-face discussions and group work, whereas in an online learning environment, interactions may occur through discussion forums, video conferencing, and other digital communication tools.

Concerning external interactions, physical proximity increases communication, face-to-face contact, and knowledge spillovers. In this vein, clusters of organisations with a high level of linkage between them and universities and R&D centres can foster success in learning environments (Toiviainen et al., 2022).

Effective interactions require active participation, mutual respect, and a willingness to engage in constructive dialogue and feedback (Delgrado et al., 2020).

3.1.6 Culture and atmosphere

This dimension identifies the mood, attitudes, expectations, practises, norms, and sensorial qualities distinguishing a learning space. It influences the effectiveness of the space by increasing or preventing motivation, attention, creativity, and the level of involvement of people. A learning space includes constructs concerning the experiences lived by the individuals involved and influenced by their behaviour. The quality of a learning space is strongly influenced by the nature and orientation of the actor's culture. (Pawlowsky et al., 2020) A positive learning environment promotes an open-minded culture, flexibility, and willingness to engage in innovative activities. It provides opportunities for learners to explore new ideas and concepts and to develop critical thinking and problem-solving skills (Burusic, 2019). Together with the actor's culture, the development of a strong knowledge culture is also a key determinant of the learning space's effectiveness. Knowledge culture drives and encourages the coding, transfer, and application of knowledge to promote learning and innovation. (Abuhassna et al., 2022; Csizmadia et al., 2022; Karkoulian et al., 2013).

The atmosphere of a learning space refers to the shared values, beliefs, attitudes, and behaviours of the individuals who participate in the learning process. It includes the norms and expectations that guide interactions among learners and instructors, as well as the creativity, level of collaboration, respect, and inclusivity fostered within the learning space. A positive learning atmosphere is fostered by supportive, friendly, active participation, critical thinking, and constructive feedback. It also values diversity and promotes a sense of community and belonging among learners. The atmosphere can be formal in traditional learning processes or informal in unstructured settings (Jung et al., 2018).

A favourable culture and energy translate into the behaviour of people who appear involved, focused, and engaged in the learning processes and dynamics.

4. Concluding Remarks

Nowadays, public and private organisations appear increasingly committed to fostering the innovation capacity necessary to deal with the challenges of a complex and uncertain scenario. A range of factors influences innovation capacity, and most of them are related to the processes of learning and knowledge. In fact, for an organisation, learning and knowledge processes and dynamics represent the engine for developing the capabilities for sustainability in the new business age. In such a perspective, learning environment, knowledge, and learning dynamics are considered key determinants of innovation capacity; therefore, spaces to foster innovation and boost learning and knowledge dynamics are acquiring increasing importance and becoming key objectives for public and private organisations.

The literature suggests that learning spaces are places where knowledge is created, shared, and applied; they may be described as spaces of interaction between individuals, their behaviours, and the external environment. Although several studies have already discussed the features characterising a learning space or a learning environment, especially in an educational context, the literature to date is fragmented and does not provide a comprehensive, fresh view of a learning space, its infrastructural dimensions, or the impact that has on learning processes and knowledge dynamics. This is particularly true in management literature.

In such a context, based on a systematic review of the literature, this study provides a clear and holistic understanding of the infrastructural dimensions characterising a learning space to support the management and assessment of these spaces in educational and organisational contexts.

Consequently, the systematic literature review has provided a consistent background for developing a theoretical framework.

Learning spaces are characterised by: i) a physical setting; ii) a technological dimension; iii) organisational resources; iv) actors and interactions; v) culture and atmosphere.

The research results synthesise the data and knowledge gathered from the literature review and offer implications and insights both for theory and practice. From a theoretical viewpoint, the paper contributes to the further development of the literature about LS by providing a definition suitable for different levels of application, specifically: "the physical, virtual, and hybrid space, of formal or informal nature, characterised by action and interactions among different actors and their capabilities, which promotes cognitive processes and influences knowledge and learning dynamics through its tangible and intangible components, generating innovation capacity." Then, the study identifies specific variables and dimensions to consider to support innovation dynamics within a public or private organisation.

Moreover, the analysis of the literature reveals the importance given to the management and assessment of learning spaces. In fact, managing and assessing a learning space is necessary to ensure its effectiveness, achieve goals and objectives, and trigger a virtuous cycle of improvement. (Reyes Mercado, 2022; Greasley and Bennet, 2014; Grieves et al., 2005)

Managing a learning space means creating an environment that supports learners' learning and knowledge processes. Specifically, effective management of a learning space involve:

- providing resources and materials that are relevant to the learners,
- creating a safe and welcoming physical space, and
- establishing clear expectations and guidelines for behaviour.

Therefore, several researchers suggest a need for further research on the management and assessment of learning spaces, particularly in terms of defining all the performance dimensions, selecting appropriate technologies, providing training and support for knowledge providers and learners, monitoring usage and engagement, and continuously evaluating and improving the space and the activities organised. The studies emphasise the importance of gathering feedback from learners and knowledge providers to ensure that the learning environment meets the needs of all actors (Reyes-Mercado, 2022; Müller F.A.; Wulf T., 2022; Erdoğdu and Çakıroğlu, 2021; Greasley and Bennet, 2014; Mueller and Strohmeier, 2011). Moreover, from the literature, it emerges that there is a need to focus on learning spaces developed in the digital age, specifically those developed integrating advanced technological tools such as augmented and virtual reality, the metaverse, artificial intelligence, and the internet of things.

Concerning more practical implications, the paper provides managers with a theoretical framework that may support different actors (e.g., universities, organisations, companies, and public administration offices) to make informed decisions and management plans based on key data and knowledge and to develop effective learning spaces supporting virtuous cycles of learning, knowledge management, and innovation.

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The Fusion of Talent Management and Knowledge Management: An Odd Couple or Happy Nuptial

Lawrence Abiwu and Isabel Martins
University of KwaZulu-Natal, South Africa

AbiwuL@ukzn.ac.za

Abstract: The purpose of this paper is twofold, firstly, to explore the factors that affect the retention of knowledge workers in South African higher education institutions; secondly, to show how talent management can benefit knowledge management practices. The mixed-methods design was employed to collect and analyse the quantitative and qualitative data. Stratified and purposive sampling techniques were used to select 347 respondents from three South African universities. Questionnaires and interviews were used to collect the data from 277 participants. The Statistical Package for the Social Sciences was used to analyse the quantitative data, while the qualitative data was analysed using NVivo (version 12.0). The quantitative and qualitative findings confirmed that work-life balance, promotion and employer-employee relationship positively impact the retention of knowledge workers in South African higher education institutions. This study provides a deeper understanding of how universities could leverage employee promotion, employer-employee relationship and work-life balance to retain knowledge workers in the competitive business environment. The study demonstrates that factors of talent management such as promotion, employer-employee relationship and work-life balance, are viable tools for retaining knowledge workers to position higher education institutions at the cutting edge. These factors can benefit knowledge management practices. The study expands on the limited research on employee retention strategies, talent management and knowledge management.

Keywords: Employee-employer relationship, Knowledge management, Talent management practices, Talent retention, work-life balance

1. Introduction

Igielski (2017) argues that, in the last decades, there have been changes in the traditional approach to work to a more modern approach, such as computerisation of workstations and distance work. Consequently, employees' skills and competencies have also changed to meet the new expectations of the employers involved in identifying and acquiring knowledge. Muzam (2022) maintains that the world economy has shifted from the traditional production system into a more service-oriented economy known as the knowledge economy. Choong and Leung (2021) and Servoz (2019) advocate that the new economy requires employees with technical know-how in almost every sector. The aforementioned assertions emphasise the importance of knowledge workers. The latter systematically acquire knowledge and have a high level of education and unique skills required to assist the organisation in achieving its goals. From the knowledge-based view (KBV) of the firm standpoint, knowledge resides at an individual level, making its integration a vital function for an organisation (Grant, 1996).

De Sordi, Azevedo, Bianchi and Carandina (2021) point out that knowledge workers use and apply organisational knowledge. Surawski (2019) compared knowledge workers with other workers, including white collars and experts, and concluded that one key feature of knowledge workers is that they work mainly with symbols and transform them into cognitive processes, creating value for the organisation. Muzam (2022) concurs that knowledge workers are autonomous individuals whose work depends on a high level of knowledge and perform complex tasks primarily focusing on problem-solving. However, it has been found that because of the competition for talent, knowledge/talent retention has become a critical issue for many firms and an equally challenging situation for most employers. For instance, Lesenyeho, Barkhuizen and Schutte (2018) assert that nearly half of the academics in South African higher education institutions (HEIs) have considered leaving their jobs. Yimer, Nega and Ganfure (2017) shared similar sentiments, in that academic turnover in South African HEIs has been a major concern as it disrupts the normal functioning of academic enterprises. In a recent study, Barkhuizen, Lesenyeho and Schutte (2020:191) argue that the voluntary turnover intentions of academics in South African HEIs are escalating, which presents significant challenges to HEIs, including “additional costs for the induction and training of new staff, loss of research outputs and organisational productivity, and reduced quality of teaching due to mid-semester replacements of lecturers”. According to Lesenyeho and Schutte (2020), compensation and recognition, as well as institutional practices had significant influence on employees’ intention to quit their jobs. Musakuro and de Klerk (2021) acknowledge that most academics leave South African HEIs for better compensation and career opportunities.

Several scholars have proposed diverse opinions and solutions to address the retention challenge in South African HEIs. For instance, Kanyumba and Lourens (2021) found that retention strategies include compensation and benefits, succession planning, training and development and career development opportunities. Similarly, Lesenyeho and Schutte (2020) suggest that HEIs redevelop talent management (TM) practices such as compensation and recognition, career development and general institutional practices to address the diverse needs of a new generation of academics. The extant literature suggests that most empirical studies on academic retention in South African HEIs focused solely on compensation and benefits, succession planning, training and development and career development opportunities (Kanyumba & Lourens, 2021; Musakuro & de Klerk, 2021; Lesenyeho & Schutte, 2020). However, there is limited empirical research concerning the influence of promotion, work-life balance and employer-employee relationship on academic retention in South African HEIs.

2. Literature Review

2.1 Talent Management

TM is not a novel concept. Nevertheless, it has been obscurely defined because of its complexity (Lockwood, 2006). Vladescu (2012) conceptualises TM as the integrated set of activities used by organisations to attract, retain, and develop the most talented people they need for future purposes. According to Aytaç (2015), TM is a process deemed to attract, develop, place, retain, and integrate highly qualified workforce members while having the potential for high performance per the organisation's long-term strategies to gain a competitive advantage.

McDonnell, Collings, Mellahi and Schuler (2017) point out that TM is gaining more significance as a vital component that creates value for organisations. Al-Dalahmeh (2020) postulates that TM has become a strategic topic for managers in global organisations. Contrary to the above findings, Al-Dalahmeh (2020) argues that although the strategic importance of TM, research in the area is still few, mainly conceptual research. Al-Dalahmeh's (2020) findings are consistent with Gallardo-Gallardo, Thunnissen and Scullion (2020) and van Zyl, Mathafena and Ras (2017), who believed that, although some organisations have implemented diverse TM practices, there are nevertheless many unknown issues of TM (Al-Dalahmeh, 2020; Gallardo-Gallardo et al., 2020) and these need to be investigated. This study attempts to address these issues.

2.2 Knowledge Management

In this competitive era every organisation requires knowledge in order to remain sustainable. According to Sokoh and Okolie (2021), knowledge creation is vital for oorganisational sustainability. The above assertion underpins the importance of knowledge management (KM) and KBV of the firm. The role of knowledge KM in organisations has become increasingly important in the knowledge-based economy. Skryme (1999) conceptualises KM as systematic activities that relate to knowledge and processes of creating, collecting, organising and carrying out in pursuit of organisational goals. Likewise, Sokoh and Okolie (2021) state that KM is concerned with discovering, creating, disseminating and utilising knowledge. Jones and Shideh (2020) discover that the essence of KM is to ensure that information is shared and transmitted to employees within organisations. For de Bem Machado, Secinaro Calandra and Lanzalonga (2022), KM represents the capacity to manage information, such as gathering knowledge, transforming knowledge into new strategies or ideas, and implementing and preserving it. Idrees, Xu, Haider and Tehseen (2023) contend that organisations have increasingly focused on KM techniques as they realised how necessary knowledge is to achieve sustainable competitive advantage.

2.3 Talent Retention Strategies

The estimated cost of employee turnover ranges between 1 to 2.5 times the employee's salary (Lewis & Heckman, 2006). Talent retention involves the science of maintaining employees in their current jobs within the organisation for a longer period (Lewis & Heckman, 2006). Also, Madurani and Pasaribu (2022) acknowledge that talent or knowledge retention involves retaining talent and ordinary employees to remain working with an organisation. In their study, Mabaso, Maja, Kavir, Lekwape, Makhasane and Khumalo (2021) found TM practices such as rewards, work–life balance, performance management system, improved training and development, employee recognition and career progression opportunities influenced talent retention in the consultancy industry. Moreover, Boakye, Arpoh-Baah, Odoom, Afram, Addai and Agyemang (2022) confirm that factors such as remuneration, care and concern from employers, training and development opportunities, an improved promotion system, conducive working environment and increased employee engagement, influenced retention of senior members in Ghanaian private tertiary institutions. This study focused on

retention strategies, such as work-life balance, employer-employee relationship and promotion, because these received little scholarly attention.

2.3.1 Work-life balance and talent retention

The term work-life balance was coined by Lockwood (2003) and has become popular in modern times, especially during the COVID-19 era. Osterman (1995) explains that work-life balance practices consist of institutionalised, structural, and procedural work arrangements and formal and informal practices, that assist people to easily manage both their work and family lives. Singh and Dubey (2016) argue that most employees leave their organisations because they feel that their emotions and passions have not been recognised. Moreover, Shockley, Smith and Knudsen (2017) and Hashim, Azman, Ghani and Sabri (2016) found that a strong link exists between work-life balance and employee retention. Likewise, Panda and Sahoo (2021) established that psychological empowerment partially mediates the relationship between work–life balance and the retention of professionals. Based on the above, the following hypothesis could be formulated:

H_1 There is a statistically significant relationship between work-life balance and talent retention

2.3.2 Employer-employee relationship and talent retention

Torrington and Hall (1998) conceptualise the employer-employee relationship as a framework of organisational justice, which comprises organisational culture and management styles and rules, as well as procedures dealing with employee grievances. A good employer-employee relationship is also important because it encourages employees to work better and to achieve increasingly good results (Burns, 2012). Oruh, Mordi, Ajonbadi, Mojeed-Sanni, Nwagbara and Rahman (2020) found that managerialist employment relations had a negative effect on the retention of doctors in Nigeria. Kim, Tam and Kim and Rhee (2017), in their study, discover that organisational justice and organisation-employee relationship quality have a negative association with turnover intention. Based on the above, the following hypothesis could be formulated:

H_2 There is a statistically significant relationship between employer-employee relationship and talent retention

2.3.3 Employee promotion and talent retention

Promotion has been described as the movement of an employee from a lower position to a higher position within the organisational hierarchy (Otoo, Assuming & Agyei, 2018; Dessler, 2008). Promotion often results in a rise in the employee's salary, with a concomitant span of authority and control (Baker, Jensen & Murphy 1994). According to Netswera and Rankhumise (2005), the opportunity for promotion is an important reason for most workers remaining in their job, particularly those young and enthusiastic. Singh (2012) concurs that promotion increases the morale of employees and encourages them to take more interest in their work. Ekabu, Nyagah and Kalai (2018) and Sitati, Were and Waititu (2016) also confirm that that prospects of promotion significantly impacted employee retention within organisations. A study by Bibi, Pangil, Johari and Ahmad (2017) reveals that compensation and promotional opportunities had a significant relationship with employee retention. In their study, Ekabu, Nyagah and Kalai (2018) confirm that promotion prospect has a negative and an inverse relationship with turnover intention. By contrast, Fairris (2004) found that employee promotion is associated with high turnover. The findings by Fairris (2004) are also consistent with Joarder, Sharif and Ahmmed (2011), who discovered that employees' opportunity for promotion has less impact on faculty turnover decisions. Following the above, the hypothesis below could be formulated:

H_3 There is a statistically significant relationship between promotion and talent retention

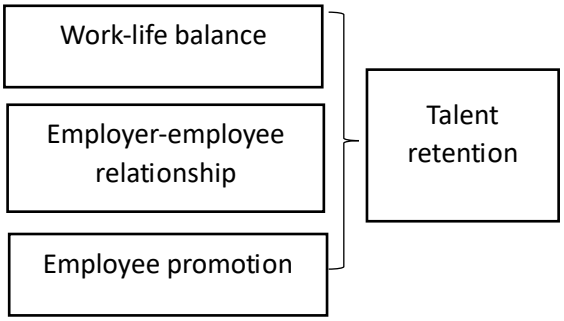
2.4 Theoretical Framework that Underpins this Study

The KBV of the firm is the most appropriate theoretical lens upon which the study is predicated. The KBV theory maintains that knowledge is the most crucial resource of every organisation (Bontis, 2002; Barney, 1991). The KBV assumes that the most important input of production and primary source of value is knowledge (Grant, 1996). The term 'knowledge' has been conceptualised as a strategic resource that does not lose value as do traditional economic productive factors (land, capital, labour, and entrepreneurship) (Alchian & Demsetz, 1972). The KBV of the firm is further based on the premise that competitive success lies in the ability of the firm to develop new knowledge-based assets that create core competencies. The assumptions of the KBV of the firm are consistent with the aims of talent retention, which stimulates and inspires talented workforce to remain working with the organisation for a longer duration. The KBV of the firm is the most

appropriate theoretical lens because, when applied, it will help HEIs to generate, integrate, share and retain knowledge required to compete in the competitive markets.

2.5 Conceptual Model

The conceptual model upon which the study is predicated is shown in Figure 1.



Source: The Authors

Figure 1: Talent Retention Strategies in Higher Education Institutions

As depicted in Figure 1, work-life balance, employer-employee relationship and employee promotion positively impact talent retention in South African HEIs. This assumption is consistent which previous empirical research, which states that work-life balance (Mabaso *et al*., 2021; Smith & Knudsen, 2017), employer-employee relationship (Oruh et al., 2020) and promotion (Sitati *et al*., 2016) statistically impact talent retention in organisations.

3. Research Methodlogy

The study adopted pragmatism as the research paradigm because it offers an alternative approach integrating positivist and constructivist paradigms into one research, thereby determining how quantitative and qualitative methods are used. Descriptive and exploratory studies were conducted to adequately describe and provide an in-depth understanding of the talent retention strategies in South African HEIs. The mixed-methods research was used to validate the research findings. The study was conducted in three South African HEIs in Durban, Cape Town and Pretoria. The target population for the study was 3613, which included academics, cluster leaders, deans, and professional services. The stratified and purposive sampling techniques were used to select 347 participants for the study. The study variables were measured on a 5-point scale, ranging from strongly agree (5) to strongly disagree (1). The questionnaire comprised 16 items: work-life balance (4 items), promotion (4 items) and employer-employee relationship (7 items). The measuring instrument was validated and fit for this study. Quantitative data quality was determined through reliability and validity, while qualitative quality control was assessed through trustworthiness – credibility, dependability, conformability and transferability. The quantitative data was collected from 265 respondents, whereas the qualitative data was collected from 12 participants. The Statistical Package for the Social Sciences (version 27.0) was used to analyse the quantitative data. Descriptive and inferential statistics were computed to interpret the findings. For instance, Cronbach's alpha coefficient was used to determine the reliability of the measuring instrument, while factor analysis was computed to assess the validity of the measuring instrument. Moreover, Kaiser-Meyer-Olkin Measure and Bartlett's Test were utilised to assess the sample adequacy. Pearson's correlation (*r*) was used to determine the relationship between the dependent (talent retention) and independent variables (employer-employee relationship, promotion and work-life balance). The qualitative data was analysed using NVivo (version 12.0). The thematic analysis was employed to analyse the qualitative data to identify, organise and report the patterns or themes from the dataset.

4. Findings

Cronbach's alpha was computed to determine the reliability of the questionnaire. It helped to determine whether tests and scales adopted in this study are fit for purpose. Traub and Rowley (1991) suggest that the reliability score ranges from 0 to 1, with perfect reliability equalling 1 and no reliability equalling 0. According to the rule of thumb, reliability scores between 0.70 and 0.80 may be acceptable (Downing, 2004). The findings are shown in Table 1 below.

Table 1: Reliability of the Questionnaire - Cronbach Alpha

Variables	Number of Items	Cronbach Alpha
Employer-employee relationship	7	0.92
Promotion	4	0.74
Work-life balance	4	0.80

Table 1 shows that the reliability scores range from 0.74 (for promotion) to 0.92 (for employer-employee relationship), suggesting internal consistency. From the statistical point of view, the findings suggest a reasonable degree of reliability because they met the threshold. Therefore, the research instrument used to collect the data was reliable, and can be adopted by scholars in similar research Table 2 below shows the results of the exploratory factor analysis (EFA).

The EFA is usually applied in social science research (Razak, Ma'amor & Hassan, 2016). EFA aims to provide in-depth relationships among variables in a study. Therefore, EFA was used to evaluate the relationship between latent variables developing theoretical constructs. The EFA, using the principal component extraction method, was computed to reduce the number of factors in the structural model. Items with loadings >0.40 were regarded as highly significant when extracting the factors, making them more interpretable.

Table 2: Validity of the Questionnaire- Pattern Matrix[a]

	Component		
	1	**2**	**3**
EER1	.741		
EER2	.763		
EER3	.809		
EER4	.742		
EER5	.736		
EER6	.742		
EER7	.790		
P1		.699	
P2		.339	
P3		.546	
P4		.493	
QWL1			.635
QWL2			.799
QWL3			.710
QWL4			.588
Eigenvalue	**7.09**	**1.74**	**0.95**
% of variance	**47.26**	**11.57**	**6.30**
Extraction Method: Principal Component Analysis.			
a. 3 components extracted.			

From Table 2, the findings revealed that three factors could be extracted: Factor 1 (Employer-employee relationship), Factor 2 (Promotion) and Factor 3 (Work-life balance). The three factors explained 65.13% of the variance of the questionnaire. Furthermore, the findings showed that all the items in the questionnaire suggested acceptable loadings of > 0.30.

As explained above, the KMO and Bartlett's test measures the sample size adequacy, ranging from 0 to 1, reaching 1 when all the items were perfectly estimated without an error. Table 3 below shows the results of the KMO and Bartlett's test.

Table 3: Meyer-Olkin Measure and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		**.901**
Bartlett's Test of Sphericity	Approx. Chi-Square	2273.605
	Df	105
	Sig.	.000

From Table 3, the measure of sample adequacy (MSA) score was 0.901 (marvellous). Statistically, the requirements of sampling adequacy were met. Thus, the sample was adequate for the factor analysis. Table 4 shows the descriptive statistics. Descriptive statistics were used to summarise the data in an organised manner, which helped to explain the relationship between variables in the sample. Measures of central tendency such as Mean was used to determine the inter-item consistency of the various constructs that formed part of the study. Using the scale of 1-5, a mean score value of 3.00 and beyond was considered significant, hence acceptable. Moreover, measures of dispersion, including standard deviation (SD) was used to describe the degree to which the data value for the construct is spread around the mean value.

Table 4: Descriptive Statistics

Dimension	**Mean**	**95 % Confidence Interval**		**Std. Dev.**	**Min.**	**Max.**
		Lower Bound	Upper Bound			
Employer-employee relationship	4.42	4.35	4.50	0.64409	1.00	5.00
Work-life balance	4.41	4.34	4.49	0.61909	1.00	5.00
Promotion	4.32	4.25	4.40	4.5000	1.00	5.00

The findings from Table 4 suggest that the items measuring employer-employee relationship (Mean = 4.42), work-life balance (Mean = 4.41) and promotion (Mean = 4.32) have very high mean scores, exceeding 3.00. The findings indicated that all the variables that form part of this study are highly significant. This implies that the respondents perceived employer - employee relations, work-life balance and promotion as TM practices that influence the talent retention in HEIs. Table 5 shows the results of the inferential statistics using Pearson's correlation.

Table 5: Pearson's Correlation

		Talent retention	**Employer-employee relationship**	**Work-life balance**	**Promotion**
Talent retention	Pearson Correlation	1	-	-	-
	Sig. (2-tailed)				
	N	265			
Employer-employee relationship	Pearson Correlation	.909**	1	-	-
	Sig. (2-tailed)	<.001			
	N	265	265		
Work-life balance	Pearson Correlation	.869**	.681**	1	-
	Sig. (2-tailed)	<.001	<.001		
	N	265	265	265	
Promotion	Pearson Correlation	.767**	.492**	.619**	1
	Sig. (2-tailed)	<.001	<.001	<.001	
	N	265	265	265	265
**. Correlation is significant at the 0.01 level (2-tailed).					

Table 5 showed a strong positive relationship between talent retention and the employer-employee relationship (r = 0.909, p < 0.001). Moreover, a strong positive relationship existed between talent retention and work-life balance (r = 0.869, p < 0.001). Furthermore, there was a strong positive relationship between talent retention and promotion (r = 0.767, p < 0.001). The subsequent section presents the qualitative findings. The data analysis suggests that talent retention strategies in South African HEIs included employee promotion, employer-employee relationships, and work-life balance. The following section describes the qualitative findings.

The qualitative data was collected from 12 participants through online interviews during the COVID-19 pandemic. The data was transcribed manually and analysed using NVivo. The study adopted the six qualitative data analysis steps proposed by Braun and Clarke (2006). These include data familiarization, generating codes, searching for themes, reviewing themes, defining themes, and write-up. Thematic analysis was adopted to help identify, organise and report the patterns from the dataset. Following this, mind maps were used as the visual representation to help sort the different codes into themes. Some codes were classified as main themes, whereas others were categorised as sub-themes. The thematic analysis revealed that promotion, employer-employee relationship and work-life balance were the talent retention strategies most employees valued most in higher education institutions. The themes which form the basis of the findings are shown in Figure 2.

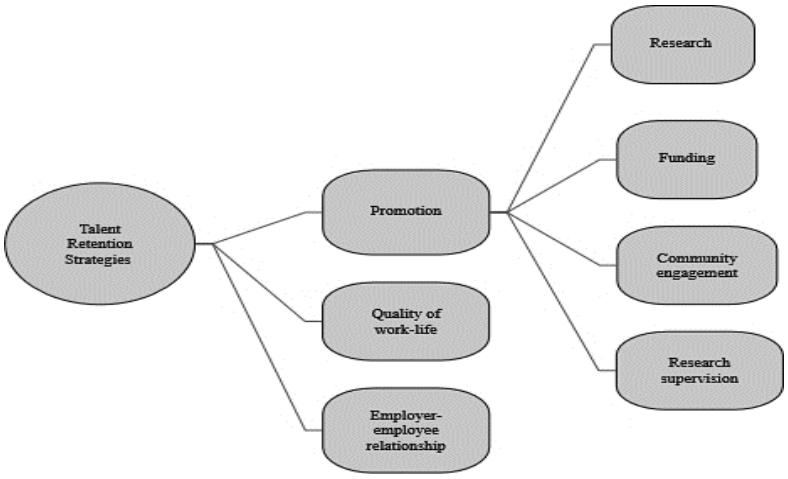


Figure 2: Talent Retention Strategies

4.1 Theme 1: Promotion

Based on the interviews, most (N = 7) participants argued that promotion was an essential TM practice that helped reduce labour turnover in South Africa. The following are some of the participants' quotes related to the findings.

Participant 7:

In academia, promotion is considered an important issue. Promotion, as a TM tool, can influence staff retention either positively or negatively. Institutions that value staff promotion is more likely to retain their human capital (Institution A).

4.2 Theme 2: Work-Life Balance

From the interviews, the majority (N = 9) expressed a similar opinion that quality of work-life balance was a vital TM practice that helped retain talent. The following are some of the quotes that emerged from the interviews.

Participant 1:

A better quality of work-life balance is the key to attracting and retaining qualified and motivated employees in an organisation. To reduce labour turnover, institutions like this have designed and implemented programmes such as flexible work arrangements to improve the quality of work-life for all staff (Institution B).

4.3 Theme 3: Employer-Employee Relationship

From the interviews, most (N = 7) participants believed that, although the employer-employee relationship influenced talent retention, the relationship among staff in South African HEIs was problematic. Some of the participants' views on the findings are stated as follows.

> *Participant 8:*
>
> *I am not sure that the relationship in this institution is a healthy one. We are supposed to be working together as teams, but some people act otherwise. For example, it is difficult for most staff to collaborate to publish papers (Institution A).*

5. Discussion

Barkhuizen et al. (2020, p.191) contend that the voluntary turnover intentions of academics in South African HEIs are escalating, which presents significant challenges to HEIs, including "additional costs for the induction and training of new staff, loss of research outputs and organisational productivity, and reduced quality of teaching due to mid-semester replacements of lecturers." Against this background, the study investigated TM practices influencing talent retention in South African HEIs. Three hypotheses supported the study. Hypothesis 1, indicated a statistically significant relationship between work-life balance and talent retention. Moreover, interviews were conducted to confirm and validate the quantitative results. This hypothesis was tested and achieved via mixed-methods research. The results of the quantitative and qualitative studies confirmed that work-life balance positively impacted talent retention in South African HEIs. The findings are consistent with previous studies (Shockley et al., 2017; Singh & Dubey, 2016), which state that a strong relationship exists between work-life balance and employee retention. According to Singh and Dubey (2016), most employees leave their organisations because they feel that their emotions and passions have not been recognised. In a recent study, Panda and Sahoo (2021) confirmed that psychological empowerment partially mediates the relationship between work–life balance and the retention of professionals. This study confirms that work-life balance leads to a stronger organisational commitment. It has been proven that employees who adhere to work-life balance programmes think more strongly about remaining in the same organisations for a maximum period. According to Panda and Sahoo (2021), 60% of research demonstrated that those employees who can balance professional responsibility with family and personal responsibilities have a greater tendency to remain in a particular organisation. The views of the above authors are also consistent with Kanwar, Singh and Kodwani (2009), who state that work-life balance programmes demonstrate the likelihood of increasing employee morale, reducing absenteeism and retaining employees.

Hypothesis 2, states that a statistically significant relationship occurs between employer-employee relationship and talent retention. This hypothesis was also tested and achieved through mixed methods. The results from the quantitative and qualitative studies agreed that the employer-employee relationship influenced talent retention in South African HEIs. Oruh et al. (2020) found that managerialist employment relations had a negative effect on the retention of doctors in Nigeria. By contrast, Kim et al. (2017) discovered that organisational justice and organisation-employee relationship quality are negatively associated with turnover intention.

Hypothesis 3, states a statistically significant relationship between promotion and talent retention. The results of the quantitative and qualitative studies confirmed that promotion positively impacted talent retention in South African HEIs. The findings are also supported by existing research. Sitati et al. (2016) confirm that promotion prospects significantly impact employee retention within organisations. Moreover, Bibi et al. (2017) confirm that compensation and promotional opportunities had a significant relationship with employee retention. Likewise, a study by Ekabu et al. (2018) reaffirms that promotion prospect has a negative and an inverse relationship with turnover intention. On the contrary, Fairris (2004) argues that employee promotion is associated with high turnover. Joarder et al. (2011) also found that employees' opportunity for promotion has less impact on faculty turnover decisions.

6. Managerial and Theoretical Implications

This study explored TM practices influencing talent retention in South African HEIs. The findings will be important tools for HEIs to retain their intellectual capital or knowledge workers. Theoretically, the findings will help expand knowledge on TM, KM and talent retention in HEIs. Thus, the study will provide better understanding of TM, KM and talent retention in HEIs.

7. Conclusion

Labour turnover in academic institutions worldwide has become a concern for many stakeholders of HEIs. For this reason, the study examined the TM practices that influence talent in South African HEIs. The findings demonstrated that TM practices, such as employer-employee relationship, work-life balance and promotion, positively impacted talent retention in South African HEIs.

8. Limitations and Directions For Future Research

The scope of the study only applied to South African HEIs, limiting the generalisation of the findings because of the differences in an organisational context. Hence, future research should focus on different industries.

Data Availability Statement

The original contributions presented in the study are included in the article. Further inquiries can be directed to the corresponding author.

Ethics Statement

The research protocol (HSSREC/00000852/2019) was approved by the University of KwaZulu-Natal Humanities and Social Sciences Research Ethics Committee.

Author Contributions

All authors mentioned in this manuscript have made a substantial, direct, and intellectual contribution to the work and approved it for publication. This article is published as an extension of the doctoral thesis pertaining to the first author.

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Competing Interests

The authors have declared that no competing interest exists.

Disclaimer

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How Sharing Pro-Environmental Knowledge Creates Business Management Processes

Małgorzata Łęgowik-Małolepsza
Technical University of Częstochowa, Poland

m.legowik-malolepsza@pcz.plz

Abstract: The study poses a research question: how does sharing pro-environmental knowledge create business management processes? Although pro-environmental knowledge is important for the success of modern enterprises, the literature on the subject does not provide insight into the dynamic processes taking place in the market environment of enterprises, not to mention how pro-environmental knowledge increases the attractiveness of enterprises' offers and allows them to react quickly to changes. Against this background, this study, conducted on a sample of 1,024 enterprises, analyzes the effects of introducing pro-environmental knowledge in the context of creating business management processes. Moreover, this study develops a holistic framework to explain the interactions between pro-environmental knowledge and tailored to the needs and expectations of all employees (Bissing-Olson, Iyer, Fielding, Zacher, 2013). Observations and the proposed framework shed new light on the understanding and acceptance of the creative role of pro-environmental knowledge in company management by company employees.

Keywords: Sharing knowledge, Pro-environmental, Business management processes

1. Introduction

The subject-matter related to pro-environmental activities is important not only due to the need to protect natural resources and minimize the negative impact on the natural environment, but also simply becomes fashionable among enterprises. In this paper “pro-environmental” knowledge is understood as ecological awareness regarding limited natural resources, environmental pollution or an increase in the level of consumer waste, which causes not only changes in consumer behaviour, but also the way of doing business by enterprises that see the need to implement pro-environmental activities (Norton, Zacher, Ashkanasy, 2015).

Possessing pro-environmental knowledge and its skillful application provides the opportunity to increase the attractiveness of offers of enterprises and allows for responding quickly to changes in the environment (Otola, 2009). However, to make this possible, it is necessary to implement an effective way of sharing pro-environmental knowledge in enterprises so that pro-environmental activities are understandable and acceptable to the company's employees. Sharing pro-environmental knowledge is also inextricably linked to adjusting pro-environmental activities to the needs and expectations of all employees.

2. Pro-Environmental Knowledge as a set of Information

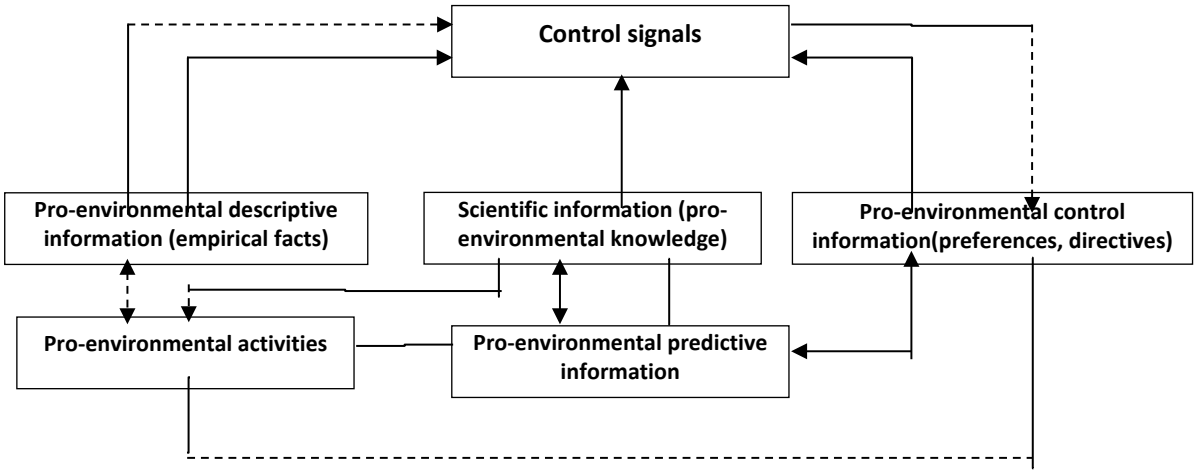
Due to the role that pro-environmental knowledge plays in the area of business management processes, taking into account the time factor it refers to, the following types of pro-environmental information in an enterprise building knowledge can be listed (Pichert, Katsikopoulos, 2008):

- pro-environmental descriptive information - presenting the real world in the present time, showing its pro-environmental aspects concerning life and work, taking into account the pro-environmental relations between participants of economic processes, pro-environmental methods and techniques applied, technical and economic connections and various pro-environmental phenomena occurring in the real world,
- pro-environmental predictive information – which relates to predicting future pro-environmental phenomena and events, the scope of which is unlimited, it may refer to the spheres of social, economic, and technological life. As part of pro-environmental predictive information, one can distinguish scientific information, pro-environmental knowledge, which is the result of scientific research. It concerns the formulation of innovation related to, e.g., new pro-environmental technologies, production, or management processes and mainly refers to future pro-environmental applications. In the economic system, there is information called control information, through which it is possible to influence the pro-environmental behavior of people and the nature of decisions made by them. Control information consists of:
- pro-environmental information on preferences – this type of information is aimed at pro-environmental tastes of users and is intended to encourage specific behavior. This information concerns the identification of pro-environmental goals and functions as well as the assessment of

value, indicates the advantages and disadvantages of the solution, it is intended to encourage or discourage,

- pro-environmental directive information - which concerns control through various types of pro-environmental orders, prohibitions, instructions, guidelines, signposts, standards, rules, guidelines. In addition, it is to persuade people to make certain pro-environmental decisions.

The relationships between the four types of pro-environmental information listed above in the perspective of business management processes are presented in Figure 1, the interpretation of which shows the links in the course of development between various types of pro-environmental information (solid lines) and the relationships in the course of controlling development (dashed lines). The diagram also shows control signals, i.e., pieces of pro-environmental information "from the real-world system and the institutional environment, which connect them together and determine the degree of compliance of actions taken under the influence of control information with the existing situation."



Source: Own study based on: Wiatrak, 1997.

Figure 1: Types of Pro-Environmental Information and Connections Between Them

In regard to the presented division of pro-environmental information in economic processes, taking into account the time factor, the role of pro-environmental information in solving decision-making problems and making decisions should be emphasized. In the field of enterprise management, the place of pro-environmental information “primarily consists in the reduction in pro-environmental uncertainty, assessment of risk of planned strategic activities and the possibility of the company’s development”. Pro-environmental information plays an important role in building the company's knowledge, and thus the competitive advantage of the company, i.e., in maintaining the company in the market, which can be classified under the following categories (Huang, 2016):

- pro-environmental information as the basis for decisions - regardless of the position taken, a sufficiently detailed information base is necessary for the process of effective decision-making,
- pro-environmental information of strategic importance - pro-environmental information applies to all areas of the company's activity at the same time, it cannot be excluded from any department, therefore it has a global reach within a given company and affects all its management functions,
- ro-environmental information as "added value" - the added value of the product or service increases in proportion to the increase in available pro-environmental information on the stages of creating this product or service,
- pro-environmental information as a commodity - information has become the object of exchange, which takes place in purchase and sale transactions. Various types of business intelligence agencies and consulting companies deal with the sale of information.
- pro-environmental information as the fourth factor of production - information, in addition to labor, land and capital, affects the size of the company's income and costs,
- pro-environmental information as a factor affecting the functioning of society - today it is impossible to imagine life without access to such a huge source of information as the Internet, the impact of which on the functioning of society is indefinable,
- pro-environmental information as meeting the needs and possibilities of management - having a specific resource of information, the management staff have insight into the internal and external

situation of the enterprise, quickly notice emerging needs that can be satisfied by using the possibilities of management.

To sum up, the presented types of pro-environmental information create knowledge in the company. Its identification, dissemination and skillful use allow for gaining a competitive advantage and survive in dynamic market conditions. Streamlining knowledge sharing processes in enterprises shapes the possibilities of creating management processes in these enterprises.

3. Determinants of Knowledge Sharing

When attempting to define the determinants of knowledge sharing, it is worth paying attention to the approach to information management, referred to as the concept of *information orientation* (IO) developed by D.A. Marchand (Marchand, 2000), which deals with the information behavior of employees, the technology applied and knowledge management. As a result of the conducted research, D.A. Marchand indicated the existence of competences affecting the effective use of knowledge and its sharing. Fifteen competencies have been divided into three areas of information management relating to:

- Human behavior - the first group includes 6 out of 15 employee competencies that should be instilled in the behavior of managers. They affect the values they present in relation to the use of knowledge and the following are distinguished here: proactivity, sharing, transparency, control, formalization, integrity.
- Knowledge sharing practices - the next five competences for the effective use of knowledge refer to the use of the company's potential to make the best use of information in the entire enterprise management process. The following competencies are distinguished in this group: knowledge identification, knowledge processing, knowledge maintenance, knowledge organization, knowledge cumulation.
- Information technology practices - the last 4 competencies concern the proper use of the available information infrastructure in the areas of: management, innovation, business processes and operations (Pavalache-Ilie, Cazan, 2018)·

The idea of the method is to show the relationship between the way of knowledge management, behavior of employees towards information and the technology used and the impact on the overall performance of the company (Davenport, Marchand, 2000). This efficiency can be measured by an increase in market share, level of innovativeness or increasing the company's reputation. The information-oriented approach to knowledge sharing integrates all levels of management and applies to all levels of activity (operational, tactical, and strategic). 15 competencies by D.A. Marchand affecting the effective application and sharing of knowledge are presented in Figure 1.

To sum up, the presented continuum of knowledge sharing conditions presenting 15 competencies by D.A. Marchand affecting the effective use of knowledge and sharing it, is a set of determinants of knowledge sharing, which, when implemented in the business activity of the entity, increase its chances of survival in the dynamic market environment of enterprises.

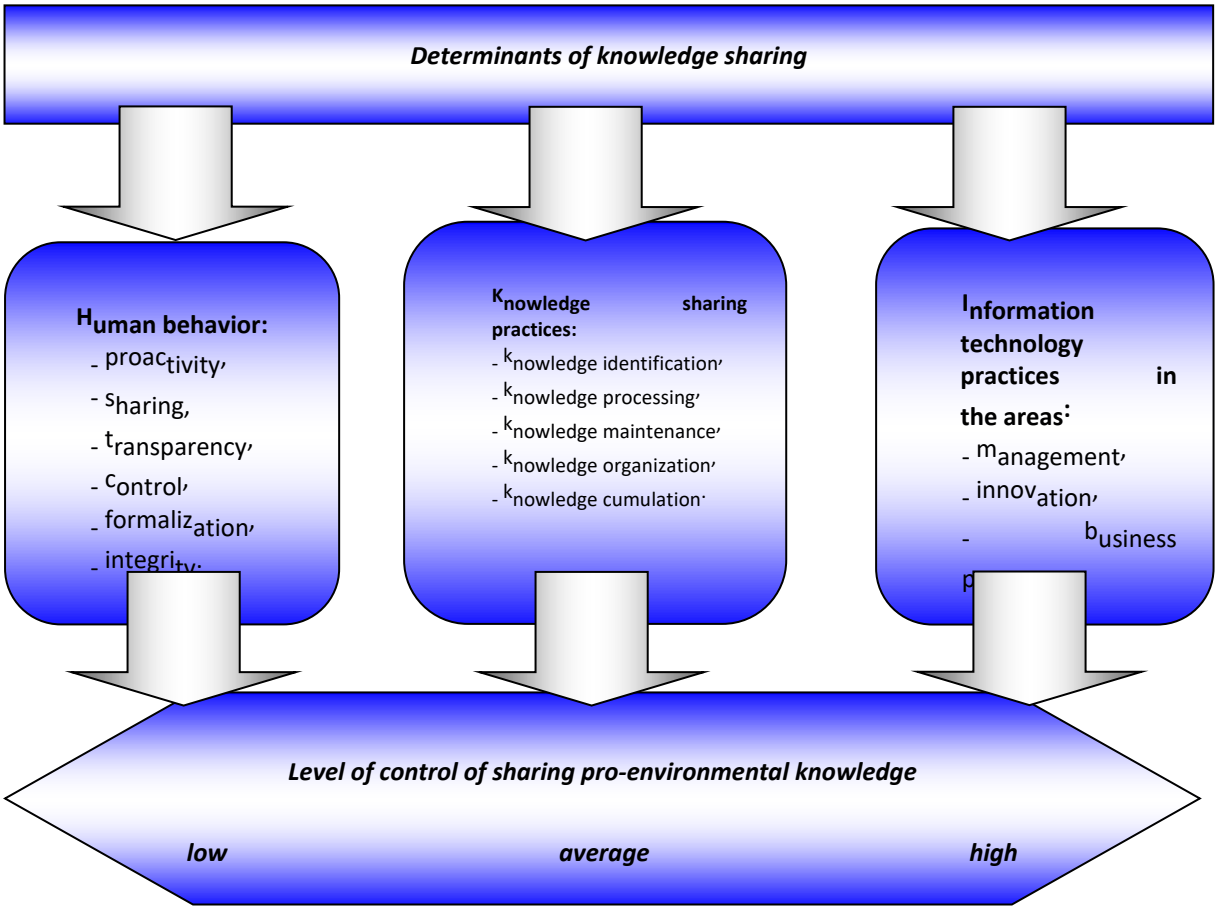
4. Objectives of Sharing Pro-Environmental Knowledge and Enterprise Management

The objectives of sharing pro-environmental knowledge in the enterprise can be considered in relation to three levels: enterprise resources, enterprise functions, management problems.

At the level of enterprise resources, sharing pro-environmental knowledge should support processes related to the management of company resources, i.e., human resources, from recruitment, through motivation, to dismissal. Another resource is financial management, including, among others, supporting cash flows. Then, sharing pro-environmental knowledge is to support processes related to the management of fixed and current assets, their acquisition and use, and involvement in the production process. Finally, sharing pro-environmental knowledge is aimed at supporting and streamlining information flows and, consequently, supplying the company and its employees with knowledge. Therefore, the sharing of pro-environmental knowledge is to support the sharing of knowledge and information throughout the value creation chain of the enterprise, by providing pro-environmental knowledge in the appropriate quantity and quality.

From the point of view of the company's function, sharing pro-environmental knowledge refers to the functional areas that exist in the company, it is aimed at supporting processes related to, among others, the area of supply

management, it is to improve the flow of pro-environmental information about suppliers, deliveries, deadlines for their implementation, etc. Another functional area is production management, where the proper sharing of pro-environmental knowledge is to facilitate the planning and control of the production process. Providing pro-environmental knowledge in the right quantity and quality is also necessary for the functioning of other areas, such as distribution and marketing management. In order to achieve the company's goals, it is necessary to share current pro-environmental knowledge in the field of market research, research into tastes and preferences of current and potential buyers, promotion and advertising.



Source: Own study based on: Stoner, Freeman and Gilbert 2001; Griffin, 2000.

Figure 2: Continuum of Knowledge Sharing Conditions

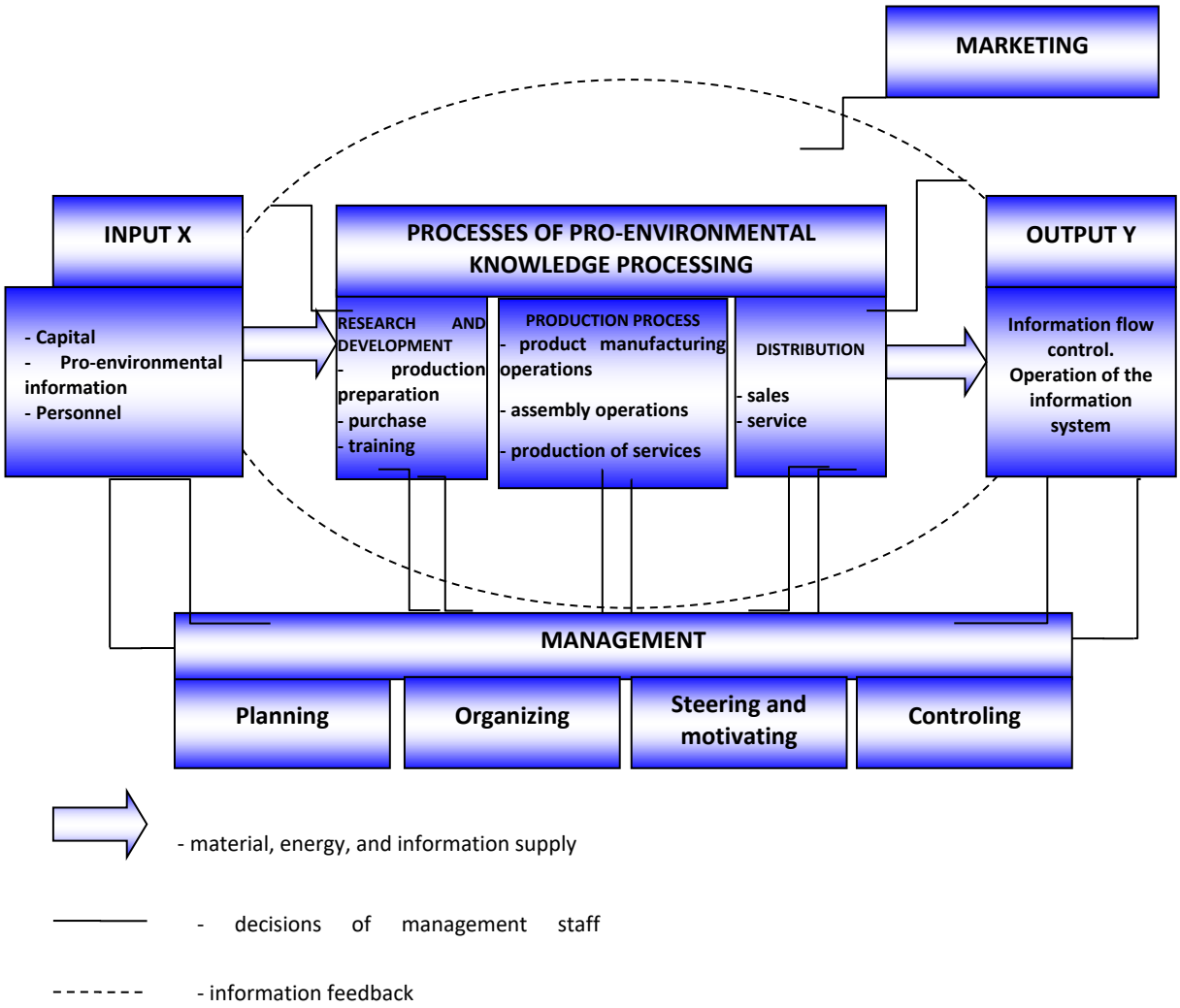
Management issues are a platform where the sharing of pro-environmental knowledge is to serve the ongoing monitoring of performance management. It is to provide pro-environmental knowledge for the calculation of performance indicators, and in the case of obtaining inappropriate parameters of these indicators, to indicate the areas causing these distortions. Analogically to performance management, pro-environmental knowledge management is intended to serve quality management (Dayan, Heisig, Matos, 2017). It is to monitor the level of quality in all possible areas on an ongoing basis and to justify the reasons for deficiencies in this quality if such cases occur.

To sum up, the discussed objectives of sharing pro-environmental knowledge in the company were related to the resources and functions of the company and management problems, but this is not a closed range of application areas of pro-environmental knowledge, but only an outline for further considerations.

5. Pro-Environmental Knowledge in Enterprise Management

When assuming that "information is treated as one of the essential factors due to which the enterprise can shorten the response time to changes in the environment" (Stefanowicz, 2004), special attention should be paid to the flow of pro-environmental information in the implementation of enterprise management processes. The dynamic aspect of managing pro-environmental information flow processes is associated with (...) planning, organizing, and controlling the actual implementation of sequences of activities

that constitute the processes implemented in the company (Pavalache-Ilie, Unianu, 2012). In static terms, process management concerns the management of pro-environmental information resources and "is associated with the issues of information policy, the required level of information quality, information security policy in the context of information technologies" (Molla, Abareshi, Cooper, 2014).



Source: Own study based on: Durlik, 1993.

Figure 3: Model of Pro-Environmental Information Flow in Economic Processes in Enterprise Management

In analogy to the three elementary levels of management, the management of pro-environmental knowledge flow processes can also be considered from the point of view of the same three levels (Klöckner, 2015):

- strategic management of pro-environmental knowledge flow processes - consists in determining how the processes and pro-environmental information flow in the company are to run within 2-3 years. It is also planned how the resources are to be used to improve the company's position in the market and gain a competitive advantage,
- tactical management of pro-environmental knowledge flow processes – its scope includes the management of processes and pro-environmental information resources for up to 1 year. As part of this management, the response to changes in the environment is important, as well as medium-term supervision of flows of pro-environmental information streams and the functioning of the information system,
- operational management of pro-environmental knowledge flow processes - consists in ongoing planning, organization, implementation, and control of the functioning of the enterprise management system in terms of economic processes and access to pro-environmental information used in everyday work (Reeves, Love, Tillmanns, 2012).

The model of the pro-environmental information flow in economic processes in enterprise management is presented in Figure 3. In this model, resources in the form of capital, pro-environmental information and personnel are at the input to economic processes characteristic of enterprises. The processing of pro-environmental knowledge should take place at every stage of the product manufacturing process, i.e., at the stage of research and development, production, and distribution, including marketing activities. At the same time, the processing of pro-environmental knowledge should be implemented in terms of each management function, i.e., as part of planning, organizing, motivating and controlling (Casaló, Escario, 2018). In such a model process of pro-environmental knowledge processing, at the output, there is the ability of control the flow and operation of the pro-environmental information system.

6. The Research Methods

The research was conducted based on critical analysis of literature. Critical literature analysis is a research method that presents existing theoretical and empirical approaches and shows how to prepare research works aimed at expanding existing knowledge or developing a specific research field. Critical analysis of literature should therefore be treated as a synthetic, objective, and reliable summary of a specific theoretical area. In the second part of the study, pro-environmental attitudes in the surveyed enterprises were verified. In this part, the respondents' answers to 4 statements in the field of pro-environmental activities of enterprises were analyzed, which at the same time defined the answer to the research question posed in this study.

7. Verification of Pro-Environmental Attitudes in the Surveyed Enterprises - Research Procedure

The research procedure focuses on the analysis of 4 statements regarding the pro-environmental activities of enterprises, which were asked for using a questionnaire. The analyzed statements are presented below:

1. pro-environmental policy is flexible enough to respond quickly to any change,
2. pro-environmental policy introduced in the company increases the attractiveness of the product/service offer,
3. pro-environmental policy introduced in the company is understandable and acceptable to employees,
4. pro-environmental policy introduced in the company is tailored to the needs and expectations of all employees.

The research was carried out on a sample of 1024 randomly selected enterprises. Verification of pro-environmental attitudes in the surveyed enterprises allows for assessing how sharing pro-environmental knowledge creates business management processes.

Table 1: Verification of Statement No. 1

			Total
pro-environmental policy introduced in our company is flexible enough to respond quickly to any changes	I completely disagree	Number	146
		%	14.3%
	I disagree	Number	160
		%	15.6%
	I neither disagree nor agree	Number	326
		%	31.8%
	I agree	Number	288
		%	28.1%
	I completely agree	Number	104
		%	10.2%
Total		Number	1024
		%	100.0%

Source: Own study.

When relating to the first analyzed statement, 32% of the respondents have no opinion on whether the pro-environmental policy introduced in their company is flexible enough to allow for responding quickly to any change. This means that the sharing of pro- environmental knowledge is not flexible in these enterprises. Moreover, as much as 30% of the respondents unequivocally state that the pro-environmental policy, and thus sharing pro-environmental knowledge, is not flexible in their company. Thus, only 38% of the respondents believe that the pro-environmental policy introduced in their company is flexible enough to allow for responding quickly to any change.

To sum up, the results of the survey show that the pro-environmental policy implemented in enterprises represented by 62% of the respondents is ineffective, inflexible and requires the more effective sharing of pro-environmental knowledge. Therefore, according to 632 respondents, sharing pro-environmental knowledge has a negative impact on the creation of management processes since, in their opinion, sharing pro-environmental knowledge does not allow for responding quickly to any change.

Table 2: Verification of Statement No. 2

			Total
The pro-environmental policy introduced in our company increases the attractiveness of the product/service offer (they are more modern, fashionable...).	I completely disagree	Number	104
		%	10.2%
	I disagree	Number	122
		%	11.9%
	I neither disagree nor agree	Number	266
		%	26.0%
	I agree	Number	307
		%	30.0%
	I completely agree	Number	225
		%	22.0%
Total		Number	1024
		%	100.0%

Source: Own study.

When analyzing the responses of those surveyed to the second statement, it is noticeable that 26% of the respondents cannot adopt a position on whether the pro-environmental policy implemented in their company increases the attractiveness of their product/service offer (they are more modern or trendy), which is a similar result as in the case of the first statement. This implies that every fourth respondent recognizes the problem regarding sharing pro-environmental knowledge. On the other hand, only 22% of the respondents believe that the pro-environmental policy implemented in their company does not increase the attractiveness of their product/service offer, which can be interpreted in such a way that sharing pro-environmental knowledge in these companies is ineffective since it does not increase the attractiveness of their product/service offer. On the other hand, as much as 52% of the respondents declared that the pro-environmental policy implemented in their company increases the attractiveness of their product/service offer.

To sum up, it should be noted that over half of the respondents recognize positive effects of sharing pro-environmental knowledge in the form of increased attractiveness of their product/service offer. Therefore, according to 532 respondents, sharing pro-environmental knowledge has a positive impact on the creation of management processes as, in their opinion, sharing pro-environmental knowledge increases the attractiveness of the product/service offer.

Table 3: Verification of Statement No. 3

			Total
The pro-environmental policy introduced in our company is understandable and acceptable to the employees of the company	I completely disagree	Number	104
		%	10.2%
	I disagree	Number	83
		%	8.1%
	I neither disagree nor agree	Number	305
		%	29.8%
	I agree	Number	389
		%	38.0%
	I completely agree	Number	143
		%	14.0%
Total		Number	1024
		%	100.0%

Source: Own study.

The next analyzed statement was difficult to verify for 30% of the respondents, i.e., 305 respondents could not answer whether the pro-environmental policy introduced in their company is understandable and acceptable to the company's employees, which leads to the conclusion that the knowledge of pro-environmental activities undertaken in these 30% of the companies is not properly disseminated, communicated, and accepted by employees. At the same time, 18% of the respondents unequivocally answered that the pro-environmental policy introduced in their company is incomprehensible and unacceptable to the company's employees, which indicates a problem with sharing pro-environmental knowledge in these companies. On the other hand, 52% of the respondents decided that the pro-environmental policy introduced in their company is understandable and acceptable to the company's employees.

In conclusion, slightly more than half of the respondents believe that sharing pro-environmental knowledge brings a positive effect in the form of understanding and acceptance by employees of the actions taken and the pro-environmental policy implemented in the company. Thus, according to 532 respondents, sharing pro-environmental knowledge has a positive impact on the creation of management processes because, in their opinion, sharing pro-environmental knowledge makes the pro-environmental policy understandable and acceptable to the company's employees.

The last of the analyzed statements was difficult to answer by almost 28% of the respondents, who were unable to determine whether the pro-environmental policy introduced in their company is tailored to the needs and expectations of all employees. This means that the respondents do not have enough knowledge about the pro-environmental activities of enterprises. At the same time, it should be noted that over 20% of the respondents believe that the pro-environmental policy introduced in their company is not tailored to the needs and expectations of all employees. This is information about the lack of effective sharing of pro-environmental knowledge in those enterprises where it is necessary to implement corrective actions. In turn, 52% of the respondents claim that the pro-environmental policy introduced in their company is tailored to the needs and expectations of all employees.

To sum up, slightly more than half of the respondents believe that sharing pro-environmental knowledge brings a positive effect in the form of adjusting the pro-environmental policy in their company to the needs and expectations of all employees. Therefore, according to 533 respondents, sharing pro-environmental knowledge has a positive impact on the creation of management processes since, in their opinion, sharing pro-environmental knowledge makes the pro-environmental policy tailored to the needs and expectations of all employees.

Table 4: Verification of Statement No. 4

			Total
The pro-environmental policy introduced in our company is tailored to the needs and expectations of all employees	I completely disagree	Number	104
		%	10.2%
	I disagree	Number	104
		%	10.2%
	I neither disagree nor agree	Number	283
		%	27.6%
	I agree	Number	350
		%	34.2%
	I completely agree	Number	183
		%	17.9%
Total		Number	1024
		%	100.0%

Source: Own study.

8. Discussion

In relation to the analyzed 4 statements concerning pro-environmental policy, and thus pro-environmental knowledge, a large percentage of indecisive respondents draws attention, which ranged from 26% to 32% in individual questions. The answer "neither disagree nor agree" was chosen by 266 to 326 respondents, which means that they do not have pro-environmental knowledge, which creates enterprise management processes in such a way that the areas for improvement are indicated. In addition, considering the total number of respondents who disagreed with the above statements, it turns out that there were from 187 to 306 of them. These results not only show the problem with sharing pro-environmental knowledge, but also give consideration to whether the applied pro-environmental activities and the applicable pro-environmental policy are effective. To sum up, it should be emphasized that the information obtained based on the 4 above-mentioned statements provides many conclusions, the verification of which implies the need to implement appropriate pro-environmental knowledge management processes in enterprises, so as to increase the number of responses accepting the statements analyzed in this study in the future. For this purpose, it is recommended to implement D.A. Marchand's 15 competencies, influencing the effective application and sharing of knowledge, referred to in this study.

9. Conclusions

The conducted analysis concerning 4 statements showed the gaps in the area of sharing pro-environmental knowledge in enterprises. It turns out that although pro-environmental activities are widely known and applied, it still often happens that:

- pro-environmental policy is not flexible enough to respond quickly to any change (30%),
- pro-environmental policy introduced in the company does not increase the attractiveness of the product/service offer (22%),
- pro-environmental policy introduced in the company is incomprehensible and unacceptable to the company's employees (18%),
- pro-environmental policy introduced in the company does not match the needs and expectations of all employees (22%).

The indicated gaps in terms of sharing pro-environmental knowledge in enterprises create business management processes that emphasize pro-environmental activities. It is recommended to particularly emphasize the flexibility of undertaken pro-environmental activities, which can be achieved by greater focus on new, up-to-date solutions. In addition, it is noted that pro-environmental activities should have a positive impact on the attractiveness of the product/service offer. In turn, the sharing of pro-environmental knowledge should

be so consistently and effectively organized that pro-environmental activities are understandable and acceptable and tailored to the needs and expectations of all employees.

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Creating Knowledge of the Competitiveness of Enterprises in the Context of Changes in Management Processes

Sylwia Łęgowik-Świącik
Czestochowa University of Technology, The Faculty of Management, Poland

s.legowik-swiacik@pcz.pl

Abstract: The unpredictable conditions of the competitive environment of modern enterprises force managers to look for new ways of managing enterprises. Furthermore, the diversity of the competitive environment requires the introduction of changes in the management processes of the company, which will enable building a competitive advantage and will allow for its sustainability. Therefore, the study raises the research question: how to create knowledge of the competitiveness of enterprises in the context of changes in management processes. The study presents the concept according to which the introduction of changes in management processes requires the creation of knowledge, which will enable distinguishing the company against its competitors. Therefore, the objective of the study has been the in-depth understanding of the creation of knowledge of the competitiveness of enterprises in the context of changes that can be introduced in management processes. Moreover, the publication deepens the understanding of the relationship between competitiveness factors determining the company's capabilities, its prospects, and the projection of changes in the environment. The research methods applied to accomplish the assumed objective are critical analysis of literature, a survey questionnaire carried out in 2022 and Pearson's correlation analysis. The empirical research was conducted on the basis of data obtained from one hundred enterprises from Poland. The conclusions from the research suggest that managers' attention ought to be focused on identifying the factors of competitiveness of enterprises that enable them to achieve a competitive advantage.

Keywords: Creating knowledge, Enterprise management

1. Introduction

The dynamics of the competitive environment of modern enterprises is a characteristic that constitutes changes in management processes. Therefore, ensuring the sustainability of the company's competitive advantage requires managers not only to have the ability to recognize market opportunities and threats, but also to identify factors that create knowledge of the competitiveness of enterprises, allowing for introducing changes in management processes to create new value. The proper selection of factors creating knowledge of the competitiveness of enterprises should correspond to changes in markets (Fischer, 2011), management trends, and technologies, as they determine the achievement and maintenance of competitive advantages (Bojar, Freitag-Mika 2008). Furthermore, the selection of factors that create knowledge of the competitiveness of enterprises requires the identification of customer needs satisfied by products manufactured, determination of groups of customers whose needs are satisfied, and indication the way to satisfy those needs, as well as determination of functions fulfilled by the enterprise in its activities undertaken with the intention of achieving market objectives.

Due to the fact that it is currently believed that the main challenge faced by management teams of companies is changes in management processes (Hamel, 2007), the research interest in this article focuses on identifying the factors for creating knowledge of the competitiveness of enterprises and the possibilities of introducing changes in management processes to implement the acquired knowledge (Borgatti, Everett, Freeman, 2002). The objective of this article is to fill the gap by deepening the understanding of creating knowledge of the competitiveness of enterprises in the context of changes that can be introduced in management processes (Torres, dos Santos Ferraz, Santos-Rodrigues, Matos, 2016). Additionally, the article develops the subject literature by seeking relationships between the factors for creating knowledge of competitiveness.

The key research question is: how to create knowledge of the competitiveness of enterprises in the context of changes in management processes? Based on the literature review, the factors for creating knowledge of the competitiveness of enterprises were identified, taking into account changes in management processes. To achieve the adopted objective and answer the formulated research question, the structure of the article consists of three main parts. In the first part of the article, the competitiveness of enterprises in terms of changes in management processes is presented. The second part of the article is the presentation of the research methodology used to achieve the research objective. In the third part, the results of the empirical research are presented and discussed, depicting some theoretical conclusions along with practical implications.

2. Competitiveness of Enterprises and Changes in Management Processes

Creating the competitiveness of companies enables distinguishing the company against its competitors and allows for sustainable functioning in variable market conditions. This means that the competitiveness of enterprises has strategic importance in the management process, as a properly developed strategy should enable the creation of a competitive advantage in the market, perceived as the company's operations that include all of its functional areas together with the entire value chain (Porter, 2003). Building a strategy based on the potential of competitiveness can be a source of a competitive advantage for the company if it considers the utilization of key resources and skills (Soo, Devinney, 2002).

Referring to management theory, it is important to emphasize that the concept of the competitiveness of companies has many definitions. In the subject literature, the competitiveness of enterprises combines certain product characteristics (packaging, advertising, delivery conditions) and key resources (financial, human, material, intellectual), (Nikolova, Rodionov, Afanaseyeva, 2017). The competitiveness of the company depends on its opportunities, as well as other enterprises competing in the market (Prahalad, Krishnan, 2008). In the context of the competitiveness of enterprises (Cyfert Krzakiewicz 2016), the company's reputation is very important, which results from the brand, as well as knowledge acquired from relationships with customers and knowledge resulting from research in terms of services and products provided (Brandenburger, Nalebuff 1996). Companies seeking to stand out from competitors search for new sources of revenue, rationalize cost structure and improve products manufactured through changes in production technologies and accessibility for customers (Bumane, 2018). Competitiveness can be analyzed in terms of a company, product, industry, region, or country (Cherep, 2014).

The basis for obtaining benefits from the gained competitive advantage is the ability to generate increased value-added, associated with the transformation of the traditional value chain (Porter, 2000). M.E. Porter, the creator of the value chain, emphasized that it is an inherent part of the theory of competitive advantage (Porter 1979). He stated that the value chain is a general conceptual framework that allows for the consideration of any actions relevant to the company's activity from a strategic perspective. The concept of the value chain enables conducting the analysis of operating costs and evaluation of their significance in terms of the possibility of differentiation (Porter, 1990). M.E. Porter is known as the creator of the positioning school, but he also appreciated the importance of the resource-based school, writing that "actions are the essence of the company's functioning and determine the character of necessary resources and skills, and the selection of strategy determines whether individual resources and skills will be valuable for the company or not" (Porter, 2000). The concept of building a competitive advantage by M.E. Porter combines, on the one hand, the positioning theory of the strategic management school with the resource-based theory on the other hand (McGahan, Porter, 1997). The basis for building a competitive advantage is the crucial role of valuable actions and the value chain. According to M.E. Porter, the concept of building a competitive advantage harmoniously combines both theories because resources and competencies are the elements of concrete actions that are not detached from costs or value generated for the customer (Porter, Kramer, 2006).

A tool enabling changes in management processes in the conditions of market competition of enterprises is the business model. It presents the logic of the company's operations in a specific field, including a set of elements, factors, and relationships between them (Afuah, A. 2004). The business model can be treated as an advanced, contemporary form of the organizational model of enterprise management, which plays a key role in achieving the primary objective of every enterprise, which is to increase the value offered to the customer, which is to ensure that the company remains competitive (Afuah, Tucci, 2003) . The business model articulates the value proposition, identifies market segments, defines value chain structures, calculates cost structures and potential revenue sources, describes the company's position in the value chain connecting the supplier (Stępień, 2022), the company, and customers, and formulates the competitive strategy that allows for retaining profits (Chesbrough, Rosenbloom 2002). To sum up, it should be noted that the definitions referred to are the result of the scientific discourse conducted by researchers in the field of management (Kramer, Porter 2011). Attempting to synthesize a multidimensional approach to creating knowledge of the competitiveness of enterprises in variable market conditions (Chluska, 2022), it can be indicated that the factors constituting changes in enterprise management processes emerge from the presented definitions, and these are:

- new sources of revenue (Osterwalder, Pigneur, 2010),
- cost structure rationalization (Morris, Schindehutte, Allen, 2005),
- changes in the set of key resources (Hamel, 2002),

- changes in customer relationships (Osterwalder, Pigneur, 2002),
- changes in the area of services provided (Casadesus-Masanell, Ricart, 2011).

The presented factors for creating knowledge of the competitiveness of enterprises, considered in the context of changes in management processes, constitute a spectrum of functions that new knowledge is to provide. Proposing the factors for creating knowledge of competitiveness serves as a starting point for conducting empirical research and becomes a conventional, abstract carrier of innovation about creating knowledge of the competitiveness of companies.

3. Research Methodology

The study of the phenomenon of creating knowledge of the competitiveness of enterprises in the context of changes possible to introduce in management processes, an extract of which is presented here, was conducted in 2022 as part of the author's own research. In the first stage of the study, based on the analysis of the literature, the most important conclusions of which are presented in the previous part of the article, the factors for creating knowledge of the competitiveness of companies were identified, taking into account changes in management processes. Based on this, a survey questionnaire was prepared to deepen the understanding of creating knowledge of the competitiveness of enterprises in the context of changes that can be introduced in management processes.

The second main part of the study was conducted using the CATI method (Hair, 2014) on a sample of 100 Polish companies running business in the Silesian Voivodeship. The choice of the region was determined by the fact of constant changes in its economic profile. The Silesian voivodeship is undergoing intensive transformation from a region once dominated by the mining industry to an area related to services and creative industries (Department of Regional Development 2022). Moreover, the requirement to achieve the objectives related to achieving climate neutrality goals causes that companies operating in the Silesian voivodeship choose a business activity model directed to innovation development and knowledge management. The population of the surveyed companies consists of micro, small and medium-sized private sector service companies with a European territorial scope of activity. The selection of the population was based on the assumption that micro, small and medium-sized private sector service companies undergo strong competition and cannot benefit from economies of scale, therefore they should create knowledge of competitiveness and introduce changes in management processes. The initial population accepted for the study included approximately 300 companies (micro, small, and medium-sized), and during the study, it was possible to reach 100 respondents from such companies.

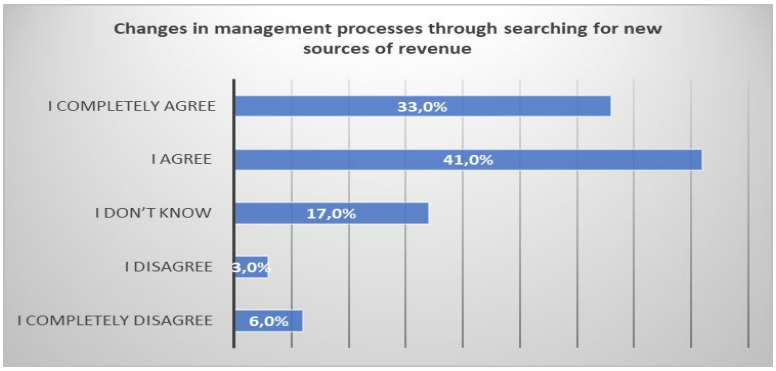
The research was conducted using a survey questionnaire. The respondents were the senior managers of the surveyed companies. The research tool was verified for reliability. The survey questionnaire used in the study covered five main issues of creating knowledge of the competitiveness of the surveyed companies in the context of changes in management processes: seeking new sources of revenue, cost structure rationalization, changes in the set of key resources, changes in customer relationships, and changes in the area of services provided. The statements describing the theoretically identified factors for creating knowledge of the competitiveness of the surveyed companies were rated by the respondents on a Likert scale, from 1 to 5, where the response of 1 indicated "I completely disagree" and 5 indicated "I completely agree" (Vogel, Koutsombogera, Costello, 2020).

To analyze the relationship between the factors for creating knowledge of the competitiveness of the surveyed companies, the linear Pearson correlation was applied in the second part of the study The ranges of the strength and direction of the linear relationship in the conducted analysis were as follows: from 0 to 0.4 - weak relationship, from 0.4 to 0.6 - moderate relationship, from 0.6 to 0.9 - strong relationship, from 0.9 to 1.0 - very strong relationship (Suchecki, 2013). In the statistical analysis, the significance level of $p = 0.05$ was assumed. The analyses were performed using SPSS software.

This article focuses on deepening the understanding of creating knowledge of the competitiveness of enterprises in the context of changes possible to introduce in management processes. Therefore, in the subsequent part of the article, the attention will be focused on the identification of factors for the competitiveness of enterprises and the relationships between these factors, which should contribute to achieving a competitive advantage through the projection of changes in management processes.

4. Results of the conducted Empirical Research

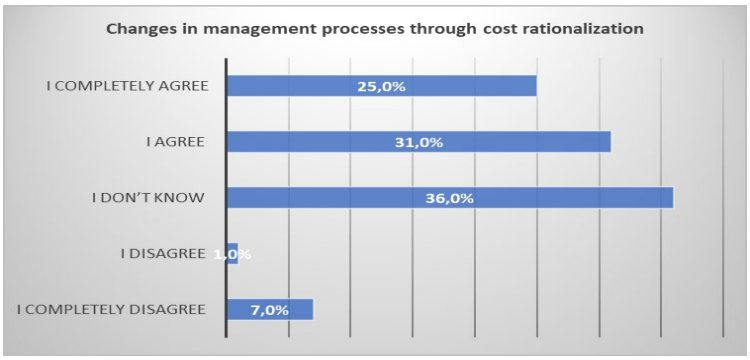
In the first stage of the research procedure, the factors for creating knowledge of competitiveness were identified and evaluated in the opinion of the respondents. Among the factors for creating knowledge of the competitiveness of the surveyed companies, the following were distinguished: searching for new sources of revenue, cost structure rationalization, changes in the set of key resources, changes in customer relationships, and changes in the area of services provided. Figure 1 shows new sources of revenue as the factors for creating knowledge of the competitiveness of the surveyed companies.



Source: Own study.

Figure 1: Searching for new Sources of Revenue as a Factor for Creating Knowledge of the Competitiveness of Enterprises

According to Figure 1, as much as 74% of the respondents declared that they completely agreed or agreed with the statement that their company introduces changes in management processes to seek new sources of revenue. Therefore, it can be concluded that the surveyed companies aim at expanding their knowledge of new sources of revenue of the conducted activity through offering new products and services, which may result in increased competitiveness. In turn, 17% of the respondents declared that they did not know whether their company searched for new sources of revenue, which may indicate the lack of the respondents' interest in expanding their offer. Additionally, 9% of the respondents completely disagreed or disagreed that their company searched for new sources of revenue. The presented research indicates that the vast majority of the respondents are interested in seeking new sources of revenue in their activities, which suggests that this is an important factor for creating knowledge of the competitiveness of the surveyed companies. Figure 2 presents cost structure rationalization as the factor for creating knowledge of the competitiveness of the surveyed companies.

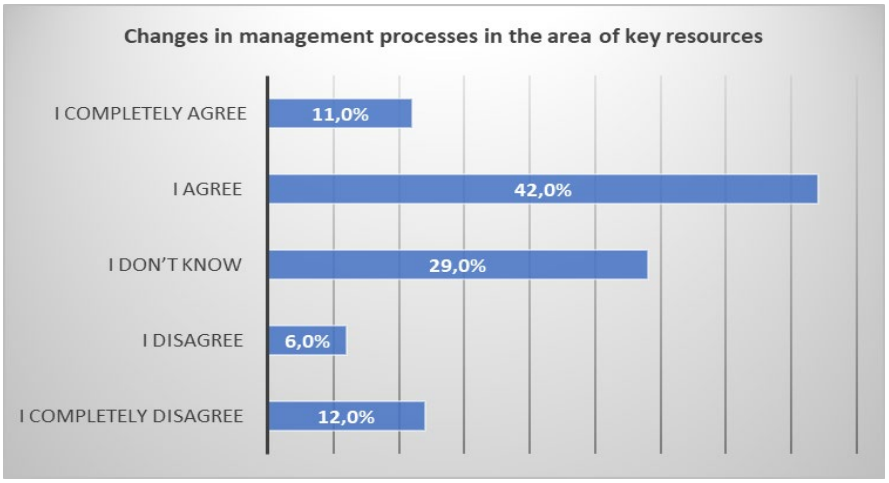


Source: Own study.

Figure 2: Cost rationalization as a Factor for Creating Knowledge of the Competitiveness Of Enterprise

According to the obtained research presented in Figure 2, 56% of the respondents declared that, in their companies, there were introduced changes in management processes through cost structure rationalization. This may suggest that these companies strive to reduce costs by identifying the areas of potential changes. In turn, 36% of the respondents do not have knowledge of cost structure rationalization in their company. Additionally, 8% of the respondents completely disagree or disagree that cost rationalization occurs in their company. The obtained results suggest that introducing changes in management processes in terms of cost structure rationalization is an important factor for creating knowledge of the competitiveness of the surveyed companies for the majority of the respondents. It informs how cost reduction affects the financial result and

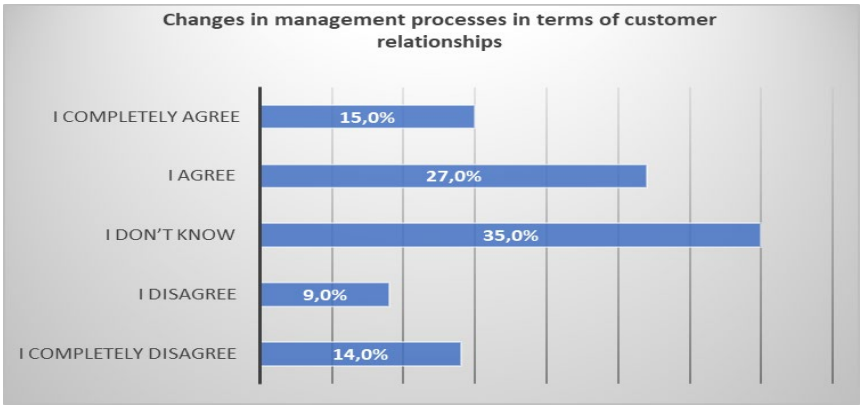
efficiency of the conducted activity. Figure 3 presents key resources as a factor for creating knowledge of the competitiveness of the surveyed companies.



Source: Own study.

Figure 3: The set of key Resources as a Factor for Creating Knowledge of the Competitiveness of Enterprises

Based on Figure 3, it can be concluded that 53% of the respondents declared that they completely agreed or agreed with the statement that their companies introduced changes in management processes in the set of key resources. In the surveyed companies, operating in the competitive environment, it is important to carefully utilize the resources possessed. Therefore, making changes to the set of key resources is an important factor for creating knowledge of the competitiveness of the surveyed companies. In turn, 29% of the respondents stated that they did not know whether changes were made to the set of key resources. Additionally, 18% of the respondents declared that they completely disagreed or disagreed with the above statement, which may indicate that, in these companies, no changes are made to the set of key resources in search for an increase in competitiveness. Figure 4 presents changes in customer relationships as a factor for creating knowledge of the competitiveness of the surveyed companies.

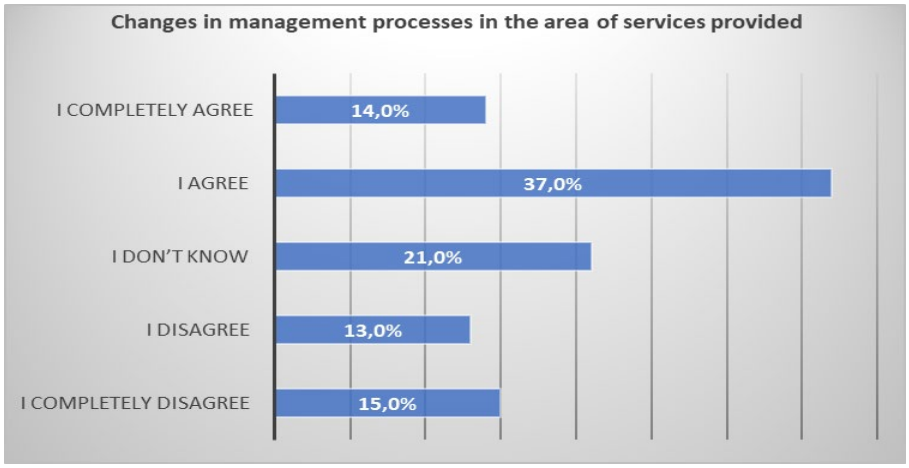


Source: Own study

Figure 4: Customer Relationships as a Factor for Creating Knowledge of the Competitiveness of Enterprises

Based on the research results presented in Figure 4, it can be concluded that 42% of the respondents declared that they completely agreed or agreed with the statement that their company implemented changes in management processes in terms of customer relationships. This may indicate that, in these companies, changes in the area of customer relationships, may translate into gaining and maintaining a competitive advantage in the market, making changes in this area an important factor for creating knowledge of the competitiveness of the surveyed enterprises. It should be noted that 35% of the respondents declared "I don't know", so it is possible that the respondents are not focused on changes in customer relationships. In turn, 23% of the respondents disagreed or completely disagreed with the statement that, in their companies, there were changes in customer relationships. This may be due to the stability of customer relationships, without

the need for changes in the relationships. Figure 5 presents changes in the area of services provided as a factor for creating knowledge of the competitiveness of the surveyed enterprises.



Source: Own study.

Figure 5: Changes in the area of Services Provided as a Factor for Creating Knowledge of the Competitiveness of Enterprises

The results presented in Figure 5 indicate that 51% of the respondents declared that they completely agreed or agreed with the statement that their company implemented changes in management processes in the area of services provided. This may mean that these companies modify their services by introducing a wider package of additional services within the basic service, which positively affects their level of competitiveness, thus constituting a factor for creating knowledge of competitiveness. From the opinions of 21% of the respondents, it can be concluded that they do not know whether changes in the area of services provided are made in their company, which may indicate that this group of the respondents lacks knowledge on this subject. In turn, 28% of the respondents declared that were no changes in the area of service provision in their company.

In the second stage of the research procedure, the relationships between the factors for creating knowledge of the competitiveness of the surveyed enterprises were examined. This should contribute to a deeper understanding of the creation of knowledge of competitiveness in the context of changes that can be introduced in management processes. When examining the factors for creating knowledge of the competitiveness of the surveyed enterprises, the strength and direction of the linear relationship between the input variables were examined in the second part of the research procedure. The investigated relationships were additionally confirmed by a significance test (at the level of $\alpha = 0.05$).

As shown in Figure 6, in the case of the companies examined, there is a strong positive relationship between introducing changes in management processes through changes in customer relationships and changes in the area of provided services (0.74). The surveyed companies make changes in customer relationships by introducing a package of additional services enabling an improvement in their competitiveness. Additionally, positive changes in customer relationships may bring favorable effects in the form of loyal customers and acquiring new ones. Furthermore, introducing changes in the area of services provided should contribute to an increase in the company's revenues, which can translate into a higher financial result.

Cost structure rationalization	0.50

Changes in the set of key resources	0.44	0.53		
Changes in customer relationships	0.43	0.35	0.63	
Changes in the area of service provided	0.45	0.35	0.66	0.74
	New sources of revenue	Cost structure rationalization	Changes in the set of key resources	Changes in customer relationships

Source: Own study.

Figure 6: Matrix of the Correlation of Factors for Creating Knowledge of the Competitiveness of Enterprises

When examining the relationships between introducing changes in management processes through changes in the set of key resources and in the area of services provided, a strong positive relationship (0.66) is observed. Companies, which introduce changes in the set of key resources, are more attractive to potential customers. Additionally, companies that make changes in the area of services provided stand out in the market, which has a positive effect on the process of building the competitiveness of the surveyed companies. Customers are more willing to use the services of companies which offer them a wider range of services compared to their competitors. The results of the research obtained using the Pearson correlation matrix show that, in the case of the surveyed companies, there is a strong positive relationship between introducing changes in management processes through implementing changes in the set of key resources and introducing changes in customer relationships (0.63). This may mean that the examined companies are interested in knowledge of the competitiveness of enterprises and introduce changes in the set of key resources to improve customer relationships. This is another action that makes the examined companies more attractive to their customers. A moderate positive relationship is observed between introducing changes in management processes through changes in the set of key resources and changes in cost structure rationalization (0.53). It follows that the examined companies are interested in changes in the set of key resources so as to enable the rationalization of operating costs, which is favorable for building a competitive advantage.

In the case of the surveyed companies, there is a moderate positive relationship between changes in management processes in terms of cost structure rationalization and seeking new sources of revenue (0.50). This may mean that the examined companies, when rationalizing costs, are oriented to new customers who will generate new sources of revenue, which are a chance to increase the competitiveness of enterprises.

Based on the results presented in Figure 7, it can be concluded that, in the case of the studied companies, there is a moderate positive relationship between introducing changes in management processes through seeking new sources of revenue and changes in the area of services provided (0.45), changes in the set of key resources (0.44), and changes in customer relationships (0.43). The source of new revenue for companies operating in the competitive market can be changes introduced in the area of services provided, implemented through changing the configuration of the key resources, which should translate into the emergence of relationships with new customers.

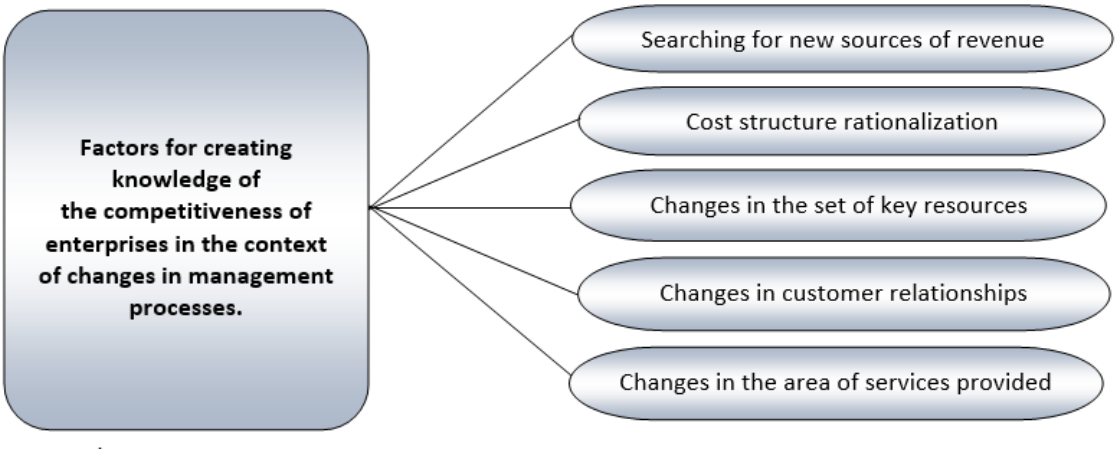
On the basis of the obtained results, it can be stated that there is a weak positive relationship between introducing changes in management processes through cost structure rationalization and changes in customer relationships (0.35) and changes in the area of services provided. This may mean that the studied companies rationalize cost structure, but the quality of customer relationships and provided services is crucial in the process of gaining and maintaining a competitive advantage, which is mainly reflected in the achieved sales revenue and not in cost reduction.

Summing up the results of the research procedure regarding the study of relationships between the factors for creating knowledge of the competitiveness of enterprises, it should be pinpointed that all the relationships

show a positive correlation. This may be due to the fact that the surveyed companies are aware of the potential of knowledge they possess and use opportunities to build their competitiveness.

5. Discussion

The knowledge of the factors that trigger changes in management processes determines the building of the competitiveness of the surveyed companies. Seeking new sources of revenue, cost structure rationalization, and changes in the set of key resources, provided services, and customer relationships (Figure 7) are the factors that trigger changes in management processes due to changes in the environment of the examined companies. Their task is to coordinate actions focused on recognizing customer preferences, acquiring, and retaining them, which allows for building competitiveness by the studied companies. This means that the examined entities build a competitive advantage by considering changes aimed at rapid adaptation to new conditions and are willing to notice positive aspects in their business activities, which contribute to their competitiveness.



Source: Own study.

Figure 7: Summary of Factors Creating Knowledge of the Competitiveness of Companies in the Context of Changes in Management Processes

It is worth noting that the strong positive relationship between changes in the area of services provided and changes in the set of key resources, as well as introducing changes in customer relationships, is a response to the question of how to create knowledge of the competitiveness of companies in the context of changes in management processes. This confirms the previously adopted assumption of the occurrence of the relationship between the examined variables. Furthermore, in the case of the set of key resources and changes in customer relationships, the observed relationships may indicate an increase in awareness among the management staff of the studied companies regarding the potential which is associated with possessing knowledge.

In this context, some new aspects of "meta" factors in management processes emerge, such as: focus on employees, implementation of models for exploiting internal and external sources of knowledge, and flexibility and agility of response to changes in the environment. By creating knowledge about competitiveness in the context of changes in management processes, enterprises should redefine their relations with employees. Employees should not be reduced to the level of the company's resources, since they bring not only knowledge, but also experience, both to and from customers. Moreover, as part of Future-of-Work, relations with employees in the long term become a generator of the company's competitive advantage, built through their work potential and knowledge. This leads to the conclusion that the further direction of research should aim at explaining what role the staff will play in value creation processes in the situation of rapid development of Artificial Intelligence. Research in the field of management science should take into account interrelationships between the acquisition and use of employee knowledge and its processing and transformation by AI into valuable results.

To sum up the above considerations, it can be assumed that the identification of factors that create knowledge of the competitiveness of the studied companies in the context of changes in management processes enables gaining and maintaining a competitive advantage.

6. Conclusions and Summary

When concluding the considerations presented in this paper, it is worth emphasizing that the factors for creating knowledge of the competitiveness of companies should secure the sustainability of a competitive advantage. However, the identification of factors that create knowledge of competitiveness requires taking into account current and future sources of revenue, which are generated due to key resources offered to customers, as well as a competitive approach to the market, which, combined with appropriate cost structure, provides new value to the customer. The considerations presented in this study allow for confirming the assumption of the research objective related to the in-depth understanding of creating knowledge of the competitiveness of companies in the context of changes possible to introduce in management processes. The conducted literature review and empirical research results allowed the formulation of the following conclusions:

- the object of the analysis in terms of creating knowledge of the competitiveness of companies is the identification of factors that determine the introduction of changes in management processes to increase a competitive advantage.
- understanding the factors for creating knowledge of the competitiveness of enterprises becomes a manifestation of strategic behavior of companies, enabling them the achievement and maintenance of a competitive advantage.

This paper supports the current view that there is no single universal model for creating knowledge of the competitiveness of companies. Moreover, the multifaceted nature of the issue of creating knowledge of the competitiveness of enterprises and interdisciplinary character of the considerations create the premises for shaping the factors for creating knowledge of the competitiveness of companies in generating new knowledge necessary for decision-making by the management staff of modern enterprises.

The further direction of research in this area should take into account the new perspectives of enterprise management processes under Future-of-Work, by redefining relations with employees in the context of the development of Artificial Intelligence

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Knowledge Management in Enhancing Organizational Flexibility in Manufacturing Enterprises

Anna Lemańska-Majdzik
Czestochowa University of Technology, Poland

a.lemanska-majdzik@pcz.pl

Abstract: In today's market conditions, enterprises operate in times of uncertainty, constant pressure from competition, increasing quality requirements, and rapidly changing technologies. The speed and intensity of changes mean that enterprises are forced to look for the most effective flexible actions to meet market conditions. The dynamic capabilities of enterprises are reflected in the dimensions of flexibility, which have different speeds and are conditioned in different ways, e.g., through the level of knowledge management in the enterprise. The article is based on the review of international literature using the science mapping method in the area of knowledge management and organizational flexibility, as well as the results of the research conducted on a group of manufacturing companies. The aim of the article is to indicate the level of knowledge management in manufacturing enterprises and its impact on selected dimensions of flexibility in the areas of organizational activity. The study is based on the results of the research on a group of 355 Polish enterprises, which was carried out in 2022. The author's questionnaire was used during the study. The results of the study were the basis for the analysis, which indicated the level of knowledge management and the level of organizational flexibility in manufacturing enterprises. The analysis also made it possible to indicate whether there are dependencies between the level of knowledge management and the level of flexibility in the organizational dimensions of companies' operations. The novelty of the article is the indication of recommendations for the increase in the level of knowledge management in order to enhance the flexible actions necessary in an extremely turbulent organizational environment.

Keywords: Management, Knowledge management, Organizational flexibility, Manufacturing enterprises, Poland

1. Introduction

In the face of the rapidly changing industrial environment and competitive pressure, companies have had to develop their ability to respond and adapt better to the dynamic business environment (Cheng, 2007). Therefore, the flexibility, and thus organizational capacity of the enterprise to use resources, strengthening their internal competencies in terms of developing diverse strategies and actions that enable the achievement of organizational goals, turns out to be essential. Organizational flexibility is a dynamic capacity, since the organization is able to renew and recreate resources, rapidly and efficiently integrating and configuring them in response to the dynamics of the environment (Yousaf & Majid, 2018). Furthermore, Shukor et al (2020) recognize organizational flexibility as a dynamic capacity, as it is important to cope with complexity, minimize uncertainty, and support management in complex and turbulent environments. In such an environment, knowledge management is the most important strategic resource and therefore is considered crucial for improving the company's performance (Carrasco-Hernández & Jiménez-Jiménez, 2016). However, knowledge management processes and the extremely dynamic environment require new ways of operating of the organization, in particular the departure from the rigid framework of functioning and the transition to flexibility in many organizational dimensions.

The objective of the article is to examine the level of knowledge management in companies and its impact on selected dimensions of organizational flexibility in the areas of business activity. The reasoning is based on the results of the research conducted in 2022 on a group of Polish manufacturing companies. The article contributes to science by combining the level of knowledge management with selected dimensions of flexibility building organizational flexibility in extremely turbulent conditions. In addition, the scientific contribution of this article consists in the demonstration of the analysis of bibliometric data related to the identified procedures in two areas, namely, knowledge management and organizational flexibility in a turbulent business environment.

2. Literature Review

2.1 Procedure

To achieve the planned main objective, the review of literature concerning the subject matter was conducted using the science mapping method in the VOSviewer software. The method used in this research is to conduct bibliometric analysis to produce a network visualization of keyword maps for the queries (Visser, van Eck & Waltman, 2021; van Eck, et al, 2010). The review of literature performed is based on the structure of data obtained from the original queries, as well as the scope and results of the database. The queries used in this study enabled the exploration of the Scopus database, which is commonly used in scientometrics to examine

the progress and evaluate various fields of science (Van Eck & Waltman, 2010). The conducted review of literature allows for data analysis using mapping tools and enables the formulation of the research problem.

The review of literature was conducted using keyword coexistence analysis, which was used to group reflecting research into organizational flexibility and knowledge management. The criteria for searching records in the database included searching by subject (title, abstract, keywords), the accepted word phrases "flexibility" OR "organizational flexibility" OR "flexibility of organization" AND "knowledge management" OR "management of knowledge". As a result, 1262 documents were obtained, which included scientific articles in journals in the field of "Business, Management and Accounting" and "Environmental Science" in English with no time limit. The further analysis of abstracts and modification of keywords not meeting the criteria (the first 20 most frequently repeated keywords) allowed for the identification of three main clusters (Fig. 1). Cluster 1 "Knowledge management" (red), Cluster 2 "Flexibility" (blue), Cluster 3 "Competitions" (green). The conducted bibliometric analysis allowed the formulation of the research problem in the form of the research question: What are the relationships between the level of knowledge management in the company and its organizational flexibility?

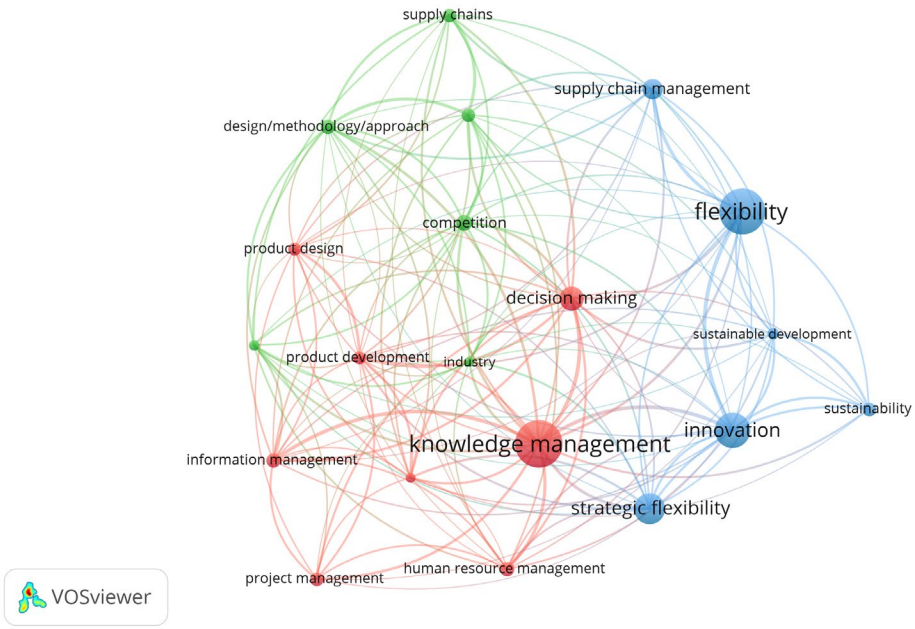


Figure 1: Bibliometric map of Keyword Coexistence Results from Scopus

2.2 Knowledge Management

Knowledge is the key resource of the organization constituting the source of sustainable differentiation, and thus competitive advantage. Knowledge in the enterprise combines capabilities and dynamic capacities, as well as information and technological practices, allowing the company to predict the nature and potential of changes in the organizational environment more accurately and determine the adequacy of both strategic and tactical operations (Wiklund & Shepherd, 2003). From the point of view of the organization, knowledge is not a resource collected solely in individual units that make up the organization, but is embedded in procedures, processes, or organizational structures, and social relationships created with stakeholders (Okręglicka, 2022). Organizations with a higher level of knowledge management capability are more likely to increase competitiveness by collecting, organizing, and transforming knowledge to achieve their organizational goals (Shujahat et al, 2019). The method, speed, and efficiency of using knowledge in management are the most important factors ensuring and maintaining the competitive advantage of the organization, and the inability to use it determines the obstacles to achieving and creating the competitiveness of the company, as well as its development (Omerzel & Gulev, 2011). According to Gao, Chai and Liu (2018), knowledge management can provide enterprises with the tools and techniques they need to overcome the overwhelming information they encounter and enable them to improve learning effectiveness and increase their competitive advantage. Moreover, the existing research suggests that a dynamic organizational capacity plays a crucial role in achieving organizational and business performance through knowledge management, including its detection, sharing, and reconfiguration (Antunes &

Pinheiro, 2020); and the capabilities in this area related to dynamic operations of enterprises in the business environment have a direct and indirect positive impact on the company's results (Lin & Wu, 2014; Li et al, 2020).

2.3 Organizational Flexibility

Flexibility, as a characteristic of the company, is desired by all organizations as it is an important factor determining its functioning. Organizational flexibility is primarily perceived as the ability that enables the organization to exist in the context of variable business conditions (Verdú & Gómez-Gras, 2009; Morgan et al, 2019). Therefore, the flexibility of operations means that entrepreneurs flexibly modify plans or decisions in a constant manner, adapting to changing circumstances of the company's functioning (Brettel, Mauer & Engelen, 2012). Unfavorable business environments currently require organizational flexibility from companies, i.e., the company's dynamic abilities to keep up with changes in the market and to respond rapidly to unpredictable and unexpected market conditions (Santos-Vijande, López-Sánchez & Trespalacios, 2012; Peng, Liu & Lin, 2015; Chatterjee et al, 2023). If significant changes occur in the organization's environment, the organization should respond to them to a greater extent. Changes introduced in the organization within the framework of flexibility may lead to a temporary change in the level of activity, which in turn may lead to the ultimate activity of the organization (Sharma, Sushil & Jain, 2010) and ensure a competitive advantage (Weaven et al, 2021). Sushil (2001) draws attention to the reflection of mutual relationships between flexibility in individual functional areas and the organization's flexibility as a whole. The flexible response of companies to unexpected changes in the environment, which are currently becoming common, is critical in the case of the impact on their organizational reactions. They require organizational discipline, consisting in adherence to principles when creating organizational structures and processes. On the other hand, organizational agility should be allowed, which can be expressed through creativity, improvisation, and adaptability of the organization (Volberda, 1997; Harrald, 2006).

The review of literature provides evidence that organizational flexibility is crucial for creating value in operational, production, and technological strategies, as well as for developing competitiveness (Lyu et al, 2022; Bhupendra & Sangle, 2022) and innovativeness of enterprises (Abubakar et al, 2019). Therefore, it is important to perceive flexibility from the perspective of its dimensions (Dreyer & Grønhaug, 2004; Zhou, Wu, 2010; Khin, Ahmad & Ramayah, 2012). Combining partial flexibilities thus gives a synergy effect, and in the case of organizational flexibility, this synergy effect can be determined as the surplus of benefits resulting from the flexibility of individual levels of the organization compared to the flexibility of the entire organization (Kasiewicz, 2009), whereby the flexibility of individual elements of the organization affects the flexibility of the entire enterprise. Therefore, according to the observations of Sushil (2001), De Toni and S. Tonchia (2005), and Eapen (2009), it can be assumed that organizational flexibility consists of partial flexibilities and is of a mixed nature. Perceiving the flexibility of the enterprise through the logic of partial flexibilities has its advantages, which, among others, affect the precise capture of the degree (level) of the company's flexibility, resulting from the functions, processes, resources, and dimensions of the organization (Moroz, 2013, p. 55).

Based on the above arguments and observations of the business environment, the main hypothesis was formulated, which is: Hypothesis 1: A higher level of knowledge management in the organization influences an increase in the level of organizational flexibility of the enterprise.

3. Methodology

The main objective of the article is to examine the level of knowledge management in enterprises and its impact on selected dimensions of organizational flexibility in the areas of business activities. In order to test the main hypothesis, the pilot studies were conducted in 2021, and then data were collected from a sample of 355 Polish manufacturing companies. The main research was conducted in 2022.

The research process was carried out in stages, i.e., firstly, the review of literature was conducted, which allowed for the identification of the research problem and the formulation of the research hypothesis. During the literature review, some scientometrics techniques were used. The science mapping method was applied, including cluster analysis for the needs of bibliometric analysis (Van Eck, Waltman 2021). The VOSviewer software and data analysis tools available in the SCOPUS database were used for the analysis.

The survey questionnaire was subsequently developed. The questionnaire consisted of closed-ended questions in the groups of individual research areas on a 5-point Likert scale (Sheng, Zhou & Li, 2011; Peng & Luo, 2000),

where 1 indicated "definitely not" and 5 "definitely yes". This is a managerial approach, in which this tool is most often used in social science research.

During the further analysis, the level of knowledge management (KM) was examined based on the classification by Carrasco-Hernández and Jiménez-Jiménez (2016), in which five sub-variables were identified consisting of items allowing for the diagnosis of the studied area. On the other hand, the level of organizational flexibility of enterprises was diagnosed based on the approach by Yeniaras, Di Benedetto and Dayan (2021), who distinguished four dimensions of flexibility that make up overall organizational flexibility, i.e., operational (OF), financial (FF), structural (SF) and technological (TF), which were constructed with relevant items.

Subsequently, based on the convenient sample selection, the enterprises participating in the research were identified. Then, the incomplete and incorrectly completed questionnaires were rejected, and the collected data were analyzed to accomplish the research objective. Finally, in the group of the surveyed enterprises, manufacturing companies were identified, over 60% of which had been operating for over 10 years, including 43% of micro enterprises, 25% of small enterprises, 18% of medium-sized enterprises, and 14% of large enterprises operating in southern Poland.

4. Results

Firstly, during the analysis of the research results, the constructed research tool was subjected to reliability tests (Table 1). The reliability estimation method using the Cronbach's alpha coefficient was used (Taber, 2018; Christmann & Van Aelst, 2006). The conducted analysis showed that, for the organizational flexibility scale in its individual dimensions, the reliability was 0.812 in total, thus it was good reliability, whereas, for the knowledge management scale in its individual components, it was 0.933 in total, thus it was excellent reliability. It turns out that the research scales constructed in the tool meet the criteria and their use in quantitative research is justified according to the adopted classification by George and Mallery (2016, p. 240).

Table 1: Reliability and Validity

Variables	**Cronbach's α**
Knowledge management	0.933
KM1	0.792
KM2	0.845
KM3	0.816
KM4	0.769
KM5	0.881
Organizational flexibility	0.812
OF	0.669
FF	0.769
SF	0.565
TF	0.801

Subsequently, the level of KM and organizational flexibility in Polish manufacturing companies in total was examined, as well as broken down by size of employment. The European classification of enterprises (number of employees) was adopted, i.e., micro, small, medium-sized and large companies (EU Commission Regulation No 651/2014). The data analysis showed that the average level of knowledge management in all companies was 3.516 on a 5-point Likert scale, and this level deviates from the average value by +/-0.849 points. The median value for the level of knowledge management indicates that at least 50% of the respondents rated KM at the level of 3.625 or less on a 5-point scale. At the same time, it can be seen (Fig. 2) that, in micro-enterprises, the level of KM is the lowest, whereas, in large enterprises, it is the highest. It is worth adding that the value of the chi-square statistic (Chi squared test=245.3945; df=19; p-value=0.00000) indicates a statistically significant relationship between the variables, i.e., the level of knowledge management and the size of employment in enterprises.

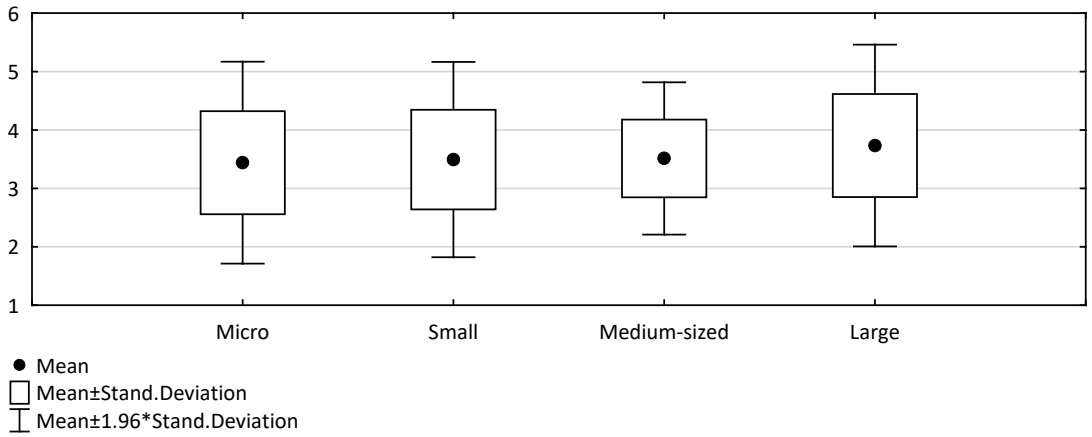


Figure 2: The Level of KM in the Manufacturing Company (n=355)

The further data analysis showed that the average level of organizational flexibility in Polish manufacturing companies was 3.735 on a 5-point Likert scale, and this level deviates from the average value by +/-0.699 points. At the same time, the median value for the level of organizational flexibility indicates that at least 25% of the respondents rated organizational flexibility at the level of 3.364 or lower on a 5-point scale. Interestingly (Fig. 3), small enterprises declare the highest level of organizational flexibility, and this level is the lowest in micro-enterprises, and the differences in the distinguished groups of companies are small and no statistical relationship.

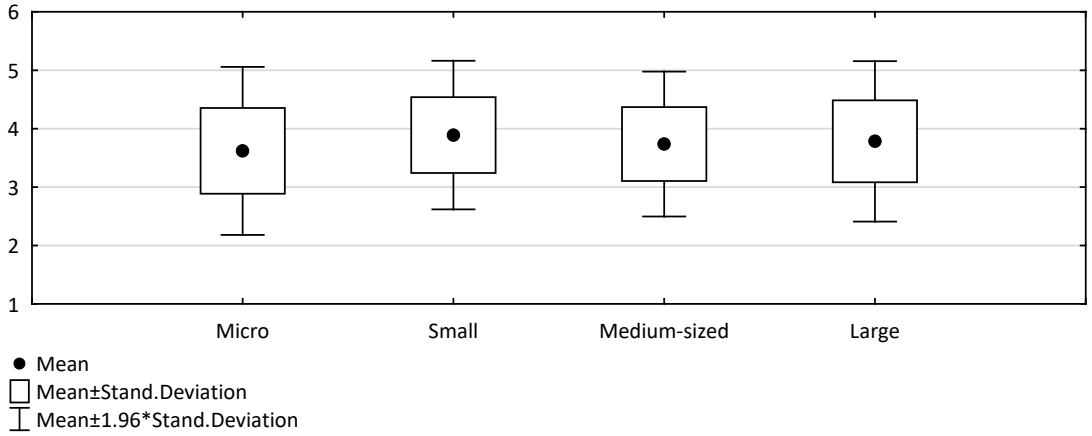


Figure 3: The Level of Organizational Flexibility in the Manufacturing Company (n=355)

In the next step, it was examined whether there was a linear relationship between the variables, for which the Kendall's tau-b correlation coefficient was used (Table 2). Initially, the correlations between the level of KM and individual dimensions of organizational flexibility (OF, FF, SF, TF) were identified, as well as between KM and the overall level of flexibility. The analysis showed that the correlations between the variables are statistically significant for $p<0.05$ and can be described as moderately positive, ranging from $t=0.306$ to $t=0.483$.

Table 2: Correlation Analysis (n=355)

Dimensions of organizational flexibility	Management of knowledge (t)
OF	0.306*
FF	0.349*
SF	0.341*
TF	0.416*
Total organizational flexibility	0.483*

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

5. Discussion

The obtained results confirm the research by Carrasco-Hernandez and Jimenez-Jimenez (2016), which shows that knowledge management is important and positively related to organizational flexibility, and thus the higher the level of knowledge management the higher the level of organizational flexibility demonstrated by the studied companies. As indicated by the research by Tippins and Sohi (2003), in an extremely turbulent environment scenario, knowledge is considered the most important strategic resource in the organization, and therefore the knowledge management process is considered critical to improving the performance of the organization. However, organizational performance is not possible without the flexibility of dynamic actions. Organizational performance and flexibility together drive the development of enterprises in turbulent business environments, but this hypothesis cannot always be confirmed in a stable environment (Phillips, Chang & Su, 2018). Therefore, organizational efficiency, perceived as the flexibility of action, affects the performance of the organization in terms of delivering products and/or services, operations of related organizations, and plays a significant role in relation to customers and business partners (Stokes, Schneider & Lyons, 2010; Yusuf et al, 2014). The review of literature also shows the research results indicating a positive impact of knowledge management on the results of enterprises (Holsapple & Jones, 2005). Organizational flexibility regarded in this way includes the mix of formal and informal mechanisms that may arise within or outside the organization. Management practices can affect employee actions, strategic behavior, and the company's results and may include the use of financial control systems, recruitment and engagement of resource managers, implementation of human resource practices, decentralization of power, and increased management engagement (Dekker et al, 2013).

6. Conclusions and Future Research Directions and Limitations

To sum up, the conducted analysis based on the research results showed that the level of knowledge management in manufacturing companies depends on their size and is linked to their organizational flexibility. This applies to all dimensions of organizational flexibility studied, and thus operational, financial, structural, and technological flexibility. Furthermore, the higher the level of management in manufacturing companies the higher the organizational flexibility, which determines the functioning of companies in extremely difficult business environment conditions. Moreover, the research results indicate the direction of dynamic actions in the field of knowledge management, which enhance the flexibility of enterprises, among others, through acquiring knowledge from the environment and from the organization members, distributing information and its interpretation, as well as organizational memory.

The conducted research is not free from limitations. Firstly, it results from the COVID-19 pandemic, which disrupted the activities and production processes of companies and their functioning in extremely turbulent and unpredictable economic conditions. Secondly, the war beyond Poland's borders distorted the needs and expectations of both companies and their customers, and the need for flexible actions was not always adjusted to the resource capabilities of enterprises. Thirdly, the study was conducted on a selected group of companies, and a wider research group selection would reveal a wider range of organizational needs and interactions. In the future, the author plans to continue the analysis by expanding it to a model and factor analysis, as well as to broaden the research to companies from different sectors of the economy operating in a different business environment.

7. Theoretical and Practical Implications

The study has several implications for practitioners. Recommendations in the area of operations for strengthening the organizational flexibility of manufacturing enterprises, which becomes the basis for functioning in an extremely variable business environment, should focus on activities that influence an increase in the level of knowledge management. Undoubtedly, the ability to acquire knowledge from the environment, as well as internal knowledge, should be intensified. The interpretation of acquired knowledge and its distribution among the organization members is of great importance. Companies should focus on strengthening teamwork, where members know and share a common goal. Organizational memory, which consists in proper management of databases available to the enterprise, is also important. Strengthening these areas of activity under knowledge management will allow for an increase in the level of organizational flexibility in various dimensions, and the synergy effect will enable strengthening the overall level of organizational flexibility of enterprises.

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Strengthening Organisational Resilience Through Knowledge Management: The Santa Catarina´s Civil Defence Case

Carlos Eduardo de Lima[1], Denilson Sell[1] and Regina Panceri[2]
[1]State University of Santa Catarina, Florianopolis, Brazil
[2]Santa Catarina´s Civil Defence, Florianopolis, Brazil

cadulima@gmail.com
denilsonsell@gmail.com
reginapanceri@gmail.com

Abstract: The constant changes in the political, social, and economic scenarios, as well as recent major crises and natural disasters that have affected Santa Catarina, Brazil, and the world, have increased the demand for organisations to provide more resilient responses. Civil Defence organisations are no exception, and they must prioritise the identification and management of critical knowledge to enhance their organisational resilience. In light of this, a case study was carried out in Santa Catarina´s Civil Defence (SCCD), a public government organisation that plays a critical role in the territorial resilience of SC state. The study aimed to evaluate SCCD's organisational resilience and develop a continuous improvement plan based on critical knowledge. To achieve this, the Resilience Analysis Grid (RAG) was used as a tool to characterise the SCCD's resilience potential. The analysis showed that the organisation has an appropriate level of resilience potential. However, to identify ways to enhance this potential, it was necessary to analyse critical knowledge for monitoring, anticipating and responding to unexpected events, as well as exploring how SCCD promotes learning in the face of new situations. To do so, a framework was used to analyse critical knowledge to organisational resilience capabilities. This framework was used to present an improvement plan for the organisation's resilience potential, based on the use of techniques and methods for knowledge management. The plan recommended several practical steps that could be taken to enhance the resilience of the SCCD, including the creation of a knowledge management system, the development of training programmes, and the identification and management of critical knowledge. In conclusion, the study highlighted the importance of critical knowledge in enhancing organisational resilience and demonstrated that a continuous improvement plan based on critical knowledge could lead to significant improvements in the resilience of organisations like the SCCD. By following the study's recommendations, organisations can become better equipped to respond to future challenges and maintain their resilience in the face of change and uncertainty.

Keywords: Organisational resilience, Critical knowledge, Knowledge management, Risk and disaster management, Civil defence

1. Introduction

Climate change and the increasing frequency of natural disasters have highlighted the need for organisations, particularly those involved in disaster management, to enhance their resilience capabilities. This is especially crucial for public defence organisations like the Santa Catarina Civil Defence (SCCD) in Brazil, which play a critical role in ensuring the safety and resilience of communities in the face of various risks and disasters.

Santa Catarina, being the second most affected state in Brazil by natural disasters, has experienced significant financial losses amounting to billions of reais. In light of these challenges, it is imperative for SCCD to strengthen its resilience potential and improve its capacity to respond swiftly and effectively to unexpected events. However, traditional approaches and methods are no longer sufficient to address the complex and unpredictable nature of disasters.

In response to this need, this study aims to investigate how knowledge management can contribute to strengthening the organisational resilience of SCCD. By focusing on the identification and management of critical knowledge, the study seeks to enhance SCCD's ability to anticipate, monitor, respond to, and learn from unexpected events. To achieve this, a case study approach was employed, with SCCD serving as the research subject due to its significant role in the territorial resilience of Santa Catarina.

The research objectives include evaluating SCCD's current organisational resilience and developing a comprehensive improvement plan based on critical knowledge management techniques. The study employs the Resilience Analysis Grid (RAG), a tool developed by Hollnagel (2010), to assess SCCD's resilience potential across four core dimensions: response, anticipation, monitoring, and learning. Additionally, Fraga's (2019) framework for analyzing critical knowledge resources is used to identify areas where knowledge management practices can be implemented to enhance SCCD's resilience capabilities.

The findings of this research have practical implications for public defence organisations like SCCD, as well as for the broader field of disaster management. By adopting effective knowledge management strategies,

organisations can improve their resilience potential, enhance their ability to protect communities, and respond more effectively to future challenges and uncertainties. Furthermore, this study contributes to the scientific understanding of how knowledge management can be leveraged to strengthen organisational resilience in the context of risk and disaster management.

To further validate and expand upon the findings of this study, future research could apply the proposed framework and methodologies to other public defence organisations. This would allow for a more comprehensive evaluation and comparison of resilience potential across different contexts, leading to the development of tailored knowledge management strategies to enhance organisational resilience in diverse risk and disaster management scenarios.

2. Theoretical Foundation

2.1 Fundamentals of Organisational Resilience

According to Fraga, Varvakis and Sell (2019), given the complexity of organisations and their intensive knowledge processes, research in multidisciplinary areas that seek to understand better these environments, such as the area of organisational resilience, is necessary.

Lee, Vargo and Seville (2013) state that the ability of organisations to continue to operate and provide goods, services, and jobs is fundamental to the ability of communities to be resilient. “However, the task of building more resilient organisations is complicated by the inability to translate the concept of resilience into tangible work constructions for organisations” (McManus et al., 2007).

When resilience became part of safety discussions, it was defined as "the intrinsic capacity of an organisation (system) to maintain or recover a dynamically stable state that allows it to continue operations after a major accident and/or in the presence of continuous stress" (Hollnagel, 2006). However, Beauchamp et al (2019) highlight that like the concept of human well-being, resilience is complex and multidimensional, often linked to desirable impacts on development.

Resilience is a multifaceted concept with overlapping dimensions, including robustness, fault tolerance, flexibility, survivability, and agility. Definitions and interpretations vary across fields, but all agree that resilience is critical for thriving in the face of adversity. (Hosseini, Barker and Ramirez-Marquez, 2016). Currently, several disciplinary perspectives operate in many domains of application of the resilience concept. These different perspectives have led to the construction of numerous organisational resilience models.

McManus et al. (2007) states that organisational resilience requires three main qualities: self-awareness, effective vulnerability management, and adaptability to new and unforeseen circumstances. The concept of resilience as a measurable property of a system or organisation is emphasized by Hollnagel and Nemeth (2021). According to Hollnagel (2010), resilience is something that an organisation does, rather than something that it possesses. In this sense, Hollnagel (2010) proposes the RAG tool for assessing the degree of resilience of an organisation based on four main abilities, including the ability to respond, anticipate, monitor, and learn (Figure 1).

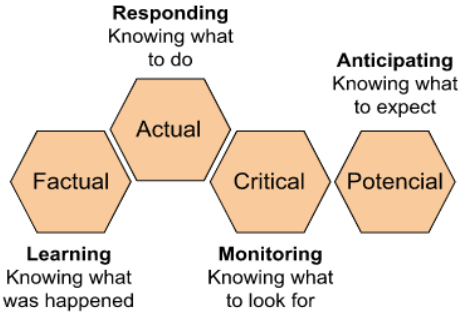


Figure 1: The four Core Capabilities of Organisational Resilience. Source: Hollnagel (2010).

Fraga (2019) states that, to be resilient, an organisation needs to be capable of working on these four basic and essential practical abilities and highlight that an organisation's ability to recover and adapt to unexpected events is a measurable quality of resilience (Hollnagel, 2010; Fraga, 2019; Hollnagel and Nemeth, 2021).

2.2 Knowledge as a Critical Factor for Resilience Potential

Knowledge is the combination of information with experience, context, interpretation, and reflection, which is applied in relevant decisions and actions. In this sense, Choo (2003) emphasizes the integration of meaning creation, knowledge construction and decision-making processes in organisations with a knowledge focus.

Fraga (2019) highlights that organisations need to be aware of their knowledge assets to achieve precise and objective management. However, the growing volume of raw data makes managing these assets an even greater challenge. Therefore, the use of tools to transform them into useful information is essential.

As emphasized by Nonaka and Takeuchi (1998), Hollnagel (2006), and Fraga (2019), knowledge is a critical factor in increasing organisational resilience. To achieve this, Neaga (2010) proposes the use of knowledge accelerators to develop resilience in uncertain and complex environments, while Albuquerque (2020) highlights the importance of a tool for all phases of organisational resilience.

Van de Walle (2014) observes that public sector organisations tend to rely on traditional recipes of organisational reform that result in new types of formalism. However, making knowledge accessible is essential to ensure sustainability and transfer of knowledge to all. Knowledge management is therefore fundamental for organisations working with risk and disaster management, as demonstrated by CEPED/UFSC (2016), which presented a systemic approach to civil protection and defence actions, represented in the operation cycle (Figure 2).



Figure 2: Cycle of civil defence´s operation. Source: CEPED/UFSC (2016) translated by authors.

Hollnagel and Woods (2006) argue that to achieve resilient performance, constant updates of knowledge, skills and resources must be available to all members of an organisation. Thus, Fraga (2019) proposes a framework for analysing critical knowledge resources related to resilience capabilities, adapting the Critical Knowledge Factors (CKF) model developed by the Paris Knowledge Management Club in 2000 to include knowledge criticality factors (Figure 3).

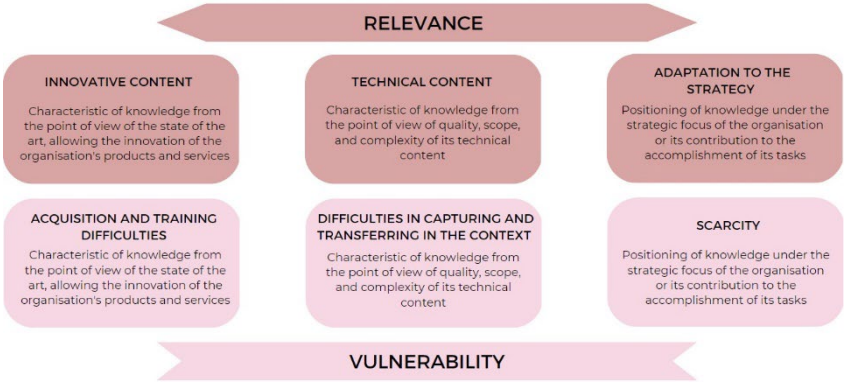


Figure 3: Factors of Knowledge Criticality. Source: Fraga (2019) Adapted by Authors

Therefore, based on the literature review, the theoretical analysis units were adapted and complemented with RDM elements (prevention and mitigation, preparedness, response, and recovery) in order to highlight the importance of knowledge as a catalyst for organisational resilience. Organisations must understand knowledge as something critical to monitor, anticipate, respond to, and learn from (Fraga, 2019) and overcome the challenge of identifying tacit or complex knowledge to apply it in their strategies and tasks.

3. Method

This research used the concept of resilience of Hollnagel (2010) as the ability of an organisation to recover and adapt to unexpected events through its capacities to respond, to monitor, to anticipate, and to learn. Furthermore, the study assumed, following Fraga (2019) and Nemeth and Hollnagel (2022), that the quality of resilience can be measured and improved.

In that regard, Fraga's (2019) framework (Figure 4) is positioned as a practical tool for identifying and analysing critical knowledge from the perspective of resilience capabilities, with the objective of enabling specific actions related to knowledge management that can contribute to organisational learning and performance. Consequently, the framework was selected as a tool for this research, with adaptations made to suit the phases of RDM. The framework of Fraga (2019) consists of four phases, each of which includes further subdivided stages that may be adapted to account for differences in the studied organisation and researcher position.

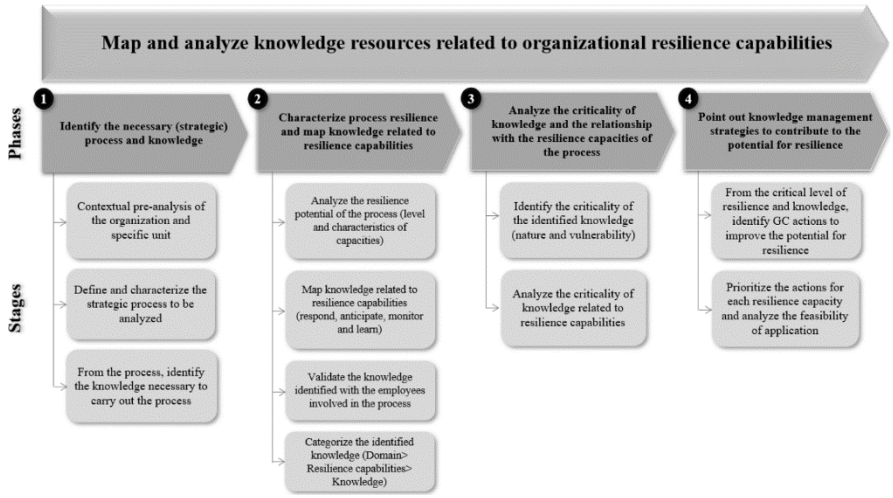


Figure 4: Analysis Framework for Knowledge Resources Critical to Resilience Capabilities. Source: Fraga (2019)

In this study, data was collected using forms, spreadsheets, individual interviews, and group meetings, following the steps described by Fraga (2019). The participants included two internal coordinators (Monitoring and Alert and a Regional Coordinator), one external coordinator (meteorology), three managers (operations, hydrology, and training and education), and four expert advisors (two geologists and two hydrologists). This allowed for a comprehensive understanding of organisational context, knowledge-intensive processes, and identification of key knowledge assets and gaps. The main phases and stages of the data collection process are presented in Figure 4, and the results of the study's application will be discussed in the following sections.

4. Analysis of Organisational Resilience of SCCD

In this section, the steps used to analyse the resilience potential of SCCD, according to the guidelines of Fraga's (2019) framework, as well as the results obtained at each stage of application of the tool, will be presented.

4.1 Phase 1 - Identification and Required Knowledge

The first phase aimed to identify the process and knowledge that would be analyzed. To do so, it was subdivided into three distinct stages carried out with the support of the following data collection instruments as demonstrated in Figure 5.

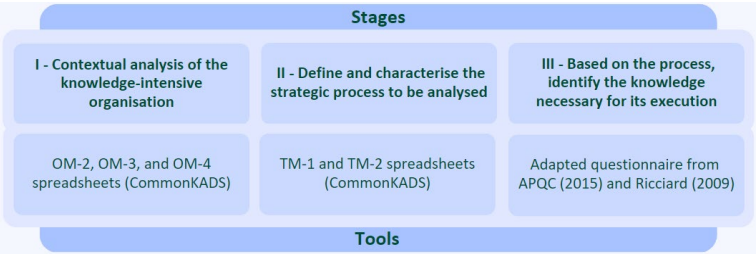


Figure 5: Data Collection Instruments for Phase 1. Source: Fraga (2019) Adapted by Authors

Based on documentation review and the researcher's experience over the last 4 years at the institution, the "Risk Assessment Process" was suggested and approved by the area responsible for it and, after the application of Phase 1, the results shown in Figures 6 and 7 were obtained.

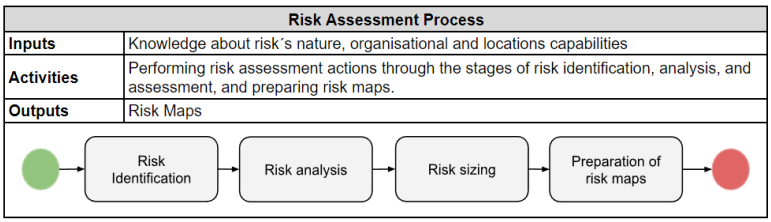


Figure 6: Representation and Characterization of the Process. Source: Authors

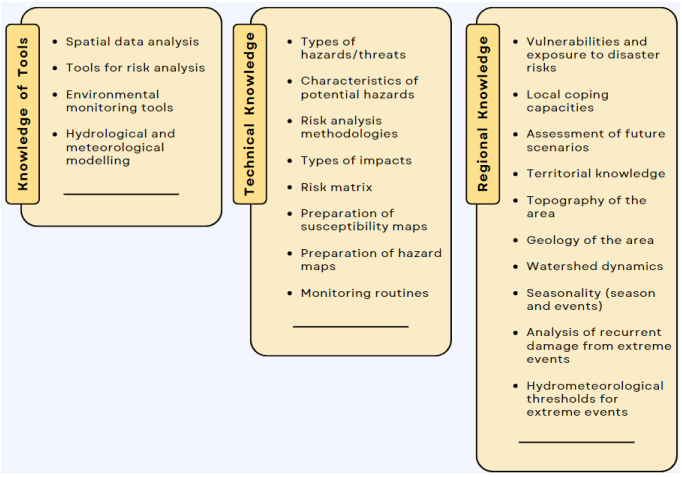


Figure 7: Table of Knowledge Required to Perform the Process. Source: Authors

4.2 Phase 2 - Characterization and Related Knowledge

The second phase aims to characterise the resilience of the process (by identifying related risks and analysing its potential for resilience) and map knowledge related to resilience capabilities (respond, anticipate, monitor, and learn). To do so, it was divided into three distinct stages, which were carried out with the support of the data collection instruments demonstrated in Figure 8.

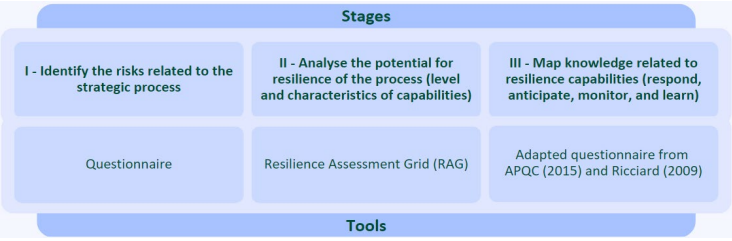


Figure 8: Data Collection Instruments for phase 2. Source: Fraga (2019) Adapted by Authors

After Phase 2 was implemented, the SCCD achieved a score of 2.79 for potential organisational resilience, which is considered acceptable based on the methodology used. This result was uniformly perceived by all interviewees, increasing the accuracy of the outcome. Moreover, individual scores were assigned to each

resilience capacity, with scores of 2.83 for anticipation, 3.00 for response, 2.83 for monitoring, and 2.50 for learning. Besides, figure 9 illustrates the list of risks related to the process.

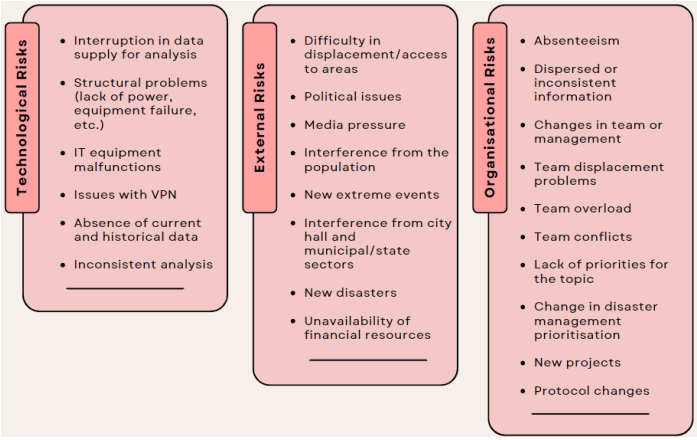


Figure 9: Risks Related to the Process. Source: Authors

In this phase, knowledge was also mapped, and in the next subsection, the analyses of the knowledge related to each resilience capability will be presented. In the following subsection, this knowledge was presented with an evaluation of criticality according to the criticality criteria used in the methodology.

4.3 Phase 3 - Criticality Analysis

In the third phase, the criticality of the previously mapped knowledge was identified according to the criteria presented in Fraga's framework, and an analysis of the importance of the knowledge was conducted based on the ratings given by the interviewees. To do so, it was subdivided into 2 distinct steps, which were carried out with the support of the following data collection instruments as demonstrated in Figure 10.

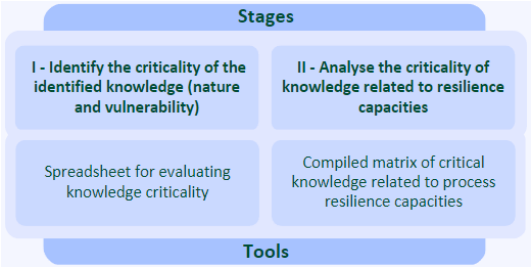


Figure 10: Data Collection Instruments for Phase 3. Source: Fraga (2019) Adapted by Authors

To perform data collection in the first stage of this phase, spreadsheets for risk assessment were used with the knowledge mapped in the previous phase. To guide the interviewees, following Fraga (2019), a Likert scale with 3 levels (1 - Low, 2 - Medium, 3 - High) was defined to grade the criticality factors of knowledge regarding their nature and vulnerability related to each of the mapped knowledge for each of the 4 resilience capabilities.

In the second stage of this phase, to analyse the criticality of the knowledge, the coefficients are calculated per criticality factor based on the median of the ratings assigned by criteria for each knowledge. With the completion of Stages I and II of the third phase of the framework, it was possible to calculate the coefficients of the criticality factor (presented in Figure 3) for each knowledge related to each resilience capacity, based on the median of the responses from the 10 interviewees.

The average of the resulting critical factors for each knowledge was calculated in order to obtain a unified score for each critical factor of the knowledge related to resilience capacities. In total, 16 knowledge related to the capacity to anticipate, 9 related to the capacity to respond, 11 related to the capacity to monitor, and 10 related to the capacity to learn were identified. After that, some inferences and revisions were made in the recorded interviews in order to identify the main knowledge to be prioritised. With this analysis, it was possible to draw specific conclusions about the knowledge related to each resilience capacity, as well as general conclusions considering all the knowledge from the different capacities together.

The first conclusion was the identification of knowledge with the highest averages, considering all six critical factors for each capability: AK9 for anticipating (knowledge of communication techniques), RK5 for responding

(knowledge of meteorological and hydrological operational processes), MK11 for monitoring (knowledge of monitoring tools), and LKs 1 and 9 for learning (knowledge of the history of risks and updating of hydrometeorological thresholds for extreme events).

These knowledges stood out not only for their high averages but also because their innovative content, technical content, and alignment with the strategy were the main contributors to these results. Another important inference was that some knowledge from the capacities presented direct relationships with each other, allowing generalisation of specific knowledge (Table 1).

Table 1: Critical Knowledge to be Prioritised

Critical General Knowledge	Abilities	Specific Knowledge
Processes Anticipating	Anticipating	AK3 - Internal process flows
	Responding	RK9 - Internal process flows
	Monitoring	MK4 - Institutional processes
	Learning	LK6 - Continuous process improvement techniques
Monitoring tools	Anticipating	AK7 - Monitoring tools
	Monitoring	MK11 - Monitoring tools
Internal competencies	Anticipating	AK2 - Competencies of other internal areas
	Responding	RK6 - Institutional operational procedures
Communication techniques	Anticipating	AK9 - Communication techniques
	Responding	RK10 - Communication
Techniques for analysing historical data	Learning	LK1 - Risk history
		LK3 - Ability to interpret and qualify historical data
		LK9 - Ability to update hydrometeorological thresholds for extreme events
	Monitoring	MK3 - Ability to interpret monitored data and its indicators

Source: Authors.

4.4 Phase 4 - Knowledge Management Strategies for Organisational Resilience

Phases 1, 2, and 3 of the framework had been applied earlier and the subsequent phase, phase 4, aimed to mitigate risks of failures in asset execution and improve asset resilience. This phase consisted of two distinct stages, which utilised analysis instruments depicted in figure 11. The primary objective of phase 4 was to implement KM actions specific to the risk assessment process to enhance the asset's resilience.

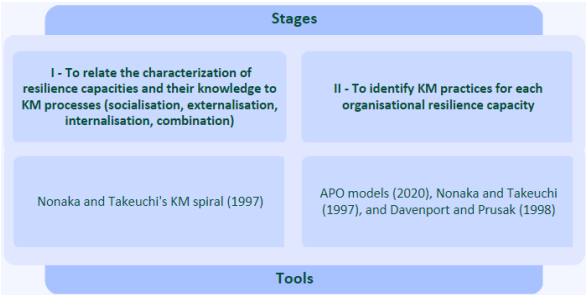


Figure 11: Data Collection Instruments for Phase 4. Source: Fraga (2019) Adapted by Authors

By mapping and prioritising critical general knowledge, along with characterising their respective resilience capacities (anticipate, respond, monitor, and learn), it became possible to identify and define some KM practices, according to the typification proposed by Nonaka and Takeuchi (1997) (socialisation, externalisation, internalisation, combination).

After analysing the previous data, as well as the results presented, it was possible to survey KM practices (such as mentoring programs, communities of practice, training, capacity-building, etc.). The intersection of these practices with issues to be solved to address knowledge deficiencies related to each of the resilience capacities of the "Risk Identification, Analysis, and Sizing" process resulted in the data presented in table 2.

Table 2: Matrix of Actions for Managing Critical Knowledge Related to Resilience Capacities

Ability to anticipate			
Issues to be addressed	Related knowledge	KM process	KM practices
Poor alignment with organisational strategy	AK2, AK3, AK9	Externalisation	Creation of discussion forums
Communication failures	AK9	Socialisation	Mentoring program, creation of discussion forums
Deficient dissemination of tacit knowledge	AK7	Socialisation	Communities of practice
Ability to respond			
Issues to be addressed	**Related knowledge**	**KM process**	**KM practices**
Dispersed or inconsistent information	RK6, RK9, RK10	Combination	KM through intranet
Limited knowledge about organisational processes	RK6, RK9	Socialisation	Space for sharing information and experiences
Complexity of knowledge	RK10	Internalisation	Mentoring program, trainings and capacity-building initiatives
Ability to monitor			
Issues to be addressed	**Related knowledge**	**KM process**	**KM practices**
Knowledge about monitoring tools	MK3, MK11	Socialisation	Communities of practice
Lack of documentation on the tools	MK4, MK11	Combination	KM through intranet
Ability to use data for analysis	MK3, MK11	Internalisation	Trainings and capacity-building
Ability to learn			
Issues to be addressed	**Related knowledge**	**KM process**	**KM practices**
Absence of current and historical data	LK1, LK3	Combination	Use of artificial intelligence tools
Diffuse knowledge	LK3	Socialisation	Communities of practice
Complexity of knowledge	LK3, LK9	Internalisation	Trainings and capacity-building

Source: Authors.

5. Conclusions

This research has provided valuable insights into the role of knowledge management in enhancing the resilience potential of public defence organisations, as exemplified by the Santa Catarina Civil Defence (SCCD) in Brazil. By focusing on critical knowledge and implementing targeted strategies, this study has demonstrated the measurable cognitive value of knowledge management in improving organisational resilience.

The findings of this research offer practical implications for SCCD and other similar organisations involved in risk and disaster management. The identified knowledge management strategies, such as communities of practice, mentoring programs, and discussion forums, provide tangible approaches to address knowledge deficiencies and enhance organisational alignment, communication, and technical expertise. By implementing these strategies, organisations can strengthen their ability to anticipate, respond to, monitor, and learn from

unexpected events, ultimately improving their resilience and their capacity to protect the communities they serve.

Importantly, the framework and methodologies used in this study can be adapted and applied to other public defence organisations facing similar challenges. By employing the Resilience Analysis Grid (RAG) and the framework for analysing critical knowledge resources, organisations can assess their resilience potential, identify knowledge gaps, and develop tailored improvement plans. This adaptability and scalability of the research methodology increases its utility and value for a wide range of organisations operating in diverse risk and disaster management contexts.

The nature of the results obtained in this study holds significant utilitarian value. By enhancing their organisational resilience through effective knowledge management, public defence organisations can save lives, reduce financial losses, and mitigate the long-term impacts of disasters on communities. The practical implications of this research extend beyond academic discourse and can be directly applied to improve the preparedness and response capabilities of organisations involved in risk and disaster management.

Further research could build upon this study by applying the proposed framework and methodologies to other public defence organisations, validating and expanding upon the findings presented here. Future studies could also explore the long-term impact of implementing knowledge management strategies on organisational resilience and the effectiveness of these strategies in different risk and disaster management scenarios.

In summary, this research has highlighted the measurable cognitive value of knowledge management in enhancing organisational resilience. By leveraging knowledge management strategies and adopting the proposed improvement plan, organisations like SCCD can better anticipate, respond to, monitor, and learn from unexpected events, ensuring the safety and well-being of the communities they serve. The applied approach has effectively guided the identification and implementation of appropriate methods and techniques that address the specific needs of SCCD. Besides, the outcomes of this research offer practical insights that can be adapted, mapped, and utilised by other organisations involved in risk and disaster management, ultimately contributing to the broader goal of building resilient communities and mitigating the impacts of disasters.

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A Meta-Analysis Study About the Relationship Between Knowledge Management Strategy and Business Performance

Gang Liu[1,2], Eric Tsui[2], Aino Kianto[3] and Yixiao Zhao[1]
[1]Student Career Development Center, Business School, Shenzhen Technology University, China
[2]Behaviour and Knowledge Engineering (BAKE) Research Centre, Department of Industrial Systems Engineering, The Hong Kong Polytechnic University, Hong Kong, China
[3]Lappeenranta-Lahti University of Technology, Finland

liugang3@sztu.edu.cn
gang.liu@connect.polyu.hk
Eric.Tsui@polyu.edu.hk
aino.kianto@lut.fi
z19926437046@126.com

Abstract: The application of knowledge management strategies, such as knowledge codification and personalization strategy, influences business performance because appropriate knowledge management strategies align with firms' strategies and support knowledge management activities. However, the findings of previous empirical studies regarding the relationship between knowledge codification strategy versus knowledge personalization strategy and business performance are inconclusive. This study aims to adopt a meta-analysis approach to investigate the relationships between knowledge codification strategy versus knowledge personalization strategy and business performance. It reveals that the knowledge codification strategy was positively related to the overall business and financial performance, while the knowledge personalization strategy was positively associated with overall business performance. To the best of the authors' knowledge, this is the first meta-analysis research that clarifies the knowledge management strategy—business performance relationship.

Keywords: Knowledge codification strategy, Knowledge personalization strategy, Business performance, Meta-analysis, National culture

1. Introduction

Knowledge management (KM) initiatives are difficult to be implemented without an appropriate management strategy (Liu, Farzad, et al., 2022; Oluikpe, 2012). Hansen et al. (1999) proposed two KM strategies, namely, knowledge codification and personalization (Sánchez et al., 2015). A knowledge codification strategy focuses on the capturing, codification, and retention of explicit knowledge with the support of technologies (Choi & Lee, 2012), whereas a knowledge personalization strategy is concerned with enhancing tacit knowledge communication through people's social networks interaction (Oluikpe, 2012).

The different choices of KM strategies, such as knowledge codification and personalization, influence the firm performance because clearly defined KM strategies align with business strategies (Liu et al., 2020) and support KM activities (Liu et al., 2022a). For example, the knowledge codification strategy emphasizes sharing, transferring, and storage of explicit knowledge. Organizations can easily use the codified knowledge they need; thus, the efficiency of knowledge application is improving, leading to better business performance. On the other hand, the knowledge personalization strategy complements the knowledge codification strategy by supporting employees to share, transfer and apply tacit knowledge. The tacit knowledge is extremely challenging to be transformed into documents. Once firms successfully establish methods for tacit knowledge sharing and application, firms can enhance their capability to receive more competitive advantages.

Previous review studies (Farooq, 2022; Inkinen, 2016) on KM and performance made no attempt to evaluate the effectiveness of the KM strategy (knowledge codification strategy and knowledge personalization strategy) on the business performance of firms. The effect size of the knowledge codification strategy—business performance relationships and the knowledge personalization strategy—business performance relationships remain unclear. A comprehensive understanding of the relationships between KM strategy and business performance is still obscure due to conflicted findings of previous studies. Thus, it is interesting to systematically examine previous KM strategies and performance studies through a meta-analysis, aiming to offer new insight into the KM strategies—business performance relationships.

2. Literature Review and Research Questions

The majority of empirical studies on KM strategy and business performance adhered to the categorization of knowledge strategy by Hansen et al. (1999), but based on this classification, there are some conflicting findings from these empirical studies. According to Ling (2013), the knowledge codification strategy had a positive or negative effect on moderating the intellectual capital—business performance relationships depending on the dimensions of intellectual capital, whereas Liao (2011) discovered a significant negative association between knowledge codification strategy and overall business performance. Interestingly, Bavarsad et al. (2015) found that the knowledge codification strategy did not have any influence on the firm's internal performance. On the contrary, several studies have shown a positive correlation between knowledge codification strategy and the financial performance of firms (Chen & Huang, 2014; Cohen & Olsen, 2015; Payal et al., 2016). In addition, Hasan et al. (2015), Shehata (2015) and Shahzad et al. (2016) concluded that the knowledge codification strategy had a positive impact on the firm's overall business performance. A significant positive relationship between the knowledge codification strategy and the non-financial performance of the firm was revealed by Cohen and Olsen (2015), while Kim et al. (2014) believed that the validation of the effectiveness of knowledge codification on non-financial performance depended on the availability of high maturity information systems and intensity of environmental knowledge. Despite there are possible reasons to explain these contradicted findings, however, such findings fail to provide a clear theoretical understanding of the knowledge codification—business performance relationship, therefore, the first research question is as follows: What is the relationship between knowledge codification strategy and business performance?

Likewise, earlier studies on the relationship between knowledge personalization strategy and business performance remain ambiguous. Ling (2013) and Payal et al. (2016) found that the relationship between the knowledge personalization strategy and the financial performance of firms was insignificant or even negative (Hartono et al., 2018). It has also been claimed that the relationship between knowledge personalization strategy and overall business performance is insignificant (Shahzad et al., 2016). However, it was argued that the relationship between the knowledge personalization strategy and financial performance (Chen & Huang, 2014) and the knowledge personalization strategy—overall business performance relationship was positive (Hasan et al., 2015). Due to such mixed findings, the second research question is as follows: What is the relationship between knowledge personalization strategy and business performance?

National culture is the collective code of the minds of a nation's people in a way that differentiates them from others (Hofstede, 2001). Hofstede et al. (2010) propose a framework including six dimensions —power distance (PD), individualism versus collectivism (IC), masculinity versus femininity (MF), uncertainty avoidance (UA), long-term orientated versus short-term orientated (LS) culture, and indulgence-oriented versus restraint-oriented (IR) culture —to evaluate the differences that exist between national cultures. All these six dimensions affect KM practices and activities (Liu, Tsui, et al., 2022). In addition, national culture, as an important moderator, is frequently applied in organizational research (Tsui et al., 2016).

Recently, many meta-analytic studies, adopting national culture as a moderator to inspect the influences of national culture on the knowledge-friendly organizational culture—performance relationship (Liu et al., 2021), the KM leadership—performance relationship (Liu et al., 2022c), the KM technology—performance relationship (Liu et al., 2023), and the organizational learning—performance relationship (Liu et al., 2022b). However, the moderating effects of national culture on the relationship between KM strategies and business performance remain unknown. Therefore, the third research question is as follows: Does national culture moderate the knowledge codification strategy versus knowledge personalization strategy—business performance relationships?

3. Methodology

3.1 Meta-Analysis

Meta-analysis offers a statistical examination based on many empirical findings from previous individual studies to integrate the empirical evidence (Hartung et al., 2008; Hempel, 2020) by amending errors and bias of the quantitative studies (Schmidt & Hunter, 2015) which is widely used in many fields, such as in educational, social, and medical sciences (Cheung, 2015). This research tries to investigate the relationship between KM strategies (knowledge codification strategy and knowledge personalization strategy) and business performance across empirical scholarly works; thus, the meta-analysis method was adopted to integrate the findings of the earlier studies. Group analysis for categorical moderators (Noel & Todd, 2012) was also applied to examine whether national culture is related to the effect sizes. The statistical analysis was carried out by using CMA3.0.

3.2 Coding of Variables

3.2.1 Primary variables

Business performance

Followed by Liu et al. (2021), the business performance was mainly measured in three different dimensions as follows. The first category used financial indicators, such as return on equity (ROE), return on investment (ROI), cash flow, sales growth, profitability, and market share to measure financial performance. The financial performance was coded as 'F'. The second category emphasized non-financial measurement which was coded as 'NF'. The second category included the following influencing factors such as the satisfaction of stakeholders, time to market, cost reduction, organizational reputation, personnel development, research and development, etc. The last category combined both financial and non-financial indicators which were coded as 'OBP' to evaluate overall business performance in this research.

3.2.2 Moderators

National cultures

Six dimensions of Hofstede et al.'s (2010) national culture framework, namely, power distance (PD), individualism vs. collectivism (IC), masculinity vs. femininity (MF), uncertainty avoidance (UA), long-term orientation vs. short-term orientation (LS), and indulgence vs. restrained (IR) culture were coded based on the regions where the data of the selected research was collected. We followed the approach of Gang Liu et al. (2021) to divide these dimensions of national culture mentioned above into two groups to evaluate the moderating effects of national culture on the KM strategy—business performance relationships (More details can be found on page 113 of Liu (2021)).

3.3 Search Strategy and Results

This research adopted the Scopus database to search relative research papers since more knowledge management journals are indexed in this database compared with the Web of Science. Additionally, the paper selection criteria are crucial to implementing meta-analysis (Cooper, 1998). *Knowledge management* and *performance* were selected to locate the papers if these keywords appear in the article's title, abstract, or keywords from 1975 to 2018 in this study. In accordance with the criteria above, 32,496 papers were retrieved and 31,526 were English-written articles. Limited to the studied topics, 24,663 remaining articles were examined by the contents of the abstracts and keywords. After excluding the unexpected papers, such as irrelevant papers, non-empirical papers, papers without reporting correlation coefficients, and inappropriate papers on measurement, finally, fourteen studies regarding the relationship between the knowledge codification strategy and business performance, eleven studies scrutinized the relationship between the knowledge personalization strategy and business performance were used in this study.

4. Results

It is apparent that the knowledge codification strategy had a positive relationship with overall business performance (r= 0.305, 95% CI: 0.132, 0.460, Z-value= 3.390, p= 0.001 < 0.01) and financial performance (r= 0.274, 95% CI: 0.174, 0.369Z-value= 5.210, p < 0.001) In addition, the knowledge codification strategy—overall business performance relationship was affected by different degrees of indulgence ($Q_{between}$: 28.538; df(Q):1; p-value: 0.000***< 0.001) of national culture. Furthermore, comparisons between collectivism and individualism ($Q_{between}$: 3.568; df(Q):1; p-value: 0.059*< 0.1) on the knowledge codification strategy—financial performance relationship were significantly different according to the categorical moderator test.

The empirical finding indicated that the knowledge personalization strategy was correlated with overall business performance (r= 0.208, 95% CI: 0.036, 0.368, Z-value= 2.362, p= 0.018< 0.1). No significant differences were found between national culture in influencing knowledge personalization strategy and overall business performance. Unfortunately, due to the limited number of research samples, studies on the relationship between knowledge codification strategy and non-financial performance, knowledge personalization strategy and financial performance, and knowledge personalization strategy and non-financial performance were not evaluated.

5. Discussion

The results of this study show that there was a significant positive correlation between the knowledge codification strategy and overall business performance. The finding agrees with the previous studies (Hasan et

al., 2015; Shahzad et al., 2016; Shehata, 2015). A positive correlation was also found between the knowledge codification strategy and financial performance. The findings corroborate with the ideas of others (Chen & Huang, 2014; Cohen & Olsen, 2015; Payal et al., 2016), who suggested that there is a linkage between the codification strategy and financial performance. Strong evidence showing the knowledge personalization strategy had a positive association with overall business performance when there was a significantly positive overall effect size. Similarly, this result matches those observed in earlier studies (Hasan et al., 2015; Shahzad et al., 2016) as well.

The study concluded that appropriate knowledge management strategies are an essential predictor of business performance since organizations can fill knowledge gaps through well-defined knowledge management strategies. First, it was analyzed that knowledge codification strategy was positively correlated with overall business performance and financial performance. For instance, if an organization's knowledge relies heavily on being stored in the brains of its employees, then, codification strategy is of vital importance in this case, especially, when the employee turnover rate is high or when leaders who were born after World War Ⅱ (baby boomers) are retiring from the organization. With this strategy, the organization can still utilize this codified knowledge when employees leave, which indicates that the more knowledge codified, the less the influence on organizational performance induced by knowledge loss. Second, there was a pronounced positive relationship between knowledge personalization and overall business performance. The knowledge personalization strategy emphasizes knowledge exchange, knowledge sharing, and transfer between employees within an organization. Employees have access to relevant knowledge within the organization's employee network about the problems they encounter in their work. Such effective knowledge transfer and application can be easily transformed into organizational value and lead to better organizational performance for the organization. However, since the number of studies on the knowledge codification strategy—non-financial performance relationship, the knowledge personalization strategy—financial performance relationship, and the personalization strategy—non-financial performance relationship is quite small, no specific effect sizes of these relationships have been provided at present, future research should continue to examine these relationships in depth. This study analyzed the effect of national culture on the knowledge codification strategy—overall business performance relationship and the knowledge codification strategy—financial performance relationship, based on the analysis, first, it concluded that the knowledge codification strategy—overall business performance relationship was stronger in restrained culture. One factual explanation for this finding is that in restrained culture, people are more likely to rely on books or other forms of codified knowledge, as used in classroom learning, and they do not interact well with others, especially, those who try to avoid interacting with strangers, and such behavior hinders their access to tacit knowledge. Second, it was found that the knowledge codification strategy—financial performance relationship was strengthened in collective societies. This result may be explained by the fact that people who work or live in collective societies are more likely to feel responsible for the development of the group, and therefore, they are keener to codifying and sharing knowledge with fellow members within the group, whereas people who work or live in individualistic societies are somewhat more independent and do not need and are less likely to codify knowledge for others. In addition, the empirical evidence could not validly specify the impacts of national culture on the knowledge personalization strategy—business performance relationship due to ambiguous comparisons of this study in terms of the knowledge personalization strategy—overall business performance relationship and an inadequate sample size of the studies regarding the knowledge personalization strategy—financial performance relationship and the knowledge personalization strategy—non-financial performance relationship.

6. Conclusion

6.1 Theoretical Contributions

This is the first comprehensive meta-analytic study that comprehensively investigated and clarified the KM strategies—firm performance relationships. It contributes to KM theory by providing a clear interpretation of the magnitudes of the relationship between the knowledge codification strategy and overall business performance, the relationship between the knowledge codification strategy—financial performance, and the relationship between the knowledge personalization strategy and overall business performance based on 1,084 subjects in six studies, 740 subjects in five studies, and 994 subjects in five studies, respectively. Our knowledge from previous studies, such as Inkinen (2016) and Farooq (2022) on the strategic KM—business performance issues, has been supplemented and expanded. The generalizability of these findings is more persuasive than in individual studies.

This is one of few studies that address national culture when investigating KM strategies and business performance simultaneously, and as such, this work makes a valuable contribution to both KM theory and international business research. It creates new knowledge and new research directions on the role of national culture in influencing KM strategies by demonstrating that the knowledge codification strategy—overall business performance relationship was strengthened in a restrained culture and the knowledge codification strategy—financial performance relationship was strengthened in collective societies by using meta-analysis.

6.2 Managerial Implications

This study helps scholars and practitioners to better understand the knowledge-based theory from the perspective of the strategic application of KM and provides feasible recommendations at the level of management implications. This combination of findings provides some support for the conceptual premise that managers need to select appropriate KM strategies that meet their business development needs as their organizations evolve. For example, the knowledge codification strategy should be prioritized if the employee turnover rate is high in an organization, whereas the knowledge personalization strategy should be deployed when employees greatly depend on others' tacit knowledge to accomplish their tasks. Such two complementary strategies, knowledge codification strategy and knowledge personalization strategy provide managers with strategic management approaches that can be combined. Therefore, managers should also assess their internal business requirements and external contexts.

These findings are of vital importance to managers as our research findings provide further instructive support for them. Managers should be aware that in addition to internal obstructions, external factors, such as national culture, might boost or impede KM activities. Those managers working in multinational companies should understand that the benefits of KM may be realized in very different ways in different cultural contexts and external circumstances. For instance, emphasizing on collective knowledge codification strategy might be less effective in individualistic societies but more likely to be easily accepted in collective societies. Furthermore, the knowledge codification strategy might be not undesirable if the knowledge codification process is tedious in indulgence-oriented societies, but it might be not a concern in restrained cultures where leisure is less valued.

6.3 Limitations and Future Research

First, the papers obtained in English written from 1975 to 2018 from the Scopus database in this study might suffer from a language bias and database bias, although such biases were considered limited, according to Livingston et al. (2008). Second, another limitation that could have affected the moderating effects of national culture on KM practices—performance relationships was the binary classification of national culture based on Hofstede's national culture scores. Differences in the national culture adjustment test might be related to the national culture group assignment, as some values close to the threshold were classified into two different groups. Third, the knowledge codification—non-financial performance relationship, the knowledge personalization—financial performance relationship, and the personalization—non-financial performance relationship still remain unclear due to the limited sample size. More studies regarding KM strategies and performance can be conducted in the future. In addition, this study only focused on knowledge codification verse personalization strategy, further research can examine knowledge exploration verse exploitation strategy—performance relationships. Finally, different types of performance, such as innovative performance, sustainable performance, team performance, and employee performance can be used to take further research on KM—performance relationships by using the meta-analysis.

Note

1 No publication bias was found after testing the sample through the fail-safe N test.

2. Details of the dataset can be obtained from the first author.

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Spiritual Knowledge Management: Practical Wisdom and Faith-at-Work Brought to Life

Elaine Long
The Chicago School of Professional Psychology, USA

Elainelong2029@gmail.com

Abstract: Integrating knowledge management, faith-at-work, and phronetic workplace domains, this paper presents phronesis, or practical wisdom, and faith-at-work (FAW) based on theoretical principles of moral actions and character virtues and real-life examples of FAW practices such as thoughts, behaviors, and feelings, bringing to life the practically-wise company. Answering a call to investigate phronesis in the workplace to understand how the individual level of practical wisdom spreads throughout the company achieving a practically-wise company this paper refines one segment of Long's (2022) research findings in Faith at Work: People, Places, Practices, and Tools from the spiritual knowledge management (SKM) domain perspective. These FAW experiences equate to spiritual knowledge and spiritual intelligence in motion while supporting human resource development strategies for employee flourishment. The methodology is empirical phenomenology presupposing theory for the relevant phenomena. The Long (2022) study adds a deeper understanding that sharpens and supports SKM by extracting specific findings and implications of the integration of practical wisdom, moral actions, character virtues, and FAW practices - intersections that enlighten organizations to create desirable value.

Keywords: Faith-at-work, Phronesis, Spiritual knowledge management, Practical wisdom

1. Introduction

The integration of practical wisdom (phronesis), knowledge management – specifically spiritual knowledge and intelligence, and workplace spirituality or faith-at-work principles can help business psychologists, industrial/organizational, and knowledge management scholar-practitioners to better understand the holistic flourishing of the mind, body, and spirit for individuals at work and the collective organization. The chosen aim of this paper is to "shift to a discussion on how best to create climates for this holistic flourishing, whether or not this is called organizational spirituality" (Poole, 2009; p. 587) while addressing the concern that "development of phronesis in the workplace ought to be investigated to enable an understanding of how the individual level of practical wisdom spreads throughout the company to the achievement of a practically wise company" (Rocha & Pinheiro, 2021b; p. 131). The integrated thinking from these domains, using real-life examples from Long's (2022) empirical study leads to a practically-wise, spiritual knowledge management model. Sections four and five, methodology and theoretical backgrounds, provide context for sections six through eight, findings, discussion, and conclusion.

2. Methodology

Long's (2022) FAW empirical research methodology provides a backdrop for relating practical wisdom to workplace spirituality. The phenomenological study provided a theoretical and practical understanding of workplace spirituality (WPS) as faith-at-work (FAW) to explore a deeper awareness of the experience in the lives of employees and managers considering various faith-at-work organizational frameworks (Miller & Ewest, 2015) and individual practices, tools, and characteristics. One problem, noted by Long (2022), is that

> *much research in organizational and management development either neglects or is inconsistent with what defines and impacts the spirituality experience (Mohamed et al., 2004; Pandey & Gupta, 2008) …since 1990, a range of literature reviews, quantitative analyses, and theory development has existed in the WPS field, but relatively few phenomenological studies combine the individual unit of analysis (i.e., employees' and managers' perceptions) in the context of the organizational frameworks. (p. 18)*

To address this, "methodology included post-modern and life story concepts to investigate two common areas of phenomenological study, i.e., what are the experiences and the contexts of those experiences, with both the participant's actions and the researcher's interpretation" (Long, 2022, p.81). The two research questions were based on workplace spirituality's ideal ontology (the nature of reality, and what kind of being *is* the human being, of FAW, is conceptual with intersubjectivity and multiple realities) and relative epistemology (the relationship between the inquirer and the known, is subjective with unique outcomes as the data): (1) How do people experience work in relation to their spiritual and faith beliefs, and (2) How are the respondents' environment, practices, tools, and characteristics part of their experience? In this study "constructivist and interpretative approaches are both applicable to the inductive and exploratory nature of

this WPS research study and address the two common areas of phenomenological study, i.e., what are the experiences and what are the contexts of those experiences" (Long, 2022, p.84).

To enhance research triangulation and data collection and analysis richness, in addition to semi-structured interviews, the manager and employee participants completed a 5-day journal and provided photographs of their FAW tools or practices in their workspaces. The number of photographs, days journaled, and interview hours of all sources were 46, 56, and 15.23 hours, respectively. These prompted and captured real-time perspectives of their lived spiritual phenomenon. A targeted sample of 50% female/male, management/non-management, for-profit/non-profit industries, and a wide representation of spirituality/faith affiliations were met.

Three phases of coding and analysis based on Moustakas' (1994) structures assembled the larger phenomenological meanings and made sense of the parts hermeneutically while bracketing but not reducing the researcher's heuristic. Pseudonyms protected the confidentiality of the eleven coded participants. Analysis of 3450 codes was not based solely on description codes (14%) but used personal values (32%), processes (23%), and felt emotions (13%). The InVivo (11%) and Themeing-the-data (7%) codes were used for member-checking narrative summaries. The coding, analysis, and findings resulted in a series of six mega-experience elements or themes of (1) tri-identity, (2) spiritual discernment, (3) wholistic spiritual exercises, (4) dynamic processes, (5) creating the right FAW environment, and (6) Faith in the Work (FitW) and W(holy)-ness, classified to a total of 24 sub and micro-experience elements or categories. Summaries of the findings by each research question also give context to the themes because some FAW experience elements are common to all the respondents, some represent similarities among a few, and others are unique to one yet have a powerful impact on a deeper understanding of the spiritual phenomenon. Managers and employees' beliefs, values, and practices revealed not only 24 experience elements but also 14 potential organizational environmental frameworks. The FAW findings that show practical wisdom, moral actions, character virtues, and practices that support scholar-practitioners in understanding and developing practically wise organizations are highlighted in this paper's findings and discussion sections.

3. Theoretical Backgrounds

The following theoretical foundations are briefly mentioned providing context and background. First, FAW embraces the forms of belief and filters through which one constructs meaning and purpose in the world (Miller, 2007) including that, "spirituality is the ongoing transformation of a human being in an engaged and responsible relationship with oneself, the other, the world, and God" (Dienberg & Warode, 2018, p. 815 as cited by Long, 2022, p. 25). FAW incorporates "there is clearly nothing in the definition of religion that necessitates membership in an organized religion. One's religion, then, is one's 'set of beliefs concerning the cause, nature, and purpose of the universe" (Dent, 2019, p. 76). In addition, "spirituality at work is not bounded by formal religious practice, but because the spirit is a sacred power, it is drawn from religions (Bell & Taylor (2001) cited by Long, 2022, p. 48). Thus, the FAW axiom used here accommodates formal and defined expressions of belief as found in religious constructs plus informal and less-defined expressions of belief as found in spirituality (Miller & Ewest, 2015) and concurs with (Lynn et al., (2009) that the workplace spirituality literature has helped to bring one's whole self to work, but needs to take more seriously that religious belief is part of the whole for many individuals. The key takeaway is to be able to live one's experience of faith in the workplace.

Secondly, this paper follows others' lead to look at workplace spirituality, aka FAW as a form of organizational wisdom (Rocha & Pinheiro, (2021a) and why it matters to knowledge management (KM) scholar-practitioners. The KM literature enumerates how organizations create, access, control, modify and keep logical, empirical, and rational knowledge to improve performance towards objective and material aspects of work. However, KM is a triple helix, involving spiritual, emotional, and rational aspects. Omitting or minimizing the spiritual orientation lacks depth and meaning for individuals and organizations (Bolisani & Bratianu, 2018; Bratianu, 2015; Farnese et al., 2019; Gull & Doh, 2004). Spiritual knowledge (SK), then, is the third helix, an intangible asset, that provides possible answers to life values, aspirations, motivations, and ethical principles even while one is at work, requiring conceptual and practical understanding.

As part of responsible knowledge management, Rocha et al. (2022) chronicle descriptions, evolution, and potential applications of practical wisdom, or phronesis in management research. Costello (2019) notes phronesis in the formation of managers and professionals and describes it with subtexts of intelligence and sound judgment from Aristotle in the Nicomachean Ethics as one of three approaches to knowledge distinguished from episteme and techne. "Whereas episteme concerns theoretical know-why and techne

denotes technical know-how, phronesis emphasizes practical knowledge and practical ethics" (Costello, 2019, p. 217). Phronesis is at the individual or the collective level, involving personal, moral, emotional, social, and religious aspects (Rocha et al, 2022). Specifically notable is that practical wisdom is "consider[ed] the all-important virtue of the mind" (Hughes, 2013, p.52, as cited by Rocha & Pinheiro, 2021b:137); it is also classified and included in the concept of moral virtues where virtue is described as a disposition that reliably does the right actions, makes the right choices, and has the right feelings (Hills, 2015). Thus, "practical wisdom is not distinguished from moral virtues" (Rocha & Pinheiro, 2021b, p.137). Biddle (2010) adds that "while a moral value is an object (or thing) by means of which one promotes one's life, a moral virtue is an action (or choice) by means of which one does so" (p.75) and one "must bear in mind not only our material needs but also our spiritual needs" (p.97) in assessing the propriety of an action.

Thirdly, collective phronesis is the sum of people's loftier independent and dispersed phronesis, and the synthesizing efforts to bring together by management pieces of the collective wisdom within and across organizations (Kodama, 2021). Finally, practically-wise organizations do more than just act morally or include a process of reflecting and making decisions, but apply all knowledge (including spiritual) to solve problems practically, efficiently, and effectively to do the least harm possible (Rocha & Pinheiro, (2021b).

4. Findings - Practical Wisdom Foundations of FAW

An integration between practical wisdom, SKM, and workplace spirituality, aka FAW idiosyncrasies, similarities, and commonalities from Long's (2022) empirical findings follows. Long's (2022) findings that focus on the FAW dynamic processes sub-element 4.2 "fruits" (moral actions) of how one treats others, sub-element 4.3 moral virtues and characteristics, and FAW practices are the most critical ones to this paper. All following examples are based on the coded findings, not the participant demographics. "The reflective inquiry process that was used highlights notions belonging to everyone's life exploring the phenomena in a heuristic or interpretative manner (Van Manen, 2016). The subsequent findings and conclusions of the people's stories and experiences go beyond purely reductive explanations of WPS phenomena and the verbatim exemplary quotes are used liberally throughout to fully illustrate the FAW experiences" (Long, 2022, p.110).

4.1 FAW Experience - Sub-Element 4.2: "Fruits" (Moral Actions) of How One Treats Others

Practical wisdom can be viewed as moral virtues (Rocha & Pinheiro, 2021b) and moral virtues as moral actions (Biddle, 2010); and "an action either promotes a person's life and long-term happiness or it does not. If it does, it is virtuous; if it does not, it is not" (Biddle, 2010, p.82). In practice, the spiritual particulars at work as FAW experience elements of virtuous moral actions add a constructive resource for scholar-practitioners.

All the employees and managers in Long's (2022) study determined that FAW is moral actions described as "how you treat others" and involve a variety of dynamic habits, qualities, and deeds. Through intensive coding, the types of moral actions or the "fruits (something that inevitably appears on a healthy tree) of how one treats others are charity, joy, peace, patience, kindness, goodness, gentleness, commitment, and continency or self-control. Tangible examples of employees' and managers' "fruits" or moral actions are found in Table 1.

Table 1: Real-life Examples of FAW Fruits/Moral Actions of How One Treats Others

Moral Action	Description	Pseudonym - Quote from Long (2022)
Charity	The love of God and fellow men expressed in concrete actions.	Kia – "All of the tasks that we have to do should be really moving toward those values of fairness and equity, and, caring, caring for, caring for people."
Joy	State of being undisturbed by the negative things in life.	Griffin – "At the core is service, serving others' needs, and the joy that comes out of serving others is priceless."
Peace	Tranquillity in our soul that comes from relying on God. Rather than getting caught up in anxiety for the future.	Theodore – "Without making time to pray, I may not act peacefully or be charitable when someone is being difficult."
Patience	Ability to bear the imperfections of other people, through our own needs as well.	Miriam – "It's really important to allow people to be who they are, regardless of what their faith is or isn't. So that's just about tolerance of any kind, right?"

Moral Action	Description	Pseudonym - Quote from Long (2022)
Kindness	Willingness to give to others above and beyond what we owe them.	Eve – "And so for me, that's how I exhibit my faith, by trying to treat people with kindness."
Goodness	Avoidance of evil and the embrace of what's right, even at the expense of one's earthly fame and fortune.	Theodore – "In Greek Orthodox practice, evil thoughts are the little things that start to enter your mind that start to direct you towards a failing of some kind. Acedia is one of the most dangerous of the eight evil thoughts…sometimes, even doing 'a good' is not, it is not 'a good' when it is not 'your good'…you must stay focused."
Gentleness	To be mild in behavior is to be forgiving rather than angry, gracious rather than vengeful.	Eve – "It's in the Bible, how many times you're supposed to forgive. He says, 70 times seven times like you're saying like you continue to forgive…Bible reminds me there is no end to being patient."
Commitment	Living life per God's will at all times.	Jacob – "When the wind is not blowing through the sail and not getting us moving, everything just feels stagnant, and it's easy to lose track and just forget the calling that God has put upon us. I find that when things are out of your control, you just really have to kind of look to the One that is in control."
Continence	Self-control is the exercise of moderation in all things.	Joyce - "My faith is emotional control; My faith is behavioral control."

4.2 FAW Experience Sub-Element 4.3: Theological, Moral Virtues, and Character Strengths

In Long (2022), the employees and managers employed the theological virtue of hope, and moral virtues supported by character strengths of prudence, justice, and temperance as part of their FAW experiences. Rocha and Pinheiro (2021b) suggest that to become a person of practical wisdom one needs character virtues and a notion that spiritual characteristics could be an antecedent to wisdom. The FAW: PPPT real-life experiences support these suggestions. Within the dynamic spiritual development and the fruits/moral actions of how one treats others FAW experience elements are the specific characteristics of temperance including prudence, justice including fairness, transcendence including hope, and spirituality. See Table 2. These real-life examples clarify what character virtues (VIA Institute on Character, 2018) of practical wisdom look like at work.

Table 2: Real-Life Examples of FAW Character Virtues

Characteristic	Definition	Pseudonym - Quote from Long (2022)
Temperance: Prudence	Being careful about one's choices; not taking undue risks	Joyce – "I always feel like the Holy Spirit's jumping in and going, warning, warning, warning, you know, always protecting me."
Justice: Fairness	Treating all people, the same according to notions of fairness and justice; giving everyone a fair chance	Kia – "I stand for the truth… not just for rules because they are the rules, there's a reason and a value behind them…fairness, justice, and equity. I see this calling as a driving force of the work that I do, I have to advocate for fair treatment."
Transcendence: Hope	Optimism, future-mindedness, expecting the best in the future, and working to achieve it	Eve – "Regardless of your situation or position even you can still be somebody who, you know, brings life, gives life, gives hope versus you know taking it away from people, and that's kind of my focus when I come into the day while I'm at this job."
Transcendence: Spirituality	Faith and purpose, coherent beliefs about higher purpose, meaning of the universe; meaning of life that shape	Amrit – "Faith wisdoms given to you, father's influence, and values; pass on to your children…it's [faith] largely engrained inside, and it is deeply set inside…. People prefer to leave

Characteristic	Definition	Pseudonym - Quote from Long (2022)
	conduct and provide comfort.	organizations if it conflicts with their value system or faith."

These character virtues help scholar-practitioners identify the phronimos, the one who uses the 'eye of the soul' honed by experience and made possible by good moral character—to act virtuously and prescribe right action to others revealing that "moral expertise is practical wisdom rather than theoretical wisdom" (Khan, 2005, p.39). Purporting there is a need for these characteristics in a phronetic workplace, "one could surmise that the phronimos can sum up a situation, weigh up various factors, and work out what to do to promote or achieve his objectives" (Costello, 2019, p.217). Yet, as FAW's real-life experiences in the next section depict, a variety of practices - thoughts, behaviors, and feelings – cognizant of moral virtues, actions, and character, can further describe phronimos in a phronetic workplace.

4.3 FAW Practices (Thoughts, Behaviors, Feelings)

Descriptions of FAW practices (which are SK or SQ in motion in the SKM domain) were in-depth and specific due to triangulation in Long's (2022) methodology addressing a research call to reduce abstraction around FAW practices (Dyck, 2014). The detailed interview questions were supplemented by five days of journalling about spiritual experiences such as, what did you do? what did you think? what did you feel? what did you believe? and how is spirit or faith present or absent at work today? as well as by the photographs of their workplace spirituality tools, environment, practices, etc. An average of eight, regular FAW practices were implemented by each employee or manager. To dignify the commonalities, similarities, and idiosyncrasies of the FAW practices, see samples of the FAW thoughts, behaviors, and feelings in Tables 3, 4, and 5.

Table 3: Sample of FAW Practices (Thoughts) by Employee/Manager Quotes

Employee/ Manager	Thoughts
Miriam	VIRTUES: … the study of Mussar I think is really instrumental in what I bring not only to work and to my clients, but just, the work on what I try to do for myself. The application of Tzedakah [Hebrew for justice], of this virtue, is really up to you, as long as you also balance using Mussar training and the other virtues.
Amrit	GOD'S GRACE: With my colleagues, faith is at two levels. One, I am spiritually awake…My faith is still there, and two, I am more connected with my colleagues when I am good to them, and in return, they also reciprocate. Supportive friends and colleagues are just a grace God has given you.
Eve	JESUS-LIKE: Jesus is a role model, be like Jesus. Things that I've learned, like the virtues, I have, I try to exhibit within the workplace, such as patience and love, are helping and supporting others.
Adeline	DIVINE ENERGY: Creative writing, not academic writing, expresses emotion, oneself, and the Beyond. Beyond is a… Divine Energy, the guiding force in the universe, God, the souls of people, also angels or småfolk, something like the equivalent of fairies.
Theodore	ETERNAL LIFE: Christian eternal life is an ongoing goal. Christ saves and we make efforts for the grace of Christ to be fully effective in us. In Eastern Orthodox everyone is called to be monastic; most are called to be in the world, not of the world.
Jacob	COVENT LOVE COMMANDMENTS: In Matthew 22:37-40, Jesus talks about the two Greatest Commandments Love God with all your heart, soul, and mind. And elsewhere in the Old Testament, we see that same concept presented to include heart, soul, mind, and body. So, so, essentially, love God, wholesomely. I need no other foundation than the eternally consistent promises of God. Hesed (חֶסֶד) is a Hebrew word that we translate as faithful love or loving-kindness. This is Covenant love and the love God displays through the promises he keeps.

Table 4: Sample of FAW Practices (Behaviors) by Employee/Manager Quotes

Employee/ Manager	Behaviors
Joyce	PRAYING: Praying every day because it's very important to me. I do that faithfully. I listen to Him tell me which would be the best way to go. I do a morning practice, next. I say three times, I believe, in reverence to my belief in the Trinity, and prayers for others. Praise God, never take things for granted, honor Lord Jesus and do no harm, and recognize the Holy Spirit constantly. End my morning practice with, thank you, my Father, Lord Jesus, and Holy Spirit for giving me this day to honor You, and listen some more.
Kia	GRATITUDE: …on my lunch hour; tapping, praying, wishing with the holy medals; it's a "thank goodness".
Monty	REFLECTING: Reflecting, meditating, and listening. The only tool that I used for workplace spirituality today was my playlist which has been consisting of Israeli and Jewish songs.
Amrit	BEING WITH NATURE: Being with natural and spiritual elements is how I connect at work. I recommend we go outside for meetings… the natural light, space, and view of the mountains are spiritual; remove obstacles to thinking clearly and allow you to be yourself at work.
Eve	EMBODYING FAITH: Embodying faith by being patient …no swearing… understand where people are coming from, …trying to connect with them. Handle differences with respect.
Griffin	SPIRITUAL WALKING: We started as a business meeting with three, now it's an ecumenical Bible study with eight men. Our relationships carry over from the corporate world to consulting to help with our spiritual walks today. We have trust… faith discussions and pray for each other.
Pat	SHARING: Listening to others' concerns without persuading them to become an atheist, being a supportive good friend, and not being responsible for others' views. When I opened up, he opened up too; sharing worldviews and our closeness includes sharing resources.
Jacob	MIND-BODY-SPIRIT EXERCISING: Being my whole self at work, including my spirituality, is being consistent with my core values. Inconsistency in one area affects others in the body, spirit, and mind diagram. My mind-emotion affects me spiritually… and in exercising. Spirit to mind to body, or in reverse. Spiritual practices... helps me navigate the day.

Table 5: Sample of FAW Practices (Feelings) by Employee/Manager Quotes

Employee/ Manager	Feelings
Joyce	THANKFUL: I feel thankful every day for what God has given me. I am thankful for giving me the opportunity to serve him throughout the day.
Eve	PEACEFUL: I desire giving and receiving understanding. My spiritual and mental health are connected so I follow my beliefs during challenges and this consistency with beliefs is peaceful.
Pat	CONNECTED: It was surprising to talk about religion at work and to learn about my co-worker's religious views and practices. It made me feel closer and a deeper connection and brought us closer by hearing about his religion and sharing that I am an atheist. Maintain faith without oppression.
Theodore	JOYOUS-SORROW: Spiritual practices at work include feelings of joy and sorrow. My faith includes opposite intentions such as joyous sorrow. Rejoice that Jesus Christ died and rose again for our sins and sorrow for our shortcomings. This gives hope that that although we're generally goof-ups, Christ is going to lead us out of that. The " gift of tears" is forgiveness for our sinful nature and for those who don't know the joy of God, Jesus, and the Holy Spirit. I feel joyful when others overcome challenges and are happy.

This sampling of practices, as mentioned, is spiritual knowledge and intelligence in motion, and represents the phronimos in a phronetic workplace. Next, the human flourishing model in Long's (2022) study is presented supporting the notion of the practically-wise organization as a virtuous learning organization (Rocha & Pinheiro, 2021b) that accesses collective phronesis, along with the integration of FAW and phronetic constructs

5. Discussion

5.1 Integrated Phronetic-Spirituality Workplace

The employees' and managers' FAW practices (thoughts, behaviors, and feelings) in Long (2022) are evidence of Rocha and Pinheiro's (2021b) viewpoint that spirituality supports the phronetic workplace in terms of the three dimensions of meaningful work, opportunities for the inner life, and sense of community and belonging. First, a synthesis of the FAW thoughts was, "[God's covenant] love empowers implementation and development of virtues for a wider scope than oneself; to calmly, purposefully serve others and self to work and live safely in, and not of, the world for eternal goals" (Long, 2022, p. 163). This relates to "once the phronetic workplace is part of a practically wise company, its members feel that their work is meaningful to them, society, and future generations" (Rocha & Pinheiro, 2021b, pp. 149–150). Secondly, a synthesis of the FAW behaviors was, "daily, constant self-awareness and improvements for eternal goals are consistent with their mind-body-spirit values…. praying for others…open discussions…studying and understanding scriptures, Saints, Christ… meditating, listening, believing, giving thanks, reflecting, removing obstacles to being your true self…spiritual elements and inspirational songs" (Long, 2022, pp. 163–164). This parallels the "opportunities for individual and collective spiritual evolution, achieving a transcendental way of living and conquering one purpose…opportunities to learn continuously… other methods… space and time for reflection, meditation, and prayer" – having an inner life within a phronetic workplace (Rocha & Pinheiro, 2021b, p. 151). Thirdly, a synthesis of the FAW feelings was "people feel releasing, uplifting, hope, forgiveness, a deep understanding that is surprising and important, sometimes a dichotomy of joyful sorrow and a gift of tears, deeper relationships with people and beyond people because of God, allowing one to maintain faithfulness without feeling oppressed" (Long, 2022, p.164). These resemble the sense of community and belonging in a phronetic workplace where "members' idiocrasies are both respect[ed] and celebrate[d]. Members' differences are favorable to the workplace, and every form to search for inner growth is valid" (Rocha & Pinheiro, 2021b, p. 150), linking the FAW and phronetic workplace constructs.

5.2 Spiritual Knowledge Management, Human Flourishing, and a Practically-Wise Strategy

Next, Rocha & Pinheiro (2021a) suggest organizational spirituality is an organizational identity that is the result of its values, practices, and discourse, composed of workplace and individual managers' and employees' spirituality; influenced by the environment, organizational culture, and knowledge management (p.248). The individual's moral actions, character virtues, and faith practices mentioned here, plus the individual's workplace culture and context not detailed in this paper but in Long's (2022) full study, assemble a similar approach that creates an organizational strategy for human flourishing. Long (2022) introduces a conceptual human flourishing (HF) model proposing that as individual FAW practices and characteristics which are spiritual knowledge (SK) and intelligence (SQ) in motion develop, they may be part of organizational values that through their interdependence of the physical and non-physical meanings and purpose lead to an organizational culture that is developed and transformed by knowledge management processes that allow changes to happen. When changes including spiritual knowledge management are allowed, a hermeneutical loop, like a virtuous learning organization in a practically-wise organization, creates a climate for flourishing. See Figure 1.

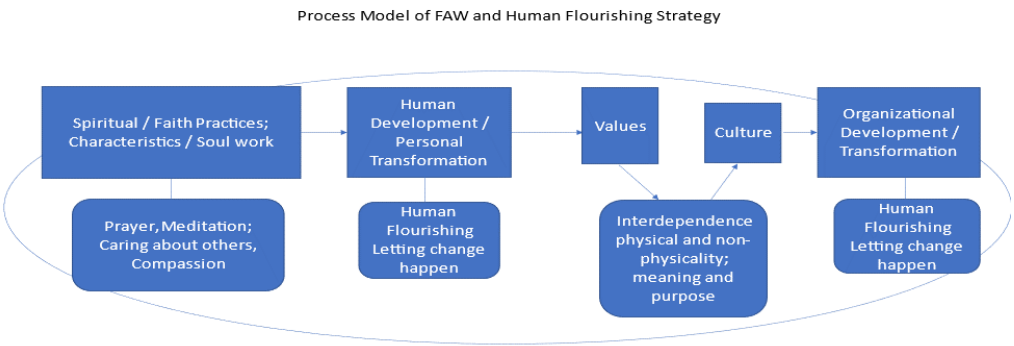


Figure 1: Model of FAW and Human Flourishing

The HF model embraces and allows for the respectful pluralistic use of various types of spiritual knowledge to access and expand spiritual intelligence supporting "how important the ambiance is for developing spirituality" (Rocha & Pinheiro, 2021b, p. 154). In practically-wise companies, workplace spirituality must be "highly developed and an advanced shared context for learning, interaction, and engagement" is crucial for spreading individual phronesis to collective phronesis; plus, "the meaning and purpose are the glue of collective knowledge and spirituality in the workplace" (p. 155). Also, Rocha & Pinheiro (2021b) propose that individual phronesis (practical wisdom) expands to workplace organizational phronesis through enhancing workplace spirituality. In the HF model, access to individual SQ practices and tools builds the collective SQ by acknowledging the glue of collective knowledge and creates value for a practically-wise company. Hence, again, SKM, practical wisdom, and FAW constructs intersect where "a high level of spirituality assists in the unfolding of practical wisdom… mainly in its role in finding the fulfillment and flourishing of one's life" (Rocha & Pinheiro, 2021b, p. 149).

6. Conclusion

The contributions are both theoretical extensions of the literature and practical organizational applications intended for scholar-practitioners.

6.1 Integrated Phronetic-Spirituality Workplace

The first discussion, and respective prior findings, extend the literature with non-abstractions clarifying how the constructs, FAW, and phronetic workplaces, connect and exemplify moral actions, character virtues, and spiritual thoughts, behaviors, and feelings from both theistic and humanistic spheres.

6.2 Practical Contributions Related to Human Flourishing

The second discussion supports a new model of linkages between the FAW experiences involving a variety of spiritual and faith-at-work practices, such as prayer and meditation, embracing FAW characteristics such as caring about others or compassion, where "soul work" develops and engages opportunities for individual phronesis, and a practically-wise organization lets these changes happen, for non-materialistic reasons and the common good, in turn, becomes organizational phronesis, with innovation and shared values creation, resulting in human flourishing. "The implementation of a continuous FAW and HF strategy would reinforce the FAW experiences and continuous FAW experiences would reinforce the HF strategy in a hermeneutical circle" (Long, 2022, p. 191).

Finally, creative inquiry through verbal, written, and visual phenomenological methodology brought to life greater awareness of, extended, and contributes to the literature and practical applications of spiritual knowledge management, practical wisdom, and FAW.

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Strategies for Knowledge Management Readiness at an Engineering Consulting Organization in South Africa

Edigar Mahuni and Madeleine Fombad
Department of Information Science, University of South Africa, Soth Africa

echavhunduka@gmail.com
fombamc@unisa.ac.za

Abstract: *Aim.* This article investigates knowledge management readiness at an engineering consulting firm in South Africa known as Zutari (Pty) Ltd, or Zutari, and suggest a strategy to achieve readiness in engineering firms. Engineering consulting firms are knowledge-intensive firms that offer specialised services in the provision of independent expert knowledge in the fields of engineering, science and other related areas in the public and private sectors, infrastructure, and construction sectors Although knowledge management is widely acknowledged as a strategic enabler in engineering consulting firms, most initiatives fail, making a knowledge management readiness assessment essential before implementation. *Methodology.*

The target population was Zutari's permanently employed technical professionals. Stratified and systematic sampling methods were applied to select a sample of 285 technical professionals. A questionnaire was used to gather quantitative data. The assessment model of Aydin and Tasci (2005) was used to assign readiness levels for the critical success factors under investigation. *Findings.* The findings reveal that the level of knowledge management awareness among Sutaria staff is quite high, even though knowledge management is practised informally. A knowledge management readiness strategy is suggested to get Sutaria to the expected level of readiness. Knowledge management is widely acknowledged as a strategic enabler by employees in Zutari, with information technology currently the only critical success factor at the expected level of readiness. *Conclusion***.** A knowledge management strategy is suggested to assist Sutaria in achieving the expected level of readiness. Further research could test the effectiveness of the readiness strategy in different contexts using mixed methods research. This research will add new knowledge to the body of knowledge in the engineering consulting sector and help firms planning to implement knowledge management. Implication. Not many studies have been conducted to test the organisational readiness for knowledge management in engineering consulting firms. This article adds to the body of knowledge in this field.

Keywords: Knowledge management readiness, Engineering consulting, Knowledge, Knowledge management, Knowledge processes

1. Introduction

Knowledge management in engineering consulting firms will leverage knowledge and best practices, providing prompt response to customer requests, avoiding reinventing the wheel and curbing the loss of knowledge when experts leave the company (Rubin & Powers 2017; Majorize & Buckley 2019; Bishop 2009; Parsons 2017; Pope 2019).Engineering consulting firms are knowledge-intensive firms that employ knowledge workers such as engineers, architects and design thinkers who provide professional consultancy to clients by assisting them in identifying and analysing problems and recommending and implementing solutions (Robinho 2015; Mazorodze and Buckley 2019; Kou 2019). Due to the large amounts of knowledge, generated most of these firms struggle to leverage the knowledge scattered across the organisation or to locate experts to assign to new projects (Mesher, Abdul-Malak, Mazorodze and Buckley 2019). A knowledge management readiness assessment will serve as a guide in planning and implementing knowledge management initiatives, thus minimising risks (Mohd Zin and Egba 2010). Mohd Zin and Egba (2010) define knowledge management readiness as the degree to which the employees in an organisation, the knowledge management processes, and information technology are ready to take advantage of the benefits accruing from knowledge management implementation.

Zutari is among the 580 engineering consulting firms in South Africa with a membership at Consulting Engineers South Africa with vast amounts of tacit and explicit knowledge. This firm has a long-standing history in the engineering consulting field dating back 90 years (Zutari 2021). It became an independent company in 2020 following the demerger of the African business and Aurecon Australia, a global international engineering and infrastructure advisory company (Aurecon Africa 2020). It has 16 offices in South Africa and 13 in other African countries with the head office is in Pretoria. Zutari has 1900 employees: 1600 are technical professionals and 300 are support staff. This firm works with clients to co-create solutions in asset management and digitisation, power generation, storage, transmissions and distribution, environment and climate resilience and many other areas (Zutari 2021). However, most of the workers in this firm work in silos; this affects the production of timely, high-quality project proposals and bids, as revealed by the Chief Executive Officer of Zutari in his address to staff at the beginning of 2021. Considering its geographically dispersed locations on the continent and its potential to become a benchmark for other companies in the engineering consulting sector in South Africa, this study sought

to ascertain Zutari's readiness for implementing knowledge management. The research outcome will help Zutari and other engineering consulting firms prepare for knowledge management implementation.

2. Problem Statement

Knowledge management in engineering consulting firms can lead to improved client satisfaction and decision-making, enhanced work quality and improved overall job performance and satisfaction, thus keeping these firms competitive (Rubin and Powers 2017; Alaudin et al. 2019). Knowledge management at Zutari is still elementary as the organisational structure and delegation of authority are yet to be defined. The question that seeks to be answered are: What is the current state of knowledge management readiness at Zutari? How can the knowledge management readiness strategies at Zutari be enhanced?

3. Knowledge in Engineering Firms

knowledge is defined by Nonaka and Takeuchi (1995:58) as a justified true belief and dynamic human process of justifying personal belief toward the 'truth'. The different typologies of knowledge highlighted in the literature may be classified into two major subcategories as tacit and explicit knowledge. The number of engineering consulting firms investing in knowledge management globally is increasing. Organisations without structured knowledge management may be wasting resources considering that an employee may spend 16% of their weekly 40 hours of work looking for information, and 44% of the time failing to find the information (Rubin & Powers 2017).In global engineering firms, employees are spread across geographically dispersed locations, making it difficult to access the tacit knowledge and to connect employees for collaboration, creation, and knowledge sharing (Barnard and Rothe 2003, Learning Uncut 2019). Despite the benefits of knowledge management by engineering consulting firms, the uncertainty on implementing a viable and cost-effective knowledge management initiative presents a barrier to knowledge management implementation in engineering consulting firms. A knowledge management readiness assessment is necessary to determine the level of readiness for implementing knowledge management; it minimises risks as it serves as a guide to leaders in planning and implementing knowledge management initiatives (Mohd Zin & Egbu 2010).

4. Organisational Readiness for Knowledge Management

Organisational knowledge management readiness is its ability to adopt knowledge management successfully and use it to benefit the organisation (Mohammadi et al. (2009). A readiness assessment will reveal the needs of the organisation, its strengths and weaknesses, any opportunities, threats, and risks regarding knowledge management implementation. Knowledge management readiness requires effective investment in the implementation of critical success factors (Davenport, De Long and Beers 1998; Hasanali 2002; Wong 2005). The common themes that determine readiness are people, structure, processes, infrastructure, technology, culture, content, community, and computing (Lee & Choi 2003; Razi, Karim and Mohamed 2017; Andrawina et al. 2018; Guribie and Tengan 2019; Kaburuan 2019) as noted in Table 1 below. It is clear from Table 1 that and the reviewed literature on knowledge management readiness that people, process, IT, organisational structure and culture are recurring factors.

Table 1: A Summary of Recurring Elements by Different Scholars in their Measurement Frameworks

References	People	Process	Organisational culture	IT Technology	Organisational structure
Lee and Choi (2003)			✓□	✓□	✓□
Nagarajan et al. 2009	✓□	✓□		✓□	
Mohd Zin & Egbu (2010)	✓□		✓□	✓□	✓□
Shahidi et al. (2015)	✓□	✓□	✓□	✓□	
Pradana et al. (2015)	✓□				✓□
Ramadhan and Andrawina (2015)		✓□	✓□	✓□	

Razi et al. 2017; Razi and Karim (2010)	✓□		✓□	✓□	✓□
Andriwana et al. (2018)	✓□	✓□	✓□	✓□	✓□
Kaburuan (2019)		✓□	✓□	✓□	

People are the source of knowledge and critical to knowledge management. They play one of manager's employees' and use their skills or to share personal knowledge (Obaide 2004; Pradana et al. 2015; Andrawina et al. 2018). Botha (2007) refers to them as repositories of knowledge since tacit knowledge resides in people's heads. People provide leadership and sponsorship, support knowledge sharing processes, manage and measure knowledge flows, and content is the knowledge what is managed. It is widely accepted that organisational culture plays an important role in knowledge management implementation in engineering consulting firms (Mohd Zin and Egbu 2010; Maraura 2015; Enshassi, Falouji, AlKilani, and Sundermeieri 2016). Cultural readiness is the extent to which an organisational culture promotes the adoption of knowledge management processes among the employees (Hasanali 2002). The variables suggested in the literature for measuring cultural readiness for knowledge management are collaboration, trust, learning, business strategy, management support and reward. The organisational structure influences knowledge management success. An organisational structure defines how an organisation is divided to manage and support knowledge management (Andrawina et al. 2018). Razi and Karim (2010) classify organisational structures as decentralised and informal. Nonaka and Takeuchi (1995) argue that the rigid horizontal and vertical divisions in hierarchical organisational structures distort knowledge. Mohd Zin and Egbu (2010) encourage organisations to adopt organisational structures that promote teamwork, project-based work and multi-skilled employees that encourage coordination among peers. Knowledge management theorists also recommend flexible and non-hierarchical organisational structures for knowledge management implementation.

IT is critical to knowledge management success and has been used by some scholars to assess IT readiness (Lee and Choi 2003, Razi and Karim 2010; Razi et al. 2017, Shahidi et al. 2015; Kaburuan 2019). A reliable technological infrastructure connects the people to the knowledge processes. Knowledge management also involves different interdependent knowledge processes such as creation, storage, retrieval, transfer and application, defined differently by different authors. Gonzalez and Martins (2017) highlight acquisition, storage, distribution and use. Hansen, Nohria and Tierney (1999) identify two basic strategies for managing knowledge as codification and personification. Codification focuses on capturing explicit knowledge in electronic format and availing it for retrieval. Personification focuses mainly on interpersonal knowledge transfers through personal interaction on communities of practice (CoPs) and enterprise socialisation spaces. A knowledge management strategy should be centred on people in the organisation, not technology (Becerra-Fernandez and Sabherwal 2010). The knowledge management strategy should align with the business strategy of each organisation (Guribie and Tengan 2019).

5. Theoretical Frameworks

The readiness model of Razi et al. (2017) was adopted in this study for identifying critical success factors, the Aydin and Tasci (2005) model to assign a knowledge management readiness level to each variable. Razi et al. (2017) identifies knowledge creation processes, organisational culture, organisational structure, IT, individual perception, and organisational members' behavioural intention in the knowledge management readiness assessment framework. The readiness assessment model of Aydin and Tasci (2005) was used to assign a knowledge management readiness level to each variable, critical success factor and the overall organisational knowledge management readiness level using the calculated mean values. This model enables easy coding and assessment; the alternatives are coded 1, 2, 3, 4 and 5, as in a 5-point Likert-type scale. The 3.41 mean score is the expected level of readiness. It is obtained by identifying the critical level using the formula: 4 intervals/5 categories = 0.8. The divisions of 0.8 demarcate the intervals. Other mean scores are either less or higher than the expected level of readiness. Lower scores indicate that they are not ready and require some work. Higher scores indicate readiness but require some work still. Based on this analysis, the levels of readiness are depicted in Figure 1.

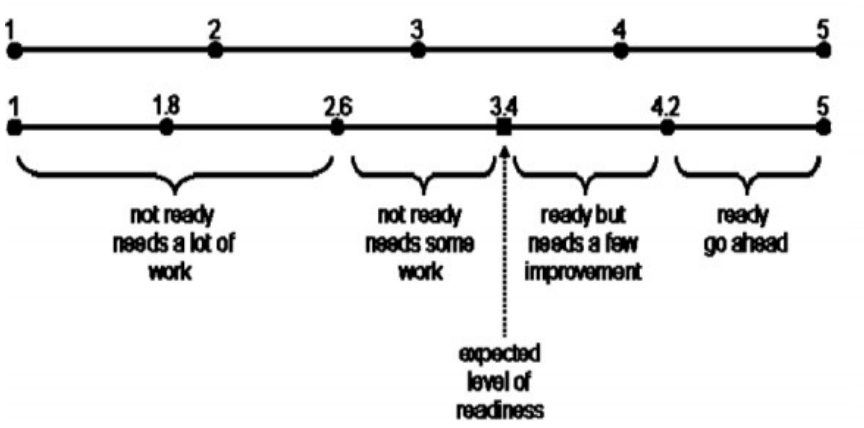


Figure 1: Readiness Assessment Model (Aydin & Tasci 2005)

6. Research Methodology

A quantitative research approach and a case study research design using Zutari as a unique case were adopted in this study. Questionnaires were used to collect data. The accessible population consisted of 1 443 technical experts

working on a permanent basis. A proportionate stratified sampling of the departments was made. Hayes's formula (2021) was used to determine the proportionate stratified random samples of the units as (sample size/population size). For a stratum size of 167, the sample size is calculated as (285/1443) *167 to obtain 33. This was followed by systematic random sampling using the formula of Taherdoost (2017). Using the target population of 1 443, with a confidence level (Z) of 94%, percentage occurrence of a state (P) of 50% and the maximum error (E) of 5%, the sample size (n) was 285 employees.

The study was guided by the following objectives:

- Assess the level of knowledge management readiness for implementing a knowledge management initiative.
- Suggest a knowledge management readiness strategy to guide Zutari in implementing a successful knowledge management initiative.

7. Knowledge Management Readiness by Variable

The variable means shown in Table 2 below were assigned a readiness level using the readiness model of Aydin and Tasci (2005) in Figure 1 above.

Table 2: Knowledge Management Readiness by Variable

Critical success factor	Variable	Mean	Readiness
People	Knowledge of knowledge management	3.1	Not ready, needs some work
	Perceived usefulness	3.7	Ready, needs a few improvements
	Socialisation	3.1	Not ready, needs some work
	Externalisation	3.2	Not ready, needs some work
	Combination	3.4	Expected level of readiness
	Internalisation	3.1	Not ready, needs some work
Process	Knowledge creation	3.3	Not ready, needs some work
	Knowledge identification	3.1	Not ready, needs some work
	Knowledge storage	3.2	Not ready, needs some work
	Knowledge sharing	3.2	Not ready, needs some work

Critical success factor	Variable	Mean	Readiness
IT	IT support	3.2	Not ready, needs some work
	ICT use	3.4	Expected level of readiness
	ICT	3.5	Ready, needs a few improvements
Organisational structure	Distribution of authority and control	3.4	Expected level of readiness
	Flexibility	3.0	Not ready, needs some work
Organisational culture	Collaboration	3.2	Not ready, needs some work
	Trust	3.4	Expected level of readiness
	Learning	3.3	Not ready, needs some work
	Strategy	3.1	Not ready, needs some work
	Top management support	3.1	Not ready, needs some work
	Reward and recognition	2.5	Not ready, needs some work

The average value of the mean values of each variable was used to calculate the mean for the corresponding critical success factor. Each critical success factor mean value is assigned a readiness level in Table 3 below.

Table 3: Critical Success Factor and Overall Organisational Mean and Readiness

CSFs	Mean	Readiness level
People	3.9	Ready needs a few improvements
Process	3.2	Not ready needs some work
IT	3.4	Expected level of readiness
Organisational structure	3.2	Not ready needs some work
Organisational culture	3.1	Not ready needs some work
Overall organisational mean	3.3	Not ready needs some work

The overall readiness score for the people dimension is 3.9, which shows that Zutari strongly values its people as they are the source of knowledge and create, acquire, and share knowledge; this is in line with Obaide (2004)'s recommendations to invest in people. The use of people-centred techniques, such as succession planning, mentoring, tutoring, discussions, technical forums, real-time document collaboration tools and lessons-learnt sessions have been encouraged (Carrillo 2004 and Bishop 2009). . The overall readiness score for process as a critical success factor was 3.2, indicating that Zutari's processes are elementary. Knowledge is created in the organisation through learning, research, and development, problem-solving, creativity and innovation. Tacit knowledge is shared through formal and informal socialisation such as mentorship, meetings, CoPs and brainstorming sessions. Creating an organisational culture and structure conducive to knowledge sharing and nurturing the attitude of seeking help among staff helps to improve tacit knowledge sharing (Obaide 2004; Collison and Parcell 2009).

ICT had the highest mean score of 3.5 and ICT support had the lowest mean score of 3.2. ICT use had a mean of 3.4, equivalent to the expected level of readiness. The overall readiness score for the IT critical success factor was 3.4, which equates to the expected readiness level. IT should not be an end; it should complement a pre-existing knowledge-sharing culture as recommended by Frost (2014). Knowledge management is more than the mere application of IT (Ragab and Arisha 2013; Kuo 2019); there should be a balance between people, process and technology (Bishop 2009; Kuo 2019). The overall readiness level for organisational structure was 3.2. Zutari has a flexible, flat and decentralised organisational structure that facilitates development, acquisition and sharing, and shortens the lines of communication between employees and their management. Zutari employs functional groupings that allow knowledge development and interchange of ideas between experts in the same discipline. The organisational structure has a bearing on the culture as it supports networking and knowledge sharing among the employees. The overall readiness level for organisational culture was 3.1, which indicates that it still needs some effort to get it to the expected level of readiness. Strategy and management support had a mean score of 3.1, reward and recognition 2.5, collaboration 3.2 and learning 3.3, indicating that they all

require some work to get them to the expected level of readiness. Reward and recognition had the lowest mean score of 2.5. Though there is evidence that reward and recognition do take place, it is unclear to most staff. Reward and recognition of those willing to learn, teach and share is a strategic tool to promote knowledge sharing (Becerra-Fernandez and Sabherwal 2010), and must be done visibly for all to see. Examples of informal rewards recommended in the literature include nominating a knowledge management employee of the month and peer recognition is considered a strong motivation with a more sustainable impact when compared to financial rewards (Collison and and Parcell 2004).

8. Knowledge Management Readiness Strategy for Zutari

There is a need to define a strategy for knowledge management implementation at Zutari. The strategic focus areas are: incorporate knowledge management as a business objective, conduct knowledge management awareness campaigns, put in place the necessary infrastructure to support the knowledge management processes and ensure regular monitoring by conducting progress reviews. Each sub-strategy is discussed in chronological order in subsequent paragraphs, starting with the first stage, as presented in Figure 2 below.

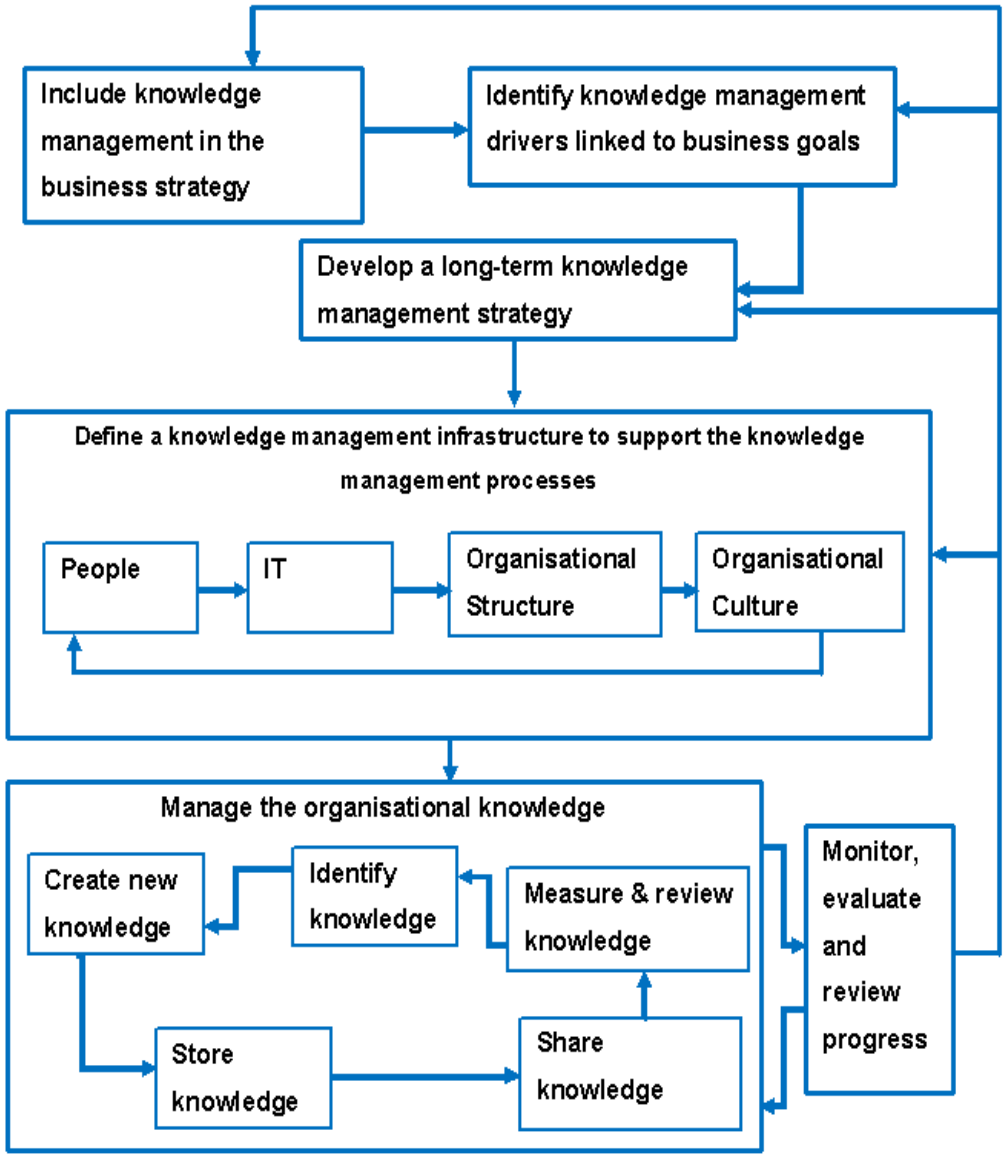


Figure 2: Strategy to Guide Knowledge Management Implementation in Zutari

The research findings reveal that Zutari has an information management standard instead, pointing to the possible existence of confusion between knowledge management and information management. A knowledge

management strategy should be developed that entails identifying and defining knowledge management roles and responsibilities and setting up a knowledge management team. A knowledge management strategy is the overall organisational approach to aligning all its knowledge with its business strategy's knowledge requirements (Mohd Zin and Egbu 2010).

Knowledge management infrastructure is a critical success factor for knowledge management implementation. A balanced knowledge management infrastructure facilitates knowledge identification, creation, storage, sharing and its measuring and reviewing for improvement. The framework of Razi et al. (2017) adopted for this study focuses on the importance of people, process, technology, organisational structure and culture. People influence organisational knowledge management readiness in terms of knowledge creation, leadership, sponsorship, management support, skills, participation and involvement (Harper 2019). Obaide (2004) suggests developing and nurturing employee knowledge management skills. Zutari should develop knowledgeable employees by implementing programmes that facilitate active learning and offering training in areas where knowledge is needed, as recommended by Farnese et al. (2019).

IT timeously connects the people who require the right content (Harper 2019). Although the research findings reveal that Zutari's IT is ready for knowledge management implementation, with a readiness score of 3.4, Zutari should however stay alert given that technology evolves rapidly. IT should be continuously reviewed and kept current. Zutari should continue to provide adequate training for all ICT tools and technologies for effective knowledge management.

The readiness score for organisational structure was 3.2, indicating that Zutari's organisational structure is not ready and needs some work to get it to the expected level of readiness. The firm should promote formal and informal networks and cross-functional teams to increase knowledge sharing. Nurturing CoPs or social networks to enhance knowledge sharing (Wenger, McDermott and Snyder 2002). In terms of organisational culture, it was 3.2 indicating that Zutari not ready for knowledge management implementation. Nenungwi and Garaba (2022) identify organisational culture as a determinant of administrative norms and values, beliefs, and work ethics that either encourage or hinder learning and knowledge sharing.

The readiness level score of knowledge management processes revealed that Zutari's is not ready for the implementation of knowledge management. Zutari should employ knowledge creation processes, among which are learning and development, problem-solving, innovation and creativity, socialisation, externalisation, combination and internalisation (Gonzalez and Martins 2017). Zutari significantly invests in its employees' development through formal and informal training programmes, workshops, conferences, coaching and mentorships. This experience can be formalised and documented as best practices, user manuals, procedures, check lists and reports that can be stored and shared over time to enhance performance and support innovation (Farnese et al. 2019). Zutari should develop programmes that promote externalisation of tacit knowledge such as mentoring, apprenticeship and demonstrations, and a strong knowledge-sharing culture to preserve the core knowledge.

Knowledge becomes passive if it is not reviewed or modified. Guribie and Tengan (2019) recommend ongoing monitoring and review to assess knowledge management maturity. Given that Zutari operates in a volatile technological and global competitive environment, it should implement knowledge review processes to evaluate and replenish knowledge components, help the business adapt to environmental stimuli, solve current organisational problems, and address the current applicability and risk of knowledge. If not reviewed, a large part of the knowledge repository may be forgotten or ignored.

9. Conclusion

The study sought to determine the knowledge management readiness of Zutari and suggest a strategy for implementing knowledge management. The findings revealed that Zutari is not ready for knowledge management implementation. It requires the development of a knowledge management readiness strategy to help it achieve the expected level of readiness. The research outcomes of this study will be generalised to engineering consulting firms in South Africa and Africa Other engineering firms grappling with knowledge management are set to benefit from adopting and using this strategy. Engineering and consulting firms will learn how to conduct a knowledge management readiness assessment and avoid the pitfalls in knowledge management. Further research could test the effectiveness of the readiness strategy in different contexts using mixed methods research to improve to strengthen reliability and internal validity.

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Impact of Organisational Culture and Employee Commitment on Knowledge Workers in an Insurance Company

Portia Makgalo and Ophillia Ledimo
Department of Industrial and Organisational Psychology, University of South Africa, South Africa

manetom@unisa.ac.za

Abstract: The purpose of this paper is to provide an empirical understanding on how the constructs organisational culture and employee commitment affect knowledge workers in an insurance organisation. In the knowledge based economy, organisational culture and employee commitment play a critical role in an organisation's sustainability. There is no one size fits all when it comes to the impact of organisational culture on organisational commitment for effective retention of knowledge workers. The relationship is based on the nature or type of the business, the environment where the business operates and employees thereof. Management of knowledge workers relies on ensuring that the culture adopted by an organisation assist to improve employee commitment, thereby retain knowledge workers. An empirical study using a quantitative design was conducted in insurance company and data was collected using survey questionnaires. Non-Probability sampling was applied where a sample size of 318 was selected from a population of +/-600 employees. The SPSS 2017 (version 25) was used for descriptive and inferential data analysis. Research results indicate that organisational culture affect affective employee commitment of knowledge workers. These findings can assist management of knowledge workers to analyse and developing organisational culture that assist in improving employee commitment, thereby retain knowledge workers. The study carried out offer executive management specific guidelines in implementing initiatives for knowledge workers retention in the knowledge-based economy.

Keywords: Organisational culture, Employee commitment, Knowledge workers

1. Background of the Study

In knowledge economy, organisational culture and organisational commitment are major requirements. Knowledge-based economies have the potential to stimulate economic growth, provide higher wages and greater employment opportunities, ultimately enhance a country's global competitiveness. Batugal (2019) notes that organisational culture provides the "glue" which holds the employees together, stimulates their commitment to a common mission, and galvanises their creativity and energy. Culture develops over a lengthy period and acquires significantly deeper meaning. Creating organisational culture that values and respects each member of the organisation is effective in producing higher levels of commitment. Employees as knowledge workers are the lifeline of any business. It is important to create a well-balanced environment in which knowledge workers and management can work knowing that they are all on the same page when it comes to work ethics, business processes, and best practices (Ebert & Griffin, 2017).

Knowledge workers play a critical role in the knowledge economy of South Africa because they apply theoretical and analytical knowledge, acquired through formal training, to develop products and services. According to Statistics South Africa (STATSSA) (2016), the number of knowledge employees in the financial intermediation, insurance, real estate and business services industries amounted to a total of over 2 million. This compares with the country's total labour force of 9 million in the same period. Hence the full labour force in the insurance industry accounted for 21.8% of the country's knowledge workforce. The industry contributed around 15% to the local GDP in 2013, making the country's insurance penetration the second highest in the world (PricewaterhouseCoopers [PWC], 2016). Again in 2018, these industries were strong supporters of the overall GDP growth. Despite the high number of knowledge employees in the insurance industry in South Africa as well as the role that this industry plays in the country's economy, the researchers found that there are limited studies in this area.

1.1 Research Question and Hypothesis

In consideration of the background above, the objective of this study was to fill the research gap by investigating the impact of organisational culture on employee commitment of knowledge workers in an insurance company.

The study was guided by the following main research question: What is the impact of organisational culture on employee commitment of knowledge workers in an insurance company?

The following hypotheses were formulated to address the research question:

(H_0): Organisational culture has no significant impact on employee commitment of knowledge workers in an insurance company.

(H_1): Organisational culture has a significant impact on employee commitment of knowledge workers in an insurance company.

2. Literature Review

2.1 Knowledge Worker Characteristics

In the current climate of turbulent changes, organisations have begun to realise that knowledge workers represent their most valuable asset. A knowledge worker can be defined through the characteristics of their work activities, which are focused on thinking, problem-solving, collaborating and networking (van den Berga, Appel-Meulenbroeka, Kempermana & Sotthewes, 2020). These skills and knowledge are acquired through formal training, such as college or professional certification. Knowledge workers use analytical, theoretical or otherwise high-level knowledge to develop or offer services or products, usually online (Ricard, 2020). Insurance organisations are knowledge intensive sector in nature. Achoki, Swansi, Pondi and Luntugan (2022) indicate that in knowledge-intensive sectors where insurance companies operate tacit knowledge is of great value because such knowledge improves the decision-making process, quality of work, customer services, organisational learning, and accuracy of tasks. A knowledge worker "thinks" for a living instead of performing physical tasks by handling complex mechanisms autonomously, focusing on quality over quantity and working relatively independently (Ricard, 2020). In this study, the researchers consider employees in an insurance organisation as knowledge workers based on their work characteristic and organisational sector that are knowledge based.

2.2 Organisational Culture in Knowledge Based Economy

Every organisation has its own culture and it highlights the need for a healthy and beneficial environment in the knowledge based economy. A healthy organisational culture values each knowledge worker in the organisation regardless of their job description, which results in employees working as a team to meet the organisations and their own personal needs. However, with an unhealthy culture, employees act as individuals, performing their duties to meet own needs, such as pay cheque or health benefits (Lencioni, 2014).

Even though culture has been the focal area of studies in anthropology, sociology, organisational theories and management, the connotation it had was not always the same. Different concepts, assumptions and interests made these connotations dissimilar. Diverse opinions predominantly affected the description of the theoretical base of culture in terms of its composition, impact and applications (Taneja & Saxena, 2014, p. 69 - 72). Culture, while at the one end is described as the set of values and beliefs, on the other is described as a set of symbols, ceremonies and myths that communicate the underlying values and beliefs of the organisation to its employees (Taneja & Saxena, 2014). Although no consensus exists, culture has most often become a heuristic term used to help anthropologists discuss the symbols, meanings, institutions, systems and behaviours of people, rather than a well-defined theoretical project (Vélez-Ibáñez & Heyman, 2017).

Linked to the above definitions, Schein (2010, p40) defines organisational culture as “a pattern of shared basic assumptions learned by a group as it solved its problems of external adaptation and internal integration, which has worked well enough to be considered valid and, therefore, to be taught to new members as the correct way to perceive, think and feel in relation to those problems”.

Previous studies indicated that employees who are happy with the organisation’s culture are willing to make significant strides in their endeavours to meet organisational objectives (Mitic, Vukonjanski, Terek, Gligorovic, & Zoric, 2016). The above definitions of organisational culture affirm that culture is a main tool in knowledge workers retention.

2.3 Organisational Commitment in the Knowledge Based Economy

What makes knowledge workers stay within one organisation for their entire career? What makes an individual attached to an organisation? What are common factors to those knowledge workers who feel they would not like to change organisations? All these questions should be analysed on a continuous basis when examining organisational commitment. Satisfied and motivated employees are a critical factor that separates successful organisations from the alternative (Millar, Chen & Waller, 2017). Ensuring continuous and desirable work outcomes of knowledge workers leads to a positive impact on the organisational commitment of employees. Employees with higher scores of commitment are expected to be more motivated and performing at the highest levels (Berberoglu & Secim, 2015). When it comes to the organisation’s gains, commitment can visibly help raise performance and attendance levels, while simultaneously resulting in lower staff turnover. “Commitment raises an employees’ levels of productivity and results” (Armstrong, 2016, p7); hence it is required in the knowledge based economy to give an organisation competitive advantage. Meyer and Allen (1991) organised commitment

into three components: affective, normative, and continuance commitment, each with related consequences. In other words, the employees stay in the organisation because they want to (affective commitment), because they need to (continuance commitment) or because they feel they ought to (normative commitment).

Organisations should foster affective commitment, such as enhancing the employees' morale to make them proud to be part of the organisation. Organisations working on increasing employee commitment should satisfy some influencers (Wainwright, 2019). Given that knowledge workers are well acquainted with the organisational culture, they will commit to the cause of the organisation (Alvesson, 2013). In line with the above, studies have also shown how uniquely, and significantly organisational culture and commitment can add to the success and competitiveness of organisations in a knowledge based economy (Shahid & Azhar, 2013). Hence continuous research on this topic is important.

3. Research Design

Descriptive research design using the quantitative approach was applied in this study.

3.1 Research Participants and Sampling Process

Non-probability sampling was applied to achieve a sample size of 318 employees from about 600 total knowledge workers (53% of total number of permanent employees) in an insurance company. These knowledge workers are based in the company's 80+ offices in the nine provinces of South Africa, including the organisation's Head Office. The sampling approach to catered for the heterogeneous nature of knowledge workers in the different branches. The sample was made of subgroups characterised as indicated in the frequency Table below:

Table 1: Sample Frequency Table (N = 318)

Variable	Category	Frequency	Representation%
Age	<25 years	0	0%
	25 – 34 years	168	52.8%
	35 – 44 years	93	29.2%
	45 – 54 years	57	17.9%
	55 – 65 years	0	0%
Gender	Male	91	28.6%
	Female	227	71.4%
Tenure period	<5 Years	50	15.7%
	5 – 15 Years	171	53.8%
	>15 Years	97	30.5%
Qualifications	No matric	3	0.9%
	Matric	155	48.7%
	Diploma	71	22.3%
	University degree	89	28%
Occupation level	Non-management	261	82.1%
	Junior Management	24	7.5%
	Middle Management	33	10.4%
Income (gross p.m)	< R 10,000	82	25.8%
	R 10,000 – R 19,000	131	41.2%
	R 19,001 – R 29,000	59	18.6%
	R 29,001 – R 40,000	31	9.7%
	> R 40,000	15	4.7%

3.2 Measuring Instruments of the Study

Biographical questionnaire was developed to establish a profile of the sample group concerning age, gender, qualifications, service period, occupation and income. Organisational Culture Questionnaire (OCQ) was utilised to measure organisational culture developed by Harrison and Stokes (1992). "The questionnaire is intended to measure four dimensions of organisational culture, namely achievement, power, role, and support cultures" (Harrison 1993, p. 1). The OCQ consists of 60 items (15 items for each dimension). Respondents rated statements based on their observations of the different cultural dimensions in their organisation, by responding to a scale ranging from 1 to 4, where 1 is "least dominant view", and 4 is "most dominant view".

Employee commitment was measured using the Organisational Commitment Scale (OCS) developed by Allen and Meyer (1991). The OCS is a self-scoring instrument which comprises a five-point Likert scale with 24 items or statements, which participants responded to on a scale ranging from 1 to 5, where 1 is strongly disagree and 5 is strongly agree. The 24 items are divided into three dimensions with eight statements per dimension, namely affective, continuance and normative commitment dimensions (Meyer & Allen 1997, p. 121). Both OCS and OCQ instruments are self-explanatory, and no supervision was necessary. The questionnaires were completed online by respondents individually, voluntarily and anonymously. The construct related to organisational culture was divided into two sub-constructs, existing culture (EC) and preferred culture (PC). Therefore, three constructs were considered in this study (i.e. existing organisational culture, preferred organisational culture and organisational commitment).

3.3 Ethical Considerations

Permission to conduct research was obtained from the College of Economics and Management Sciences at the University of South Africa (UNISA). The organisation understudy as well as the Research Ethics Committee of UNISA's Department of Industrial and Organisational Psychology granted the researchers ethical clearance. The research activities adhered to the UNISA research policy guidelines.

3.4 Data Collection Analysis

Data collection was conducted using the Lime Survey programme and structured questionnaires used as instruments to collect primary data. Information received from sampling was then interpreted to determine that the population was representative as indicated in Table 2.

Table 2: Response Rate

Employee response rate	
Population	600
Sample	318
Total responses received	437
Incomplete / invalid responses	119
Complete / valid responses	318
Response rate (based on valid responses)	53%

3.5 Statistical Analysis

Research approach adopted in the study was quantitative analysis based on descriptive statistics followed by inferential statistics using the Statistical Package for the Social Sciences 2017 version 25. Analysis of data included the application of Pearson Correlation Coefficient and Regression analysis. The internal consistency of the measuring instruments was determined using the Cronbach's Alpha.

4. Research Results

Discussions and tables below present the descriptive and inferential statistics of the constructs of Organisational Culture Questionnaire (OCQ) and Organisational Commitment Scale (OCS).

4.1 Descriptive Statistics

All the dimensions of the measuring instruments as shown in Table 3. Overall, the two measures obtained scores above 0.80 using the Cronbach's Alpha results, suggesting that the questionnaire is a reliable measure. The

results revealed a high level of internal consistency across the scale and the items of the OCQ – (EC & PC) and OCS variables.

Table 3: Summary of the OCQ (EC & PC) and OCS Reliability (N=318)

Reliability Statistics of OCS-EC		Reliability Statistics of OCS-PC		Reliability Statistics of OCS-S	
Cronbach's Alpha	No. of Items	Cronbach's Alpha	No. of Items	Cronbach's Alpha	No. of Items
0.887	15	0.803	15	0.877	24

The Harrison and Stokes' (1992) OCQ research measuring instrument has already been tested in the South African population and the questions therein were proven to be suitable. Similarly, studies on the reliability of the Meyer and Allen (1997) OCS questionnaire indicate it is a reliable measuring instrument for assessing organisational commitment. Meyer and Allen (1997, p 120) found the internal consistencies of the OCS dimensions "varying between 0.85 for affective, 0.79 for continuance and 0.73 for normative".

4.2 Mean Scores of OCQ (EC & PC) and OCS

Table 4: Summary of the Means and Standard Deviations for the OCQ (EC)

Dimension	N	Minimum	Maximum	Mean	Standard Deviation
Existing Power Culture	318	1	4	2.63	1.27
Existing Role Culture	318	1	4	2.95	2.14
Existing Achievement Culture	318	1	4	2.77	1.61
Total				2.78	

According to Table 4, the mean scores range from 2.63 to 2.95 on OCQ - EC. The highest score was on the existing role culture (mean = 2.95), which is much closer to 3, indicating that the perceived dominant culture in this organisation is role culture. This indicates that knowledge workers of this organisation perceive the current culture as one that provides stability, justice and efficient performance (Harrison, 1993). Achievement culture was the next highest score with a mean score of 2.77. Power culture was the least preferred at 2.63. Standard deviations of the dimensions range from 1.27 to 2.14, which explains the variability in the respondent.

Table 5: Summary of the Means and Standard Deviations for the OCQ (PC)

Dimension	N	Minimum	Maximum	Mean	Standard Deviation
Preferred Power Culture	318	1	4	3.01	1.14
Preferred Role culture	318	1	4	2.83	1.84
Preferred Achievement Culture	318	1	4	2.87	2.07
Total				2.90	

Mean scores ranged from 2.83 to 3.01 on OCQ - PC. The dominant preferred culture in this organisation is the power culture with a mean of 3.01. This means that knowledge workers prefer leadership that is strong in terms of direction, decisiveness and determination" (Wiseman, Ngirande & Setati, 2017, pp. 244-245). Achievement culture was the next dominant, with a mean score of 2.87. In this culture, influence is based more on expert power than on position or personal power, but the influence is more widely dispersed. It measures how organisational culture is based on competence (Harrison, 1993). Closely aligned to achievement culture in terms of the mean score is role culture which is the least dominant with a mean score of 2.83 (Harrison, 1993). Support culture did not meet the required reliability criteria on both OCQ (EC & PC) and was excluded. The standard deviations of the dimensions ranged from 1.14 to 2.07.

Table 6: Summary of the Means and Standard Deviations for the OCS

Dimension	N	Minimum	Maximum	Mean	Standard Deviation
Affective commitment	318	1	5	3.50	1.20

Dimension	N	Minimum	Maximum	Mean	Standard Deviation
Continuance commitment	318	1	5	3.25	1.27
Normative commitment	318	1	5	3.39	1.21
Total				3.38	

Presented above in Table 6 are the mean scores indicate that the knowledge workers of the insurance company are generally committed to the organisation for various reasons, with mean scores ranging from 3.25 to 3.50 The highest score is on affective commitment at 3.50, indicating that the knowledge workers stay with the organisation because they feel a strong sense of belonging to the organisation. Normative commitment was the next highest with mean score of 3.39 commitment, which shows that the knowledge workers have sense of obligation to stay with the organisation. Employees stay in the organisation because they believe they ought to. These employees display both loyalty and moral aspects in the sense that they stay even if things are not good for them because it is the right thing to do (Allen & Meyer, 1996). Continuance commitment indicate a positive mean at 3.25; which indicates the knowledge workers' commitment based on costs associated with leaving the organisation. Employees with this kind of commitment stay employed in the organisation because they need to. Fear of loss can extend beyond financial concerns and include concerns such as the loss of friendships that the employees have developed whilst working for the organisation (Allen & Meyer, 1996). The standard deviations of the dimensions ranged from 1.20 to 1.27.

4.3 Inferential Statistics

Inferential statistics were used to make inferences or estimates about data collected. Multiple regression analysis and Anova results are reported to determine significance and substantiate the model and correlation coefficients. To investigate the impact between the variables under study, correlational statistics for the variables were obtained. These correlations were obtained to test the hypotheses, which are:

(H0): There is no significant impact between organisational culture and employee commitment of knowledge workers.

(H1): There is a significant impact between organisational culture and employee commitment of knowledge workers.

The inferential analysis results of organisational culture and two commitment dimensions, namely continuance and normative were excluded in this paper because there are no significant findings. Table 7 and 8 display, the results of the regression analysis investigating the impact of organisational culture-existing culture on affective commitment. The regression results indicate that the full model is statistically significant at 1% and 5% levels of significance (R = 0.132 with a p-value of 0.000, p-value < 0.01), indicating that 13.2% of the total variation in "affective commitment" is explained by the organisational culture - existing culture.

Table 7: Organisational Culture-Existing Culture and Affective Commitment

ANOVA[a]	R Square	F	Sig.	Durbin-Watson	Sig.
Regression	.132	15.854	0.000[b]	2.009	0.000

a. Dependent Variable; *affective commitment*

b. Predictors: (Constant), power culture, role culture and achievement culture-existing culture.

Table 8: Regression Analysis (model 1): Organisational Culture-Existing Culture and Affective Commitment

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	1.196E-17	.053		.000	1.000
	Power culture	.265	.043	.285	5.418	.000
	Role culture	.154	.053	.174	3.304	.001
	Achievement culture	.131	.049	.142	2.700	.007

a. Dependent Variable; *affective commitment*

b. Predictors: (Constant), power culture, role culture and achievement culture-existing culture.

Table 7 and 8 show that all three factors, namely power culture, role culture and achievement existing culture have a significant contribution in the affective commitment model. There is a positive relationship between power culture, role culture and achievement culture and affective commitment. The higher the degree of the organisational existing culture, the higher the affective commitment. Researchers were guided by these statistics to accept or reject the hypotheses. The statistics determine significant impact between variables and their dimensions. Pearson's correlations were used to determine the level of significance. These correlations determine whether the null hypothesis is true or false. Hypothesis (H1) was accepted partially based on a 5% level of significance and therefore the null hypothesis (H0) was rejected. This is consistent with the findings by Masouleh and Allahyari (2017) who confirmed the relationship between organisational culture and commitment in their case study.

5. Discussion and interpretation

This section discusses the results of this study.

Table 9: Summary of Results

1	What is the impact of existing organisational culture on employee commitment of knowledge workers?	Existing organisational culture has a positive impact on affective and continuance commitment. This means that when the level of organisational culture increases, the level of affective and continuance commitment increases significantly. However, existing organisational culture has a negative impact on normative commitment, indicating that when the level of existing organisational culture decreases, the level of normative commitment decreases.
2	What is the impact of preferred organisational culture on employee commitment of knowledge workers?	Preferred organisational culture has a negative impact on employee commitment, which means that when the level of preferred organisational culture decreases, the level of commitment decreases.
3	What is the empirical impact of organisational culture on employee commitment of knowledge workers?	The impact of preferred organisational culture on commitment is insignificant. However, the impact of existing organisational culture on employee commitment is significant.

5.1 Existing Organisational Culture v/s Preferred Culture

From a culture perspective, the empirical study results indicated that the dominant existing culture is perceived to be the role orientated culture. However, the dominant preferred culture is the power culture. The study findings are consistent with previous studies in literature such as Nazir, Qun, Hui, and Shafi, (2018) whose study indicated that organisational culture has no significant impact on affective commitment. Contrary to this, research findings by Azar and Avanki (2016) found a positive relationship between organisational culture and affective commitment at the 0.05 level of significance. The descriptive summary of organisational culture for both the existing and preferred cultures, for most of the items, the mean value is between 2 and 3 (leaning more towards 3) which means that the knowledge workers tend to agree on the statement on the questionnaire on a greater scale than 2.

5.2 Organisational Commitment

With regards to commitment, the findings revealed that knowledge workers are affectively committed to the organisation. For most of the items the mean value was between 3 and 4 (most of the values are closer to 4) which means that the respondents tend to agree on the statement. This is a demonstration that the respondents are affectively committed to the organisation. Affective commitment expresses the emotional attachment of the knowledge workers to their organisation, their desire to see the organisation succeed in its goals, and a feeling of pride at being part of that organisation. In other words, knowledge workers stay in the organisation because they want to, as defined by Meyer and Allen (1991; 1997), and also indicated in studies by Pinho, Silva, Oliveira, Oliveira, and Barbos (2020), Presbitero, Newman, Le, Jiang, and Zheng, (2019) as well as Amofa and Ansah (2017, p.18). The standard deviations of the dimensions ranged from 1.20 to 1.27. The dimension with the highest score is continuance commitment, with a total mean score of 1.27. This means that as much as the

employees have affection to the organisation, there is somewhat a sense of obligation around the sense of belonging, i.e. knowledge workers also feel that they ought to stay with the organisation.

5.3 Empirical Relationship Between Organisational Culture and Commitment

From the research findings, it can be concluded that (H_1) is partially accepted. Organisational culture has an impact on the affective employee commitment of knowledge workers in an insurance company. This is evident with the impact of existing culture on affective employee commitment being positive. Similarly, the study by Presbitero et al. (2019) found organisational culture to have an influence on affective organisational commitment. Studies by Aranki, Suifan, and Sweis, (2019); Batugal (2019) as well as Zhou (2017) have also consistently found that there is a relationship between organisational culture and commitment. Therefore, the null hypothesis of this study (H_0) is rejected as it state that organisational culture has no significant impact on employee commitment of knowledge workers in an insurance company. The hypothesis (H_1) is partially accepted in this study. This implies that organisational culture has a significant impact on affective employee commitment of knowledge workers in an insurance company. This supports the studies of Aranki et al. (2019), Wiseman et al. (2017) and Mitic et al. (2016) who confirmed that organisational culture has an impact on organisational commitment. It was further discovered that existing organisational culture has a significant effect on affective and normative commitment followed by continuance commitment. This implies that employees are emotionally attached to the insurance organisation as a result of the organisational culture in their organisation; this is consistent with the findings by Masouleh and Allahyari (2017). In their study in the Ghanian Banking Industry, Amofa and Ansah (2017) also observed that organisational culture has greater influence on affective commitment; followed by continuance commitment while normative commitment had the least impact. The researchers conclude that there is adequate evidence of 5% significance level to infer that organisational culture has an impact on affective employee commitment of knowledge workers in an insurance company.

6. Limitations of this Study Literature Review and Empirical Study

Despite the high number of knowledge workers in the insurance industry in South Africa as well as the role that this industry plays in the country's knowledge-based economy, the researchers has learnt that there are limited studies in this area. There are still many gaps that require further investigations to fully understand the impact of organisational culture on employee commitment to guide future studies. Pinho et al. (2020) and Demo, Fogaça and Costa (2018) note that studies relating this theme to other variables of organisational behaviour are necessary. Jiang (2016) concurs that there are few studies that relate to HR practices with different constructs, particularly commitment. In terms of the empirical study using the OCQ and OCS, the following limitations were found: The study is based in one insurance organisation and therefore limited. Consideration should be given to similar studies in other insurance organisations. The sample could be too small to rely on the results without further investigations. The biographical questionnaire includes income brackets, which some employees may not have preferred to share, thereby leading to incomplete/invalid questionnaires. Quantitative methods were used for this research. According to Nazir et al. (2018), quantitative data can only be utilized to conclude what the relationship between two different variables is, but this type of data cannot describe why such relationships exist or do not exist. In this study, supplementary qualitative data or the mixed method approach could have been helpful to determine why power culture is preferred as well as why existing organisational culture has a negative impact on normative commitment.

6.1 Recommendations for the Organisation Under Study, Insurance Companies, IOP Practitioners and Future Research

Role culture seems to be dominant on existing culture whilst power culture is dominant in terms of preferred culture. Knowledge management practices requires organisational culture that has a positive effect on employee commitment. The findings of this study can be the basis for the leadership of the organisation to create or enhance a culture which will enhance the preferred power culture by the knowledge workers. Ritonga, Ibrahim, and Bahri (2019) add that leadership styles in such conditions are meaningful in knowledge development, sharing and conservation in the knowledge-based economy. The organisation under study should revise their strategy to pave the way for the culture preferred by its knowledge workers. Strengths of power culture and affective commitment should be highlighted, emphasised, maintained and celebrated by the knowledge workers and the organisation; in order to gain competitive advantage in realising knowledge-based economy goals.

Given the results above, it is evident that organisational culture has an impact on employee commitment of knowledge workers. Based on these findings, organisations are advised to diagnose their cultures and determine how it affects knowledge workers' commitment for retention purposes. Better understanding of existing and

preferred organisation's culture may lead to the development of ideal culture in a knowledge-based economy. Van Rooij and Fine (2018) note that cultures are notoriously difficult to change, and lofty promises of changed cultural values and practices can generate more corporate dissonance when real change does not occur. It is therefore important to caution against promises of an easy fix. Subsequently, it is recommended that other organisations should develop cultures that are consistent with the interest of their knowledge workers to gain their commitment and retain them for maximum periods (Olaigbe, Unachukwu, & Oyewole, 2018).

Based on the limitations of this study, future research should look at obtaining larger samples to represent the entire population in the industry. Insurance industry is a constantly developing environment which may have a huge impact culture change. Therefore, future research should continue investigating the impact of organisational culture and employee commitment of knowledge workers. Based on the finding that there is a dearth of knowledge on this topic as well as the large number of knowledge workers in the financial and insurance industry, it is evident that there is a need for further studies on the topic at hand.

7. Conclusion

The main objective of this study was to investigate the impact of organisational culture on employee commitment of knowledge workers in an insurance company for retention purposes. Two hypotheses were selected and tested; data was collected from knowledge workers in an insurance organisation in South Africa. It is therefore concluded that organisational culture has a significant impact on employee commitment of knowledge workers.

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Knowledge Management Practices and the Evolution of Healthcare Organizations Based on a Certification Program

Patsy Balconi Mandelli , Cinthya Zanuzzi, Lia Caetano Bastos and Gregório Varvakis
Universidade Federal de Santa Catarina, Florianópolis, Brazil

patsymandelli@gmail.com

Abstract: Quality certification programs are internationally recognized processes for externally assessing and improving quality, resolution, and sustainability in healthcare organizations. In these organizations, knowledge is a strategic intangible asset. Concurrently, knowledge management (KM), through its practices and tools, promotes the use of organizational knowledge, and can help transform knowledge into action in the dynamic, systemic, competitive, and demanding environment faced by such organizations. In this context, this study aims to analyze the association between strategic KM practices and the evolution of certified health organizations by measuring the evolution of quality descriptors implemented during participation in the certification program. The research adopts a quantitative approach, with a descriptive-exploratory nature, and follows a cross-sectional design. Presented here are concepts relative to the theme and constructs that support the analysis proposed in this study. For data collection, two instruments were used. The first is related to the evolution of companies participating in a certification program, and the second is a questionnaire designed to identify knowledge management practices developed within the companies. The study was developed in 24 healthcare companies in Brazil that participated in a certification program. The results identify an association between KM practices and the level of evolution of certified healthcare organizations. The companies have in common the incentive to share knowledge in the workplace, as well as providing continuous training opportunities. There is an observed need for organizations to effectively communicate their strategic objectives and develop financial incentives and career development based on knowledge. The results confirm the relationship between KM practices and the evolution of healthcare organizations.

Keywords: Healthcare organization, Physiotherapy services, Certification/accreditation, Quality assurance, Knowledge management practices

1. Introduction

Healthcare organizations offer differentiated services that demand singular answers to constant unexpected events, and that face challenges to provide assistance that delivers safety to the end user, resoluteness and generation of value, a competitive advantage, sustainability, and growth for companies (Nicklin, Engel and Stewart, 2021; Bernardino, 2017).

The COVID pandemic abruptly showed us the importance of health care systems, their complexity and the need for adapting and reorganizing the system as a whole – end users, service providers, financiers, clients, governments, academic institutions and so on (Zimlichman *et al*., 2021).

Sustainable societies need to consider the connection between knowledge management (KM) and healthcare to be a critical issue for social development with safety for the patient (Karamitri, Kitsios and Talias, 2020). The authors affirm that the sustainability of healthcare organizations depend on the efficient use of knowledge assets and resources. It is necessary to investigate how knowledge permeates the structures of a healthcare organization, identifying possible knowledge sharing predictors that may support the KM strategy of a healthcare company (Nicklin et al., 2017).

Quality certifications are internationally recognized external evaluation programs based on the premise that adhering to preestablished standards and compliance will produce better quality healthcare services in an increasingly safer environment. They are also a way to publicly recognize that a healthcare organization meets national standards of quality (Pomey, 2004).

Michell, Graham and Nicklin (2020), understand that the certification is a tool for translating implementation knowledge or intervention, which aims to improve and increase assimilation of evidence within healthcare organizations while emphasizing knowledge to promote action.

According to Darroch (2005), KM would act as a coordination mechanism within organizations, allowing resources to be efficiently used, promoting interaction, and fomenting improved organizational capacity. It is seen as a coordination mechanism that allows resources to be converted into abilities (Nelson; Winter, 1982). These coordination mechanisms are supported by KM practices, oriented to adequately manage knowledge, aiming at its efficient use and in line with organizational objectives and tasks (Kianto and Andreeva, 2014; Cen, 2004; Dávila et al., 2014).

In view of this context, this study will use concepts of quality certification, knowledge management and its practices, while aiming to identify the association of KM practices with the level of evolution of certified healthcare organizations, within a certification program.

2. Theoretical Foundation

2.1 Certification

Pomey et al. (2010), define certification as a rigorous process of external evaluation which comprehends a self-evaluation, as well as external evaluations according to a certain set of standards. The authors believe that certification processes help introduce organizational changes that improve the quality and safety of service. These changes vary according to organizational context, and the process of certification is a highly effective tool to: 1. accelerate integration and foment a spirit of cooperation within healthcare organizations; 2. help introduce continuous quality improvement programs for recently certified organizations or those not yet certified; 3. create new leadership for quality improvement initiatives; 4. increase social capital, giving collaborators the opportunity to develop relationships, and 5. promote connection among healthcare organizations and other areas.

Guaranteeing updated processes that allow for patient safety is related to quality management in organizations that are based on future-oriented strategies, geared towards society, dynamic and human-centered, especially when performing procedures that decrease risk and waste, and boost the management of continuous improvement in a dynamic, fast, accelerated and often unknown environment (Braithwaite et al., 2020; Greenfield and Braithwaite, 2008; Nicklin, 2015; Nicklin, Engel and Stewart, 2021; Nonaka and Takeuchi, 2021; Zimlichman et al., 2021). According to Novaes (2015), certification programs represent a method that facilitates the development of standards for continuous improvement of patient care and organizational performance.

Within the context of healthcare organizations that provide services, quality certification programs are a vehicle to disseminate learning, effectiveness, and efficiency, to present evidence of their processes and, with that, enable the translation of knowledge within the organizational environment (Nicklin, Engel and Stewart, 2021). Mitchell, Graham and Nickiln (2020) state that, even though quality certification programs are widely recognized, especially for improving organizational performance, researchers provoke the assumption that the true value of a certification process lies in its contribution to safety and quality of healthcare as a means to stimulate and support knowledge for action, a key value for certification which has not yet been articulated. “[…] it is a form of knowledge translation (KT) or implementation intervention that aims to improve and increase the input of evidence in healthcare organizations". (Mitchell, Grahan and Nicklin, 2020, p. 445).

2.2 Knowledge Management

For Peter Drucker (1993, p. 42), the knowledge which we consider knowledge is proven in action. This refers to knowledge as efficient information towards action, and information with a focus on results. These are described as results which are outside the person, in society and in the economy, or in the advancement of knowledge itself. Each individual converts ability into something that can be taught or learned. The changes from one piece of knowledge to another can create a new society; based on knowledge and on the people of knowledge, this would give them power.

In the same year, Wiig (1993) states that many organizations are becoming more and more concerned with organizational knowledge, and the use of knowledge to create and make quality products, deliver quality services, and maximize the efficiency of internal operations. Further, Nonaka and Takeuchi (1994) describe organizational knowledge as the capacity of organizations to create knowledge, disseminate it throughout the organization, and incorporate it into products and processes.

It is understood that knowledge does not remain static within constantly changing economies, as in present times. It is a valuable asset that must be identified, evaluated, acquired, transferred, stored, used, and maintained, remaining available for decision-making (Nonaka and Takeuchi, 1991; Pemberton and Stonehouse, 2000; Downes, 2014).

Consequently, knowledge management presents itself as a process through which an organization perceives and generates value through its intellectual and knowledge assets, and is considered to be a new, influential and visible approach to the art and science of management in recent decades (Uriarte, 2008; Inkinen, Kianto and Vanhala, 2015).

2.3 Knowledge Management Practices

In 2003, the Organization for Economic Co-operation and Development (OECD) pointed out that the implementation of knowledge management (KM) practices would be a crucial phase in which organizations could promote change and integration within a knowledge-based economy. The Comité Européen de Normalisation (CEN, 2004), sustains that KM practices support and constitute a link between the processes of the KM cycle and the strategic objectives of an organization, precisely because authors consider that absorbing elements of knowledge and combining them is an important management challenge within healthcare organizations (Akdere, 2009; Faraji-Khiavi, Ghobadian and Moradi-Joo, 2015). In a systematic review of the literature on KM practices and organizational performance, Inkinen (2016) presents as a contribution of the study that the results increase the understanding of the efficient and effective management of knowledge resources for organizational benefit. They also point out that organizations must be attentive to attributes of leadership and organizational arrangements to achieve company performance through KM.

This present study considers KM practices to be intentional activities or routines, formal or informal, geared towards adequately managing knowledge. It is also based on its efficient use aligned with task-related objectives that support knowledge management, allowing companies to add value from their knowledge-based assets (Andreeva and Kianto, 2012; Dávila et al., 2014; Kianto and Andreeva, 2014; Inkinem, Kianto and Vanhala, 2015).

We chose the concept of certification presented by Nicklin et al. (2014), as a process of external evaluation used to evaluate and improve quality, efficiency, and efficacy of healthcare organizations, therefore producing higher quality health services in a safe environment. Healthcare organizations that provide physiotherapy services and which belong to the National Federation of Physiotherapy Associations and Companies (FENAFISIO) are the object of this study. Such organizations participate in the FENAFISIO Quality Certification Program, have the Quality Certification Seal, and were consequently subjected to external audits at two different times, diagnosis and audit, at an interval of 6 to 8 months. For this study, we adopted the point of view of Inkinen, Kianto and Vanhala (2015), in which KM practices are a set of management activities that allow companies to add value from their knowledge-based assets, grouping KM practices in ten dimensions, according to Table 1.

Table 1: Dimensions and Aspects of KM Practices

Dimensions	Aspects
Strategic management of knowledge	Knowledge as a key input for the development of the organization's strategies
Organizational design	Contemplates the decisions made regarding division of work and responsibilities
Communication and information technology (CIT)	The means to access knowledge in the organization
Knowledge-based recruiting	Directs attention to candidates´ skills and abilities
Knowledge-based training and development	Includes courses and seminars for professional development
Knowledge-based performance evaluation	Employee ability to create, use and disseminate knowledge
Knowledge-based compensation	Involves tangible and intangible motivation; career progression; work recognition
Supervision work	Encompasses key management activities; crucial factors in the performance of organizational culture
Knowledge protection	Use of patents, agreements, legislation, or confidentiality
Learning mechanisms	Increased organizational learning through practice and experience

Source: Inkinen, Kianto and Vanhala (2015).

The choice of this list of KM practices is justified using relevant studies in Brazil (Macau, Brito and Duarte, 2016; Dávila, Andreeva and Varvakis, 2019; Dorow et al., 2019; Anjos, 2020). However, this study intends to evaluate nine dimensions of practices: strategic knowledge management, organizational design, communication and information technology, recruiting, training and development, performance evaluation, knowledge-based compensation, supervision and learning mechanisms. We have excluded the knowledge protection dimension since the healthcare organizations participating in this study do not develop patents.

In order to reach the central objective of this study, it is necessary to know the evolution of the quality descriptors that were evaluated, as well as the presence of strategic KM practices in these organizations. In this manner, we present the methodology used to support this study.

3. Methodology

The research is of an empirical and applied nature, aiming to generate knowledge for practical application. It is an exploratory, explanatory, and descriptive research (Gil, 2009). Regarding the means, the research utilizes the survey method as it deals with primary data from a sample. Through a quantitative approach and analysis, it seeks to draw conclusions corresponding to the collected data (Gil, 2009).

The population is composed of data from 24 (twenty-four) healthcare organizations distributed throughout 9 (nine) states in Brazil, which belong to the quality certification program of the National Federation of Physiotherapy Associations and Companies, FENAFISIO. This federation is composed of healthcare organizations that provide outpatient, hospital, and home-care physiotherapy services. The analyzed data are part of the quality descriptors verification Check List, verified for adequacy and compliance with the 43 quality descriptors evaluated in the program between December 2018 and December 2022. The analyzed data regarding strategic practices of knowledge management were answered by the managers of the organizations through Google Forms after having been certified, that is, having finalized the process of certification. The respondents indicate how much they agree with the 29 questions related to strategic practices ok KM.

The stages of the research are presented in Table 2.

For this study, two measurement instruments were applied, assuming that this study involves the theory about the relationships between a set of variables relevant to the phenomenon under investigation, and that the measurement instruments attribute value to a certain object or event, considering that the phenomenon of interest is inferred from an indicator with which it is correlated (Pedhazur and Schmelkin, 1991).

The first instrument is the actual document from the certification program we studied, that is, the Verification List of quality descriptors. Each of the 43 quality descriptors evaluated can be found on the checklist and is measured on a conformity scale of 1 to 5. These 43 descriptors are subdivided into 3 (three) groups, which are: Infrastructure (physical infrastructure and administrative infrastructure), Provision of Services and Satisfaction (internal client and external client). The organizations participating in the program are analyzed at two different moments of external evaluation: diagnosis and audit. This includes an interval of approximately 6 months between the two. This document is part of the FENAFISIO program for quality certification called Seal of Certification of Quality, and it is a confidential document based on the "Constructivist model for measuring the quality of physiotherapy services from the manager's perspective" (Mandelli, 2015). The evaluated checklist items are presented on the verification list of quality descriptors on Table 2.

Table 2: Verification List of Quality Descriptors

Infrastructure	Physical structure	Noise, lighting, ventilation, temperature, size, privacy, organization, cleanliness, ergonomic space, internal accessibility, external accessibility, quantity of equipment and calibration
	Administrative structure	Management model, financial management, customer service, integration and training program, standardization of administrative and assistance processes.
Customer service	Professional domain	Scheduling, service time, number of patients per hour, degree of specialization, performance, external improvement, therapist-patient bond, risk

		management, compliance with regulatory bodies, use of PPE, clinical protocols, medical records
	Efficiency and efficacy	Treatment plan, treatment time, objectives achieved, adherence to protocols.
Satisfaction	Professional satisfaction	Fee flexibility, continuing education program, compensation, career plan.
	Client satisfaction	Ability to involve the patient in decisions, listening skills, record of complaints, satisfaction questionnaire.

Source: Mandelli (2015).

The second instrument, the strategic practices of KM questionnaire, obtained from Inkinen, Vanhala and Kianto (2015), considered 9 (nine) dimensions of KM practices. All the answers are scored on a 5-point *Likert* scale, where 1 means completely disagree, and 5 means completely agree. The 9 (nine) dimensions are: strategic knowledge management, organizational design, communication and information technology, knowledge-based recruitment, knowledge-based training and development, performance evaluation, knowledge-based compensation, supervision work and learning mechanisms. Based on these dimensions, 29 practices were contemplated. The questionnaire was sent to all certified organizations in the quality certification program, and 24 (twenty-four) responses were received, the same number of organizations analyzed with research instrument 1, respectively.

4. Results and Discussion

Of the 24 organizations analyzed, 5 offer physiotherapy services in hospitals and 19 offer outpatient physiotherapy services (physiotherapy clinics). At first, we observed the evolution results of these healthcare organizations based on the evolution of the quality descriptors represented by the Verification list of quality descriptors (Research instrument 1). Subsequently, these analyses were descriptively associated with the presence of strategic practices of KM within these organizations (Research instrument 2).

The collected data was processed by means of metric tests, run on SPSS 21 software, and presented in descriptive manner.

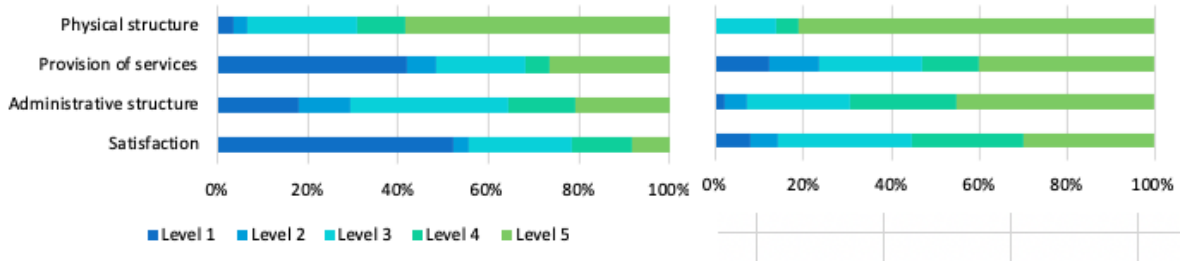
The metrics (before x after) are first presented, which synthesize and compare the average and deviation of the scores according to a group of descriptors, at the time of diagnosis and audit, and the analysis allows for differentiating groups with greater and lesser evolution between both periods (situational diagnosis and final audit). We consider that the average provides a notion of central tendency of the responses obtained from each group. The deviation provides a notion of dispersal, of how homogeneous (the greater the number, the more heterogeneous) are the responses from each group. The variation (%) indicates, in terms of percentile, how much the average and deviation of the items of each group increased (+) or decreased (-) from the diagnosis to the audit.

Group 2	Diagnosis		Audit		Variation (%)	
	Average	Deviation	Average	Deviation	Average	Deviation
Physical structure	4,17	1,24	4,67	0,50	12,0	-60,1
Administrative structure	3,09	1,82	4,05	1,08	31,0	-40,8
Provision of services	2,68	2,76	3,57	2,01	33,3	-26,9
Satisfaction	2,22	1,98	3,63	1,43	63,6	-27,8

Source: Developed by the authors (2023).

Figure 1: Descriptive Measures of Item Evaluated by Groups in the Diagnosis and Audit

We can see in Figure 2 the synthesis and comparison of the distribution of answers obtained from the items of each group, according to scale levels, at the time of diagnosis and audit. The analysis allows for perceiving the evolution of response distribution between both periods. This presentation format also shows how well each group is evaluated. Levels 1 to 5 correspond to the possible answer categories of evaluated items, from 1 (worst) to 5 (best), and the colored bars indicate the percentage of answers at each level.



Source: Developed by the authors (2023).

Figure 2: Distribution (%) of Answers Per Groups in the Diagnosis and per Scale Level in the Audit

In this manner, the evolution of the verified items was considered to be statistically significant. The satisfaction group presents the greatest evolution of descriptors in relation to the other groups. Customer service and satisfaction are the groups that have descriptors related to the human resources area, such as training and development, performance evaluation, continued education, communication with internal and external clients, as well as client involvement in the decision-making process of their treatment. This present study aims to corroborate with other authors, confirming that certification programs facilitate organizational performance through the lens of improving the evaluated processes in these programs.

The information related to strategic practices of KM is the result of the application of research instrument 2 (two), a KM strategic practices questionnaire, which aims to identify the presence of strategic practices of KM within these organizations.

Firstly, it is important to describe the profile of the respondents. The sample is composed of 24 (Twenty-four) managers, 51.4% of whom are exclusively managers. The remaining respondents are managers and physiotherapists, a characteristic often found in the healthcare organizations that make up FENAFISIO, where the manager also acts as physiotherapist, and vice-versa. The organizations from the sample have been offering physiotherapy services for an average of 21 (twenty-one) years, have an average of 50 (fifty) employees, and their respondents have been working for these organizations for an average of 15 years. Further, all the organizations have gone through the process of quality certification in the last 2 (two) years.

As for the results based on the respondents´ perception of existing practices in the actual organizations, we highlight the investigated dimensions that yielded responses above 80%. These were: knowledge-based supervision work and training and development. Tables 3 and 4 exhibit the specific questions for each of the dimensions and the percentage of responses.

Table 3: Dimension Supervision Work vs. Percentage of Respondents on the Likert Scale Score

Respondents´ perception	score 5	score 4	score 3	score 2	score 1
Encouraging employees to share knowledge in the workplace	91%	8.6%	0	0	0
Encouraging employees to question existing knowledge	80%	11.4%	5.7%	2.9%	0
Supervisors value employees' ideas and point of view by taking them into account	91.4%	8.6%	0	0	0
Supervisors promote discussion in an equitable manner in the workplace	82.9%	14.3%	0	0	0
Share knowledge openly and equitably	91.4%	8.6%	0	0	0
Supervisors allow mistakes to occur and see them as a learning opportunity	54.3%	40%	5.7%	0	0

Respondents´ perception	score 5	score 4	score 3	score 2	score 1
Supervisors continually update their own knowledge	71.4%	22.9%	5.7%	0	0

Source: Developed by the authors (2023).

We observed a considerable presence of KM practices related to the dimension of work supervision. Knowledge management practices that represent this dimension are the managerial practices that Inkinen, Kianto and Vanhala (2015) link to how these organizations establish their organizational culture, which, in turn, communicates with authors that relate supervision work as a crucial factor in the development of organizational culture. This affirms the direct impact on how an organization deals with knowledge management. However, we observed a lesser perception of improvement opportunities derived from mistakes. Inkinen (2016), cites supervision work as a dimension that encompasses key management activities, a critical factor in organizational culture performance.

Table 4: Dimension Knowledge-Based Training and Development vs. Percentage of Respondents on the Likert Scale Score

Respondents´ perception	score 5	score 4	score 3	score 2	score 1
Employees have the opportunity to deepen and expand their knowledge	88.6 %	11.4%	0	0	0
The company offers training that provides employees with knowledge that is up to date	82.9 %	5.7%	8.6%	2.9%	0
Employees have the opportunity to develop skills through training tailored to their specific needs	79.4 %	8.8%	11.8%	0	0
Professional development needs are discussed with employees on a regular basis	60%	34.3%	5.7%	0	0

Source: Developed by the authors (2023).

The intensity of KM practices also appears significantly in the dimension of training and development, which is related to human resource management. This dimension refers to practices that involve the implementation of courses and seminars for employee training and performance. These findings confirm the studies by Dorow (2019) regarding the importance of knowledge sharing in knowledge-intensive healthcare organizations.

Our results corroborate the findings of Inkinen (2016) concerning human-oriented practices as significant factors for company performance. Human resource-oriented activities are related to knowledge-based human resource management and leadership in KM.

The other dimensions of KM practices emerged sporadically in the responses, with little significance in the dimensions of strategic knowledge management and knowledge-based compensation. The literature defines strategic knowledge management as the activities of strategic planning, implementation, and updating related to the knowledge-based assets of the company (Kianto et al., 2014). These activities can enhance organizational performance through mechanisms that allow the organization to focus on activities that add the most value to the company, which is important as intangible assets are sources of competitive advantage (Inkinen, Kianto and Vanhala, 2015; Conner and Prahalad, 1996; Grant, 1996). Aligning strategic knowledge management across various aspects of the organization ensures the utilization of organizational knowledge for action, generating value for healthcare organizations.

Our results support the study by Novaes (2015) that quality certification programs facilitate the development of standards for continuous improvement in patient care and organizational performance. However, when analyzing the presence of knowledge management practices, we observe a relatively incipient and empirical

implementation. This confirms the argument that sustainable societies need to consider the connection between knowledge management and healthcare as a critical issue for social development with patient safety and sustainability for healthcare organizations, as these organizations are also considered to rely on the effective use of knowledge assets and resources (Karamitri, Kitsios and Talias, 2020; Braithwaite et al., 2020).

According to the results obtained in the study, the healthcare organizations participating in the certification program indeed demonstrate significant improvements in the evaluated quality descriptors, particularly in the service delivery and satisfaction groups. When associating these findings with KM practices, we observe an intensity of practices in the dimensions of supervision work and knowledge-based training and development, aligning with the findings of Karamitri, Kitsios and Talias (2020). These authors highlight the existence of KM practices for translating knowledge into action in healthcare organizations regarding specific knowledge sharing issues. However, it is evident that in the other dimensions, the presence of KM practices is incipient, as stated by Silva et al. (2016).

Our study further reinforces the findings of recent research by Karamali (2020) and Hinchcliff (2021), highlighting the need for a greater understanding and formalization of the organizational impact with the presence of KM practices concurrent with the implementation of a quality certification program.

5. Final Considerations

This research aimed to comprehend the presence of KM practices alongside the development of certified healthcare organizations within a certification program in Brazil. It explores the potential for certification programs to generate organizational value through knowledge-based management.

It is evident that the groups of quality descriptors related to human resource management demonstrate significant advancements. Specifically, these dimensions encompass the incorporation of KM practices, such as knowledge-based supervision and training and development.

Our research contributes to bridging the identified gap in the literature regarding the association between KM practices and certification programs. These programs have been employed as management tools, providing support and facilitating the implementation of KM.

Considering the significance of KM practices for healthcare service providers and the nascent discussion within Brazil and within a certification program, the necessity for further studies to deepen the understanding of KM practices associated with organizational development has come to light. Such studies would support organizational performance and development, fostering sustainability and value creation for these organizations.

The obtained results substantiate the importance of incorporating specific quality descriptors for knowledge management within certification programs. This inclusion enables the creation, utilization, and dissemination of knowledge for actionable outcomes within healthcare organizations.

However, the research faces limitations concerning the sample size, specifically the number of participating organizations and respondents. These limitations impede the generalization of the findings. Thus, future studies are suggested to investigate a larger number of organizations, as well as the presence of KM practices in certified organizations. These additional studies can contribute to a comprehensive understanding of how quality management supports KM and jointly generates value and sustainability for healthcare organizations.

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Mitigating the Disruptive Consequences of Knowledge Loss in Organizational Settings: Knowledge Loss Clusters and Potential Organizational Interventions

Stefania Mariano
Department of Management, School of Business Administration, American University of Sharjah, UAE

smariano@aus.edu

Abstract: This paper reviews the management and organization studies literature underpinning the construct of knowledge loss. It proposes that five clusters of knowledge loss influence the capacity of organizations to retain their valuable organizational knowledge. Such clusters include hanging, fading, disengaging, dissolving, and vanishing. To overcome the disruptive consequences of knowledge loss, this paper proposes five potential organizational interventions including reminding, refreshing, re-acquiring, re-building, and re-inventing. This paper discusses the implications for theory and managerial practice in the context of the knowledge management literature and provides directions to future research.

Keywords: Organizational knowledge, Organizational forgetting, Knowledge loss, Knowledge management, Organizational interventions, Literature review

1. Introduction

Organizations are constantly working on the proper retention of organizational knowledge, either in the form of storage facilities, or as workforce retention programs. Losing valuable organizational knowledge is indeed costly in terms of wasted time, money, or key resources (Mariano et al., 2020).

Despite the disruptive consequences of losing valuable organizational knowledge, knowledge loss still needs to be fully understood. For instance, the magnitude of disruptions caused by knowledge loss is still unclear. In the scholarly literature, there has been a tendency to treat different instances of knowledge loss univocally, with some exceptions (Martin de Holan and Phillips, 2004). However, a more in-depth examination of the existing scholarly literature shows that this tendency may be detrimental. Addressing the consequences of the most experienced organizational member's departure may be more challenging than retrieving a codified procedure from an archive that has become temporarily unavailable. These two examples relate to dissimilar clusters of knowledge loss that require separate interventions to prevent unsolicited disruptions.

This paper builds on an in-depth examination of the scholarly literature and proposes that different clusters of knowledge loss may indeed exist in organizations, suggesting potential managerial interventions. In this paper, knowledge loss is defined "the accidental disappearance of existing organizational knowledge" (Mariano et al., 2020, p. 191). This paper answers the following research questions: What are the clusters of knowledge loss? Which managerial interventions can reduce the disruptive consequences of knowledge loss?

This paper classifies different instances of knowledge loss in five clusters—i.e., hanging, fading, disengaging, dissolving, and vanishing—and suggests five potential interventions—i.e., reminding, refreshing, re-acquiring, re-building, and re-inventing—to help overcome the disruptive consequences of knowledge loss in organizational settings.

By proposing these five clusters of knowledge loss and their related organizational interventions, this paper contributes to current theory and managerial practice in several ways. First, it provides a more granular description of knowledge loss. Second, it proposes specific organizational interventions that may assist managerial practice with positive consequences on improved productivity and quality (Darr et al., 1995); maintenance of stocks of organizational knowledge (Boone et al., 2008) and knowledge retention mechanisms (Levy, 2011; Schmitt et al., 2011). Finally, this paper helps direct future empirical studies investigating the different impacts of knowledge loss on organizational practices (Mariano et al., 2020).

2. What is Knowledge Loss?

Knowledge loss has become a topic of scholarly and managerial interest since the early 1990s when it was originally discussed in the context of learning curves and organizational forgetting conversations (e.g., Argote, 2013; Blackler et al., 1999). Compared to unlearning (e.g., Cegarra-Navarro and Wensley, 2019)—which is the intentional removal of organizational knowledge to make room for new ways of doing things—knowledge loss

has been conceptualized as an unsolicited phenomenon with disruptive consequences on organizational productivity, efficiency and performance.

Over the last decades, scholars have documented knowledge loss in studies of organizational members' behaviors (Martin de Holan and Phillips, 2004); investigations of storage facilities (Argote, 2013); or have consider it an unsought consequence of organizational restructurings, mergers, or acquisitions (Anand et al., 2012). Grounded in such an extensive scholarly literature, this paper provides a synthesis for theory and managerial practice, grouping the potential causes of knowledge loss into five clusters. This paper also proposes five potential interventions to ease the disruptive consequences of knowledge loss.

3. Clusters of Knowledge Loss

3.1 Hanging

When organizational members become repositories of key organizational knowledge, the likelihood of disruptions associated to their unwanted behavior may increase (Massingham, 2018; Cattani et al., 2012). Hanging describes these potential disruptions and represents a first cluster of knowledge loss. If proper retention mechanisms are omitted, this valuable individual knowledge may be lost. This may be the case of knowledge that has not been used daily, which tends to disappear more easily (Fernandez and Sune, 2009). Indeed, passage of time and infrequent use have been proposed to be potential causes of knowledge loss at the individual level (Argote, 2013). Similarly, the extent to which knowledge is perceived as valuable is likely to influence its usage. Research has found that knowledge not directly connected to the relevant day-to-day tasks tends to disappear more quickly than core knowledge used on a regular basis (Mariano and Casey, 2016). If passage of time, infrequent use, or low perceived value influence the extent to which knowledge is used, hanging may surface. Hanging may be particularly detrimental when multiple individuals contribute to organizational processes and, therefore, the loss of one contribution may have a critical impact on the overall performance at a more aggregated level. For instance, there may be periodic submissions happening at given points in time and there may be considerable work to be performed to meet deadlines. If deadlines are missed, there may be interruptions in the amount of work performed by other individuals at higher levels in the hierarchical structure. Therefore, if the individual knowledge is lost, this may result in potential issues at a more collective level. Proper preventive mechanisms may have to be staged and periodically used to prevent collective disruptions.

3.2 Fading

Fading describes a second cluster related to knowledge retained in storage facilities such as records, archives, collective electronic infrastructure, and databases. Scholars have praised the role of shared databases to preserve information quality and facilitate knowledge transfer across organizational members (Boone et al., 2008; Agrawal and Muthulingam, 2015). Some have proposed that knowledge embedded in technology and storage facilities is less prone to depreciation or loss than knowledge embedded in routines or organizational members, promoting more technologically sophisticated organizational forms (Argote, 2013).

However, the disbandment of storage facilities such as when they break-up or cease to function; or their deterioration—a symptom of reduced quality, strength, passage of time or fall in disuse—are likely to determine the loss of crucial organizational knowledge. For instance, the removal of a repository can affect organizational memory, especially when the repository is highly centralized (Fernandez and Sune, 2009). Similarly, improper "clear desk" policies may produce documentation inaccessible to organizational members (Blackler et al., 1999). At times, technical or physical constraints (Easterby-Smith and Lyles, 2011) may prevent a proper access to storage facilities, records, or databases, although it may be temporal. Similarly, codification processes that make knowledge explicit but more abstract and generalizable could generate the loss of situated and heuristic knowledge available previously (Treleaven and Sykes, 2005).

Since organizational knowledge may dissipate in the long term—in terms of content as well as the rationale behind it (Easterby-Smith and Lyles, 2011)—deliberate and properly planned maintenance strategies are crucial. Having storage facilities is a necessary but not sufficient condition for organizational knowledge to be available and up to date. Keeping a repository functioning and updated is challenging. Similarly, if knowledge is hard to be found in the storage facilities, the system is less likely to be used (Franco and Mariano, 2007). Proper maintenance mechanisms have to be implemented to prevent the accidental loss of explicit organizational knowledge.

3.3 Disengaging

When organizational members move to other roles, departments, subsidiaries, or geographical locations, potential detrimental consequences may occur to organizational knowledge. Such detrimental consequences may include poor data handover (Shankar et al., 2013); reduced knowledge accessibility and coordination (Shaw et al., 2005); disruptions to knowledge flows (Ward and Wooler, 2010); disappearances of important contacts (Ward and Wooler, 2010); and misplaced, lost nodes, or broken links in networks of relationships (Shaw et al., 2005).

Disengaging describes those instances and represents a third cluster of knowledge loss. In such instances, knowledge may be lost but there is still a chance to retrieve it from the network of relationships. Research has found that gatekeepers, brokers, central nodes and, at times, peripheral network nodes contribute to the preservation of organizational knowledge (Argote, 2013; David and Brachet, 2011). A key aspect would be to make individual expertise known at a more collective level and facilitate internal interactions. Acquaintance and socialization strategies, especially in labor intensive organizations, become crucial (Boone et al., 2008). Similarly, a proper assessment of the roles and positions of organizational members may help reduce accidental knowledge losses. Certain forms of social networks that favor an optimal mix between strong and weak ties may also reduce knowledge loss if organizational members move (Droege and Hoobler, 2003; Schmitt et al., 2011). Additional strategies such intergenerational learning practices (Bratianu and Leon, 2015), architectural knowledge, coordination among units, and development of existing capabilities to be transformed in effective organizational routines (Daghfous et al., 2013) could potentially mitigate knowledge loss and increase organizational knowledge retention.

3.4 Dissolving

Dissolving describes a fourth cluster of knowledge loss. In this specific instance, knowledge is permanently lost. It may be the case of departing organizational members, including internal replacement, quitting, or retirement of employees (Parise et al., 2006)—such as aging workforce (Calo, 2008), or replaced management teams (Ciuk and Kostera, 2010). When organizational members leave without a proper knowledge management strategy in place, organizations are likely to experience decreased revenues (Schmitt et al., 2011) and productivity (Massingham, 2018); disruptions to firm's credibility (Joe et al., 2013); customers mistrust (Massingham, 2018); and increased needs to orient and train newcomers (Droege and Hoobler, 2003). Knowledge loss due to turnover (Eckardt et al., 2014) includes the parting of subject matter expertise (Martin de Holan and Phillips, 2004; Eugene Jennex, 2014; Schmitt et al., 2011; Sumbal et al., 2018) and governance knowledge (Joe et al., 2013; Mariano et al., 2018); knowledge about business relationships and social networks (Easterby-Smith and Lyles, 2011); knowledge of business systems, processes or value chains (Joe et al., 2013); and institutional memory (Scalzo, 2006; Massingham, 2008; Haunschild et al., 2015). Indeed, when key organizational members leave, the subsequent knowledge downsize caused by their departures may challenge the capacity to rebuild the lost organizational memory. Depending on who leaves and what knowledge departs with them, knowledge loss may have a qualitatively different impact. Turnover-related disruptions have highlighted the crucial importance of knowledge transfer strategies such as centralized knowledge management systems, demographic inventories (Calo, 2008), knowledge risk profiles, increased collaboration levels and stronger network ties (Droege and Hoobler, 2003; Daghfous et al., 2013; Schmitt et al., 2011), knowledge overlapping procedures, and job and career redesign.

3.5 Vanishing

Vanishing describes a fifth cluster related to the complex combinations of collective and physical spaces where organizational activities take place. It may be the case when mergers, acquisitions, of restructuring impose radical changes that have a disruptive influence on the amount and quality of knowledge possessed at the organizational level, creating knowledge asymmetries (Anand et al., 2012), and loss of know-how. Mergers or outsourcing have been found to create knowledge asymmetries and produce hidden costs of outbound knowledge flows. At times, they may have contributed to the loss of technological know-how (Conti, 2014) or legal knowledge (Reitzig and Wagner, 2010). For instance, leakages of technological know-how have been proposed to be asymmetric with respect to a firm's research and development strategy, with higher losses of valuable organizational knowledge in the case of riskier projects (Conti, 2014). More trusted partners have been proposed to let organizations acquire more knowledge, lose less valuable knowledge, and increase the overall level of alliance satisfaction (Norman, 2004).

4. Mitigating the Disruptive Consequences of Knowledge Loss

This paper proposes the following five potential interventions to help mitigate knowledge loss i.e., reminding, refreshing, re-acquiring, re-building, re-inventing.

4.1 Reminding

Reminding is a first intervention that is proposed to relate to the first cluster of knowledge loss i.e., hanging. It relates to individual knowledge. Reminding is proposed to be performed before (ex-ante) the accidental loss of knowledge may create disruptions at a more collective level. Strategies include prompt mechanisms to avoid knowledge loss due to passage of time or infrequent use of knowledge such as the use of how-to lists to accomplish a routine task; self-training mechanisms to re-acquire knowledge loss due to infrequent use; or the introduction of automated or less automated reminders to be sent periodically to provide the necessary information to accomplish certain tasks. For instance, an automatic gentle reminder that urges to provide certain documented forms of knowledge at given points in time e.g., "please remember to provide your elaborations by (include a certain date)", accompanied with instructions on how to get the task done or individuals to contact in case of specific questions or concerns. Useful managerial assessment questions could include: Can this knowledge be conveniently codified for future uses? Who is in charge of collecting this knowledge? At what point in time is this knowledge going to be requested? Can an automated mechanism prevent potential knowledge loss-related disruptions?

4.2 Refreshing

Refreshing is a second intervention that is proposed to relate to the second cluster of knowledge loss i.e., fading. It relates to organizational knowledge embedded in storage facilities. Refreshing is proposed to be performed concurrently to keep the storage facilities fully functional. Strategies include the facilitation of both access and maintenance of the storage facilities. For instance, facilitating the access to electronic repositories, archives, documents to find explicit knowledge; introducing a dedicated person or system (e.g., automated chatbot) to provide pointers/links; and introducing mechanisms to facilitate and incentivize the sharing or tacit knowledge at a more collective level, since the act of documenting has been proposed to be a valuable strategy to keep key organizational knowledge in place (Levy, 2011). Useful managerial assessment questions could include: How can this knowledge be maintained and retrieved? What retrieval mechanisms can facilitate the location of this knowledge? Will there be a person in charge of maintaining this knowledge? What incentives can ensure the correct and timely update of the storage facility?

4.3 Re-acquiring

Re-acquiring is a third intervention that is proposed to relate to the third cluster of knowledge loss i.e., disengaging. It relates to knowledge found in the individuals' networks of relationships. Re-acquiring is proposed to be performed concurrently to keep or strengthen the networks of relationships to find valuable knowledge that otherwise would be lost. This may be particularly useful during restructuring (Kleiner et al., 2011). Thus, the major aim of re-acquiring would be to facilitate the access to key nodes and links in available networks of relationships, including gatekeepers, brokers, central nodes and, at times, peripheral nodes. Strategies include the facilitation of virtual or less virtual networking sites; datasets of expertise or demographic inventories (Calo, 2008); or the development of relationships that may help increase knowledge exchange to answer questions such as "could you please tell me how we used to do that?" especially at an intergenerational level (Bratianu and Leon, 2015) to facilitate coordination within and across units. Additionally, it may be worth sending periodical updates related to network nodes that clarify where useful knowledge can now be found e.g., "Please note that Person X is now available for clarifications" or "Please note that the position has been assigned to Person Y who will be in charge to answer your questions". Useful managerial assessment questions could include: How can the extended network of relationships be used to retrieve organizational knowledge that has now become unavailable? What pointers or referrals can be implemented to facilitate knowledge retrieval? How can a dataset of expertise be implemented? How can virtual and less virtual networking sites aid the location and retrieval of knowledge?

4.4 Re-building

Re-building is a fourth intervention that is proposed to relate to the fourth cluster of knowledge loss i.e., dissolving. Re-building is proposed to be performed ex-post, through reflection attempts and performance of actions to restore the lost knowledge, with the overall aim to strengthen the capacity to re-build the knowledge that had dissipated. Common clues to this type of knowledge loss include comments such as "we

used to know how to do this but not anymore". Another clue may regard the temporary shift of roles. This may be the case in small businesses when the owner often has to take charge of a position that has become temporarily vacant and for which a replacement has yet to be found. When the organization realizes that knowledge may have been dissolved, actions to rebuild this knowledge, and to prevent similar disruptions need to be taken. These actions include the re-building of tacit, explicit, or relational knowledge, depending on the knowledge type that has been dissolved, including the overlapping of knowledge to have it always available at multiple locations, for instance implementing a master pool strategy to ensure that multiple individuals possess the needed knowledge. Useful managerial assessment questions could include: Is there a chance to restore the lost knowledge? Who can help re-build the lost knowledge? What actions can be initiated to recover from the lost knowledge on a short as well as long term basis? How a distributed knowledge system can be developed to prevent the loss of knowledge?

4.5 Re-inventing

Finally, re-inventing is the fifth intervention that is proposed to relate to the last cluster of knowledge loss i.e., vanishing. Re-inventing is proposed to be performed when knowledge has been permanently lost, often unknowingly. The major aim is to facilitate the recreation or optimization of knowledge and related processes to favor knowledge reinstate. It may be particularly important to look for clues that signal this cluster of knowledge loss after restructuring, mergers, or acquisitions. In these instances, there may be a tendency to re-invent the wheel because of lost know-how (Conti, 2014), knowledge asymmetries (Anand et al., 2012), or loss of technological and legal knowledge (Reitzig and Wagner, 2010). If knowledge loss occurs, there may need to be a conscious intention to identify it to prevent future knowledge loss. Useful managerial assessment questions could include: Has the organization experienced a reduced level of productivity after the restructuring? Could this reduced level of productivity be associated with lost knowledge? What organizational areas have been disrupted the most and who was involved with them? Have knowledge asymmetries advantaged our partners and disadvantaged our organizations? How can this be prevented?

For a summary, see Table 1 and Figure 1.

Table 1: Five Clusters of Knowledge Loss and Potential Organizational Interventions

Cluster	Disruptions	Organizational Interventions and Timeline	Mitigation Mechanisms	Assessment Questions
Hanging	Chain of task interruptions Collective outcomes disruptions	Reminding (ex-ante)	Prompt mechanisms to avoid knowledge loss due to passage of time, infrequent use, or low perceived value e.g., how-to lists, self-training, reminders	Can this knowledge be conveniently codified for future uses? Who is in charge of collecting this knowledge? At what point in time is this knowledge going to be requested? Can an automated mechanism prevent potential knowledge loss-related disruptions?
Fading	Disbandment (i.e., break up or cease to function), deteriorations, fall in disuse Loss of a centralized repository Clear desk policies and inaccessible documents Technical or physical constraints Loss of situated and heuristic knowledge during codification processes	Refreshing (concurrent)	Properly maintained IT Documentation eliciting explicit knowledge storage, access, and retrieval	How can this knowledge be maintained and retrieved? What retrieval mechanisms can facilitate the location of this knowledge? Will there be a person in charge of maintaining this knowledge? What incentives can ensure the correct and timely update of the storage facility?
Disengaging	Knowledge accessibility, coordination, and flow	Re-acquiring	Shared close relationships and	How can the extended network of relationships be used to

Cluster	Disruptions	Organizational Interventions and Timeline	Mitigation Mechanisms	Assessment Questions
	Broken links, misplaced or lost nodes Disappearances of important contacts Poor data handover	(concurrent)	workspaces Increased level of socialization and acquaintance in labor intensive organizations Assessment of role and position: Gatekeepers, brokers, central nodes, and peripheral nodes Favored forms of network structure with optimal mix between strong and weak ties Intergenerational learning Architectural knowledge and coordination among units Development of existing capabilities to transform into routines	retrieve organizational knowledge that has now become unavailable? What pointers or referrals can be implemented to facilitate knowledge retrieval? How can a dataset of expertise be implemented? How can virtual and less virtual networking sites aid the location and retrieval of knowledge?
Dissolving	Newcomers training needs Interferences in knowledge transfer Loss of subject matter expertise, business relationships, network knowledge, institutional memory including know-how, business systems, processes, and value chains knowledge Loss of governance knowledge Decreased revenues, productivity, credibility Increased customers mistrust	Re-building (ex-post)	Centralized knowledge management systems Demographic inventories Knowledge risk profiles and assessment Job and career redesigns Increased collaboration and stronger network ties Knowledge overlapping	Is there a chance to restore the lost knowledge? Who can help re-build the lost knowledge? What actions can be initiated to recover from the lost knowledge on a short as well as long term basis? How a distributed knowledge system can be developed to prevent the loss of knowledge?
Vanishing	Accidental loss due to re-structuring, mergers, or outsourcing Knowledge asymmetries in inter-organizational alliances Hidden costs of outbound knowledge flows Loss of technological/legal knowledge Leakages of technological know-how with higher knowledge losses in riskier projects	Re-inventing (ex-post)	Trusted partnerships Recreation/optimization attempts to facilitate knowledge reinstatement	Has the organization experienced a reduced level of productivity after the restructuring? Could this reduced level of productivity be associated with lost knowledge? What organizational areas have been disrupted the most and who was involved with them? Have knowledge asymmetries advantaged our partners and disadvantaged our organizations? How can this be prevented?

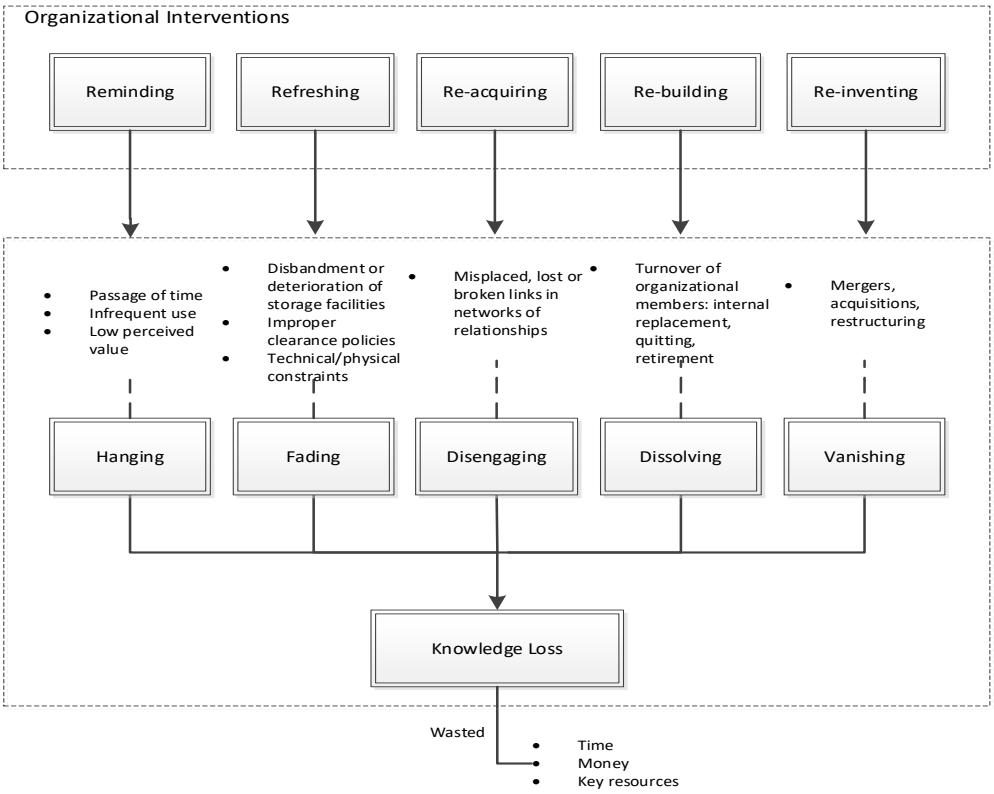


Figure 1: A Synthesis

5. Implications for Theory and Practice

This paper contributes to theory in several ways. First, it expands current understanding by proposing a classification of five different clusters of knowledge loss i.e., hanging, fading, disengaging, dissolving, and vanishing. These clusters of knowledge loss were grounded in the relevant literature on knowledge loss, and showed how changes to individuals and their relationships, storage facilities or the organizational structural dimensions could have an influence on the accidental departure of organizational knowledge. While a great deal of scholarly work has extensively investigated the key role of organizational learning and has linked it to organizational performance, only a few studies have provided more granular descriptions of the disruptive consequences of knowledge loss, proposing organizational dysfunctions such as avoidance, resistance, struggle, alteration, and conversion processes (Mariano and Casey, 2016). This paper adds to these studies and proposes that five clusters of knowledge loss may have different impact on an organization's possessed knowledge, depending on passage of time and infrequent use (Fernandez and Sune, 2009), low perceived value of knowledge (Mariano and Casey, 2016); failures in storage facilities (Franco and Mariano, 2007) or network of relationships (Shaw et al., 2005); or because of changes to an organization's structural dimension (Mariano and Casey, 2016).

Second, this paper proposes five potential organizational interventions to overcome the disruptive consequences of knowledge loss. These interventions include reminding, refreshing, re-acquiring, re-building, and re-inventing. These interventions are proposed to be applied ex-ante, concurrently, and ex-post, to anticipate potential knowledge loss disruptions, correct them along the way, or adjust collectively possessed knowledge after some organizational instances may have reduced it or completely lost it.

Third, this paper provides a new theoretical perspective and novel assumptions that may be tested by future empirical studies, especially those investigating organizations that are going through restructurings, significant changes to workforce, or introduction/disbandment of storage facilities (Levallet and Chan, 2019).

Managers who want to reduce the disruptive consequences of knowledge loss could consider specific points in time to positively enforce, assist, or support certain interventions that may help prevent or overcome knowledge loss. The proposed classification and potential organizational interventions provide managers with a roadmap to better understand knowledge loss as well as the possible ways to decrease its disruptive consequences.

6. Future Research Directions

Future research could empirically investigate the impact of each cluster of knowledge loss (or their combination) on organizational outcomes or organizational change processes.

Another area of investigation could examine the circumstances under which the rigidity of an organization's structure could affect the unintentional departure of organizational knowledge.

Furthermore, future research could investigate the temporal dimension of knowledge loss clusters. How does passage of time influence knowledge loss clusters? What are the conditions under which knowledge loss caused by passage of time produce organizational tensions and unsolicited organizational change?

Organizations that are experiencing high turnover rates or significant changes to workforce, and organizations that are going through restructurings or introduction/disbandment of storage facilities and information technology systems (Levallet and Chan, 2019) would represent ideal settings to conduct empirical examinations.

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Decision Making for Knowledge Management in the Tequila Sector: A Fuzzy Logic Model

Antonieta Martínez-Velasco[1] and Antonia Terán-Bustamante[2]
[1]Facultad de Ingeniería, Universidad Panamericana, México
[2]Facultad de Ciencias Económicas y Empresariales, Universidad Panamericana, México

amartinezv@up.edu.mx
ateran@up.edu.mx

Abstract: Knowledge management creates value for organizations, allowing them to be more innovative, productive, and competitive if that knowledge is used appropriately. Through this management, vital information is created and disseminated systematically and efficiently, and at the same time, knowledge learning is adopted, transformed, shared, and applied. This research analyzes decision-making for knowledge management in a mature low-tech sector, such as Tequila in Mexico. At the same time, it generates a predictive model of knowledge management that allows innovation in this sector by combining knowledge of modern technologies and ancestral knowledge in manufacturing the product, along with providing support to public policymakers and decision-makers to support small producers and rural communities. The methodological strategy used is an expert system through fuzzy logic, starting from a data set based on the patterns found in a Bayes network. The results show that the most relevant variables in decision-making for knowledge management in the Tequila sector are modern technologies, ancestral knowledge, and the Denomination of Origin. Under the above, it could be inferred that the ancestral knowledge variable is the most influential in achieving high values in managing knowledge management -the output variable preserving the value of a product with a designation of origin.

Keywords: Bayes network,Decision making, Knowledge management, Fuzzy logic model, Machine learning, Tequila sector, México, Low tech

1. Introduction

Knowledge management is a strategic element in the innovation and competitiveness of organizations, for which learning capacity is a critical factor in achieving it. The agribusiness sector is no exception; they must implement knowledge management practices to achieve this. That sector is characterized by small family businesses with a low propensity to generate knowledge and innovation (Vesperi et al., 2021).

According to Gaziulusoy et al. (2013), Pelizza (2020), and Vesperi et al. (2021), agribusiness, being traditional and low-tech companies, are in a situation in which they need to find and implement new ways of innovation, to create, provide and generate value to face current challenges and be more competitive. However, this sector cannot generate new knowledge independently; therefore, it must go beyond its limits (Gaziulusoy et al., 2013; Pelizza, 2020). In this way, knowledge is acquired through or in conjunction with various actors (Chesbrough, 2006) with which they are linked. According to the above, agribusinesses would benefit from the exchange of knowledge with partners, research centers, and universities (Vesperí et al., 2021),

The Tequila sector in Mexico is a traditional and low-tech agribusiness in which knowledge management is crucial to innovation and competitive advantages. That sector has established itself as one of the main agro-industries in Mexico by producing one of the most emblematic alcoholic beverages worldwide and with the denomination of origin (Macías, 2001; Gallardo, 2019; Terán-Bustamante et al., 2022). Currently, this industry represents today more than 25,000 producers in 5 States, and 181 municipalities, a production of more than 2,611 thousand tons of agave that represents 651.4 million liters per year (CRT, 2023); 292 companies certified with Denomination of Origin (CRT, 2023), 1,831 registered trademarks (1,582 national and 376 abroad) (CRT, 2023), employment for more than 70 thousand families (IIEG, 2022).

According to the above, the Tequila industry represents a tremendous economic value for Mexico while having the potential to contribute to rural development and small producers. However, this sector has not benefited the local population or the environment of the drink's origin region. Four factors are argued to explain poor performance: performance:

- The power of the large Tequila-producing companies and the pressure exerted by transnational companies to recognize the contributions of the region of origin and small agave growers (Bowen, 2012; Terán-Bustamante et al., 2022).

- Availability and supply of raw materials suffer from cyclical crises that fluctuate over the years and considerably affect both production levels and costs (Herrera et al., 2018; Terán-Bustamante et al., 2022).
- Connection with the land of origin – geographical indicator (Bowen, 2012) and ancestral knowledge (Terán-Bustamante et al., 2022).
- Management of ancestral knowledge with modern technologies that preserve the benefits of the Denomination of Origin (DO) and explore the knowledge for the natural conservation of the Agaváceas and Nolináceas (Golubov, 2007) for the sustainability of this sector.

Therefore, it is necessary to create an environment that favors disseminating knowledge among companies, communities, producers, and other organizations such as universities and research centers to use knowledge as a strategic resource (Núñez, 2015).

In general, knowledge in organizations needs a structure that facilitates its use effectively. On the other hand, the knowledge generated and appropriated through innovation processes, the acquisition of technology, work with suppliers and customers, interactions with competitors, and the business environment present difficulties to be integrated into the daily actions and activities of the organization. For this reason, it is necessary to develop mechanisms that allow all people to have the full potential of knowledge dispersed in the organization.

Derived from the previous problem, the questions that guide the present research are, What are the critical factors for adequate decision-making in the Tequila Industry in Mexico for optimal knowledge management? Using a knowledge management model, how can the tequila sector make better decisions that benefit all producers and rural communities?

This paper aims to provide knowledge to decision-makers in the public and private sectors to funnel public policies that support rural communities and smallholders. At the same time, generate knowledge by providing a knowledge management model in a low-tech industry such as Tequila, where innovation is developed.

The present work is organized into three sections. The first section addresses the theoretical framework, the main concepts of scientific knowledge, ancestral knowledge, and knowledge management and its relationship with innovation. A very brief characterization of the Tequila sector in Mexico is also made. The second section presents the analysis methodology and model construction based on Bayesian Networks (BNs). The methodological strategy used is an expert system through fuzzy logic, starting from a set of data based on the patterns found in a Bayes network. Finally, the third section presents the results, discussion, and conclusions.

2. Theoretical Framework

2.1 Knowledge Management: Conceptualization and Importance

Knowledge management aims to generate, share, and use explicit (codified) knowledge and know-how existing in a given space to respond to the needs of individuals and communities in their development (ILO, 2023).

Therefore, knowledge management has become the primary key to creating value, so knowledge has been considered a strategic source in organizations.

Value creation is mainly related to activities that concern the human capital of the company, which are aimed at creating new skills through research, learning, or knowledge acquisition. This generation of new knowledge must be linked to its conversion into innovations that provide commercial value (Solleiro and Castañón, 2004 and 2016; Terán-Bustamante et al., 2022).

That involves creating and deploying knowledge management strategies that integrate five fundamental actions: understanding knowledge needs and opportunities; building sector-relevant knowledge; organizing and distributing knowledge; creating conditions for the application of knowledge, and exploiting knowledge, The creation of conditions for the application of knowledge is an action focused on the generation of sustainable competitive advantages (Xue, 2017).

In addition to strategies, it is necessary to consider the barriers to knowledge management; for Doz, Cuomo, and Wrazel (2007), there are four barriers to the integration of knowledge into business activities, which correspond to diversity of knowledge, dispersion of knowledge, the complexity of knowledge and ownership of

knowledge. That implies understanding the dimensions of each one to generate actions that allow overcoming them and thus ensure effective management of the knowledge and experiences available to the organization.

It is worth mentioning that because it is intangible, knowledge is characterized by being complex to understand, share and take root among the sectors of the organization. Using knowledge effectively and consistently is crucial to gaining a competitive advantage. Investing in KM ensures the use of all available knowledge in an organization (Rabeea et al., 2019; Wu and Wang, 2006; Martins et al., 2019).

The Tequila and the value generated by its appellation of origin and knowledge management.

Tequila became the first Denomination of Origin (DO) of Mexico in 1974, which means that it has an intellectual protection model that generates value as a product whose quality and characteristics come exclusively from the geographical environment and from natural and human factors of the place where it is produced (Official Gazette of the Federation (DOF, 2018).

Tequila is considered a symbol of Mexicans for its historical, sentimental, and national value (Olmedo-Carranza, 2010). The value lies in the intrinsic and extrinsic qualities that give it worthy representativeness and motivate to safeguard agave, preserve tequila art, and include Tequila as a gastronomic product of origin and tradition in social, cultural, and economic activity, such as tourism (Schlüter, 2008).

Therefore, the DO of this distillate is a tool for territorial valorization and tourism promotion (Gómez-Cuevas et al., 2020), which has managed, together with the Tequila Regulatory Council (CRT), to control and endorse compliance with the Mexican standard in its production, guaranteeing the consumer its origin and quality (Official Gazette of the Federation,

DOF, (2018).). The Tequila Denomination of Origin (DOT) extends to more countries; today, 44 nations recognize the DOT (mipatente, 2023).

In this context, the value of Tequila has a legacy for the community, as it gives it a sense of belonging that manifests its work, dedication, and part of its essence, in addition to the time it took to create and consolidate the drink (Gómez, 2018). In addition to the above, the denomination of origin that contributes to the product's value positions the Tequila brand and helps preserve and enhance cultural and natural heritage. Industrial and tourist competitiveness would differ (IIEG, 2021). (IIEG, 2022).

3. Methodology

This research was based on a work that modeled the knowledge of experts in the production of Tequila through a Bayes Network (Terán-Bustamante et al., 2022). Next, a data set was obtained from the patterns found in the proposed Bayes network. On the data set, the classification was carried out with the Knowledge Management variable as the objective variable, and it made several experiments to classify the data set. In them, we apply three algorithms for classification Support Vector Machines (SVM), Neural Networks (NN), and Naive Bayes (NB). The metric used to choose the best model was a recall, where we obtained the values 0.573, 0.682, and 0.991 for NB, NN, and SVM, respectively.

In this way, we found that the most relevant variables for the classification process are Ancestral Knowledge, Competitive and Technological intelligence, Customer needs detection, Cultivation of raw materials Agave, Designation of origin based on ReliefF metric (ReliefF measures the ability of an attribute to distinguish between classes on similar data instances).

To have elements to validate the integrity of the results, we apply two methods, the Multiple Criteria decision-making method, and fuzzy logic. The general operation of each of them is described below.

First, it has applied Multiple-criteria decision-making to determine the most relevant factors to achieve the best scenario for Knowledge Management. It is one of the primary decision-making problems which aims to determine the best alternative by considering more than one criterion in the selection process.

We apply the Analytic Hierarchy Process (AHP). AHP is a multi-criteria decision-making method that was proposed in the 1970s by Saaty (Saaty, 2008). It is used to derive ratio scales from both discrete and continuous paired comparisons. These comparisons may be taken from actual measurements or a fundamental scale that reflects the relative strength of preferences and feelings. It has been used extensively for analyzing and structuring complex decision problems. It is a general theory of measurement. AHP is recognized as a valuable method to handle issues with several criteria (Fattoruso, 2023).

The AHP consists of four steps: Identify the decision, options, and criteria; Compare in pairs. It Calculates the importance weight of each criterion; Identifies the best choice by calculating something called utility. In other words, applying the methodology consists of establishing the importance of weights associated with the criteria in defining the overall goal. That is done by comparing the criteria pairwise.

AHP's popularity stems from its simplicity, flexibility, intuitive appeal, and ability to mix quantitative and qualitative criteria in the same framework. AHP has been applied to various decision problems focused on decision-making (Asonitis, 2010).

The first stage of the AHP method consists of establishing the hierarchy of the decision problem by defining the objective; next, the criteria and sub-criteria are specified, then a hierarchical model is elaborated based on element comparison matrices and the use of matrix algebra elements; Finally, once the hierarchical structure of the problem has been built, the elements are assessed, for which the decision maker evaluates the criteria through paired comparisons and considers the different alternatives concerning each criterion, the AHP It allows these comparisons to be made based on both quantitative and qualitative factors, since for them the scale proposed by Thomas Saaty is used, in this way the decision maker can express his preferences between two elements through numerical values. In summary, 1) it offers a numerical ranking according to the classification of alternatives. 2) Allows the use of criteria and sub-criteria. 3) Enables the use of qualitative information. 4) Allows the use of quantitative data. It allows working with a multidisciplinary team.

Next, we use Fuzzy Logic to find the best scenario to achieve Knowledge Management. Considering the selected variables, a model based on Fuzzy Logic (FL) was built, which has a remarkable characteristic that allows building models based on the experience of experts that, like any process where there is human intervention, has value scales that do not they are necessarily exact. There are qualifications for the variables where the scale can be Good, Fair, or Deficient with intermediate values between them, such as Very Good, Good, Almost Good, Fair, Almost Fair, Deficient, or Very Deficient, etc.

In this way, the most relevant variables for the classification were fed, being able to infer the results when mapping the input variables given an output. The process involves membership functions, fuzzy logic operators, and if-then rules. This way, a model involving five input and one output variable was built (Figure 1).

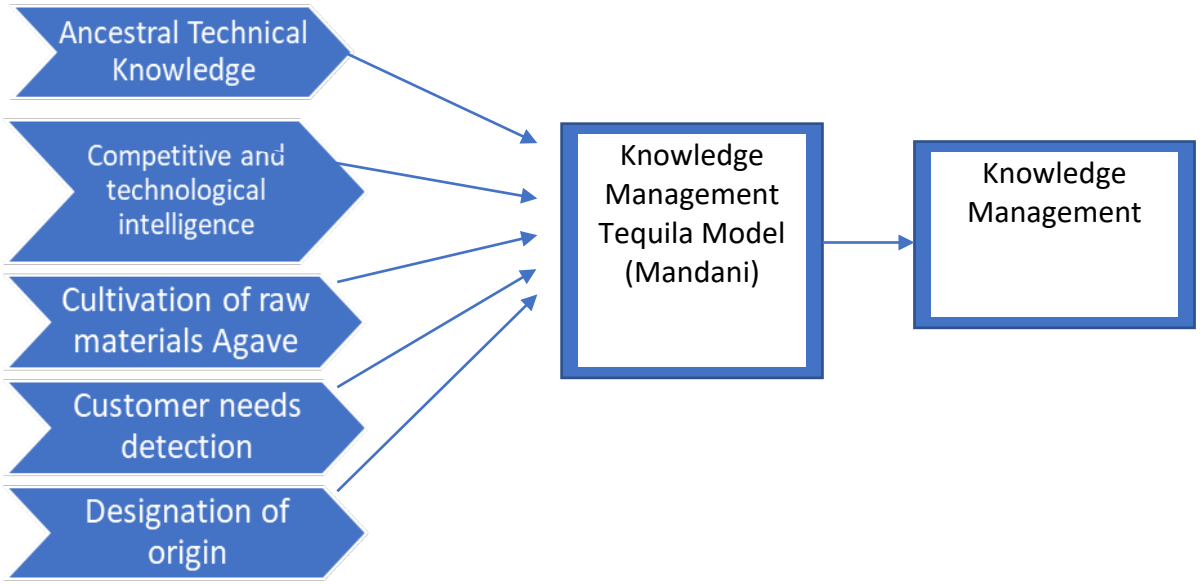


Figure 1: Fuzzy Model

The most straightforward membership functions are formed using straight lines. Of these, the simplest is the triangular membership function, a collection of three points that form a triangle, which has the advantage of simplicity. There are other types of membership functions, such as trapezoidal. A membership function (MF) is a curve that defines how each point in the input space maps to a membership degree between 0 and 1.

Furthermore, fuzzy sets describe vague concepts that admit the possibility of partial membership in them. A membership function associated with a given fuzzy set maps an input value to its appropriate membership value.

Fuzzy logical reasoning operates based on standard Boolean logic. Fuzzy sets and fuzzy operators are the fundamental elements that allow us to build complete sentences. These are the conditional statements, the if-then rules permuted to make valuable inferences. Inferences from a fuzzy rule assign a complete fuzzy set to the output. If the antecedent is only partially true, then the output fuzzy set is truncated according to the implication method. The set of rules competes. The output of each rule is a fuzzy set. However, what is wanted is that the output of an entire collection of rules is a single number (Figure.2).

The input to the defuzzification process is a fuzzy set, and the output is a single number. Given a fuzzy set that spans a range of output values, it is required to return a number, thus going from a fuzzy set to a crisp output.

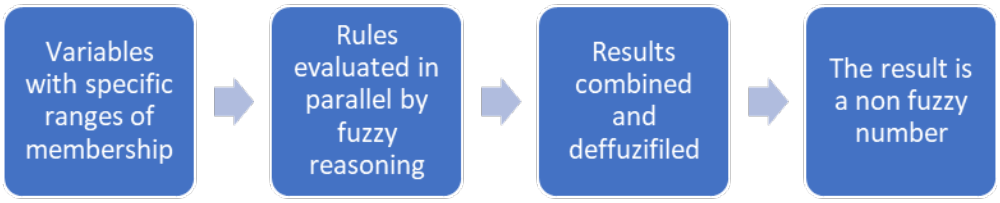


Figure 2: Fuzzy Logic Process

Fuzzy inference systems have been successfully applied in various fields. Due to its multidisciplinary nature, the fuzzy inference system is known as a fuzzy rule-based system, fuzzy expert system, fuzzy model, and fuzzy logic controller, among others.

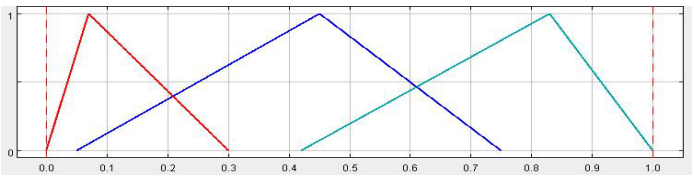
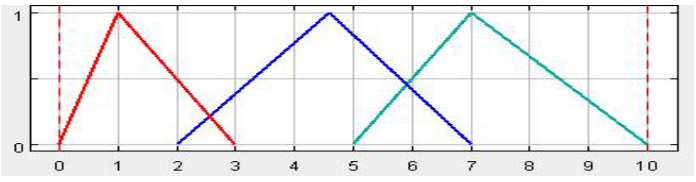
The membership functions are based on the Innovation and Technological Management Model results in the Tequila Sector in Mexico (Terán-Bustamante et al., 2022). Memberships are expressed in terms of probabilities in a Bayes Network Model.

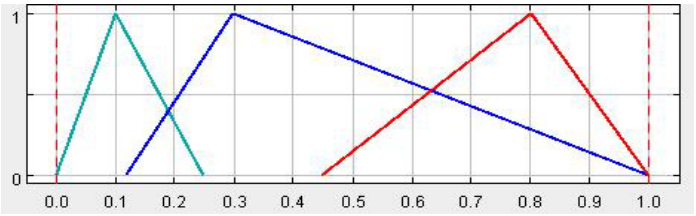
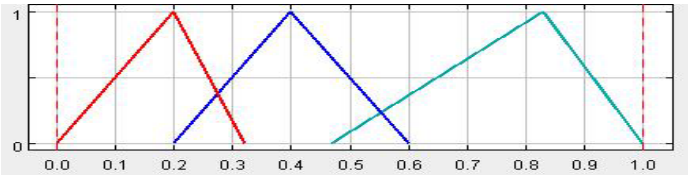
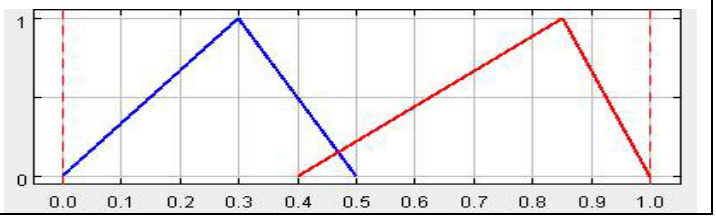
The Fuzzy Logic system was constructed using a Mamdani inference system to obtain the logical implications of the ten rules and five input variables used to build the model (Table 1).

The assigned ranges for the membership functions were given considering the previously assigned crisp values. In this way, sets of fuzzy values were built for each of the parameters assigned to each variable.

A triangular membership function was applied for its efficiency and simplicity. This is explained by employing the graph located in the "membership parameters" column. On the "x" axis, the values that each variable can take are indicated through lines identified with a color code.

Table 1: Fuzzy Logic System Description

Input Variables	Range	Membership Functions	Membership parameters
Ancestral Technical Knowledge	[0,1]	Optimum (Green) Regular (Blue) Deficient (Red)	
Competitive and technological intelligence	[0,1]	Optimum (Green) Regular (Blue) Deficient (Red)	

Input Variables	Range	Membership Functions	Membership parameters
Customer needs detection	[0,1]	Optimum (Res) Regular (Blue) Deficient (Green)	
Cultivation of raw materials Agave	[0,1]	Optimum (Green) Regular (Blue) Deficient (Red)	
Designation of origin	[0,1]	No (Blue) Yes (Red)	

We constructed a set of 10 inference rules that, without trying to be exhaustive, express the possible relations among the input variables based on the knowledge expert (Table 2). Rules must meet some basic standards of completeness, consistency, interaction, and robustness. Completeness: The rules must comply with all possible combinations of inputs so that there are no gaps in which no action is taken. Consistency: Two actions cannot coexist in the same situation, which would produce a contradiction. Interaction: Corresponds to the weight of a rule among the rest; for this, the effect of the rules on the control action must be analyzed. Robustness: It measures the controller's reaction to input disturbances.

The defuzzification step transforms the aggregated fuzzy set into one crisp number using the centroid method. This method returns the area's center of gravity projection under the membership function. Thus, the defuzzification is realized by a decision-making algorithm that selects the best crisp value based on a fuzzy set. The interpretation of these values is the probable value the output variable will have under the inference rules.

Table 2: Inference Rules

Inference Rules	Ancestral	Cultivation	Customer	Origin	Knowledge Management
1	Optimum	Optimum	Optimum	No	0.05
2	Optimum	Optimum	Regular	Yes	0.85
3	Optimum	Regular	Regular	Yes	0.85
4	Optimum	Regular	Deficient	Yes	0.7
5	Regular	Regular	Deficient	No	0.01
6	Regular	Deficient	Regular	Yes	0 75
7	Deficient	Deficient	Deficient	Yes	0.55
8	Deficient	Regular	Regular	Yes	0.56
9	Regular	Optimum	Optimum	No	0.32
10	Regular	Regular	Optimum	No	0.3

Based on the expert's knowledge, the values achieved from the defuzzification process are expressed as a numerical value in the range [0,1] for the output variable (KM).

4. Results, Discussion, and Conclusions

Applying AHP has made it possible to find the optimal values for the combinations of Ancestral Knowledge, Cultivation of Raw materials, Customer needs detection, and Origin denomination factors.

The steps followed to determine the best combination of factors to arrive at the optimal value of KM according to AHP are the determination of comparison criteria, calculation of the weighting for each of the variables, and validation through the value of the ratio of the consistency index, the configuration of the alternative's comparison matrix—finally, the determination of the best combination of factors for Knowledge Management.

The importance of variables comparison was registered in a Criteria Comparison Matrix (Table 3), where the values represent the relative importance based on a range from 3 to 9 according to the Saaty scale. It is based on the opinion of experts on Tequila production as to the importance of the variables about each other.

Table 3: Criteria Comparison Matrix

	Ancestral Technical Knowledge	Cultivation of raw materials Agave	Customer needs detection	Designation of origin
Ancestral Technical Knowledge	1	3	5	5
Cultivation of raw materials Agave	0.333333333	1	3	3
Customer needs detection	0.2	0.333333333	1	3
Designation of origin	0.2	0.333333333	0.333333333	1

Based on the information in the Criteria Comparison Matrix, the weights corresponding to each variable were obtained (Table 4). In this way, the most important variable is Ancestral Technical Knowledge.

Table 4: Calculated Weights for Each Variable

Variable	Weight (Wi)
Ancestral Technical Knowledge	0.54
Cultivation of raw materials Agave	0.24
Customer needs detection	0.14
Designation of origin	0.08

The value assigned for the consistency index is 4, corresponding to the number of variables. In consequence, the Consistency Index Ratio is 0.099. This value is less than 0.10, which validates the calculations made.

Next, the alternative comparison matrices for each variable were elaborated based on the values obtained through the results obtained in the previous work in which the values assigned to each variable in the Bayes Networks were reported (Terán-Bustamante et al., 2022) (Table. 5).

Table 5: Assigned Values to Each Variable

Ancestral Technical Knowledge	Cultivation of raw materials Agave	Customer needs detection	Designation of origin
OPTIMUM	OPTIMUM	OPTIMUM	NO
OPTIMUM	OPTIMUM	REGULAR	YES
OPTIMUM	REGULAR	REGULAR	YES
OPTIMUM	REGULAR	DEFICIENT	YES
REGULAR	REGULAR	DEFICIENT	NO
REGULAR	DEFICIENT	REGULAR	NO
DEFICIENT	DEFICIENT	DEFICIENT	NO
DEFICIENT	REGULAR	REGULAR	YES
REGULAR	OPTIMUM	OPTIMUM	NO
REGULAR	REGULAR	OPTIMUM	NO

The results obtained based on AHP methodology indicate that the combination of values assigned to each variable read by row is shown in Table 6. Where the prioritization value indicates the better combination of values. Combination 1 and combination 2 are the best scenarios to achieve Knowledge Management.

Table 6: Prioritization Results

	Ancestral Technical Knowledge	Cultivation Of Raw Materials	Customer Needs Detection	Designation Of Origin	Prioritization	%
Comb1	0.15	0.18	0.18	0.06	0.15	**15%**
Comb2	0.15	0.16	0.08	0.13	0.15	**15%**
Comb3	0.17	0.08	0.08	0.13	0.13	13%
Comb4	0.17	0.08	0.03	0.13	0.13	13%
Comb5	0.07	0.09	0.03	0.04	0.07	7%
Comb6	0.08	0.05	0.10	0.13	0.08	8%
Comb7	0.03	0.04	0.03	0.13	0.04	4%
Comb8	0.03	0.08	0.09	0.13	0.06	6%
Comb9	0.08	0.18	0.18	0.05	0.11	11%
Comb10	0.09	0.08	0.20	0.04	0.09	9%
Weight (Wi)	0.54	0.24	0.08	0.14	1.00	100%

Next, the procedures corresponding to Fuzzy Logic are applied, and the corresponding results are reported.

Once the Fuzzy Logic Model was applied, the results of the combinations in the fuzzy values of the variables were obtained based on the inference rules fed to the model.

One way to graphically explain the results obtained is through surface plots. Where the influence that each variable has on the objective variable is presented in a three-dimensional graph, where the variables are located on the "x" and "y" axes and the "z" axis, the objective variable is represented.

Based on the inference rules, it is observed that the highest value reached for the objective variable (Knowledge Management) are numbers 2 and 3. In this way, the value achieved by the Knowledge Management variable is explained through the most relevant variables for the classification. For rule 2, the values for the variables Ancestral Technical Knowledge, Cultivation of raw materials, Customer needs detection, and Designation of Origin was optimum, optimum, regular, and yes, respectively. In the same way,

in rule 3, the values for the same variables were Optimum, regular, regular, and yes. In both cases, 80% was obtained for the objective variable. That makes it explicit that different combinations of the fuzzy values in the input variables allow us to achieve satisfactory results in the output variable.

Some of the most relevant results are presented below, utilizing surface plots to explain the influence of pairs of variables.

Then, the influence that the variables have on the output variable indicates that the values in the range [0,1] for the Customer needs detection variable and [0.4,1] for the Ancestral Knowledge variable allow obtaining values close to 85 in the variable output Knowledge Management (KM) (Figure 3).

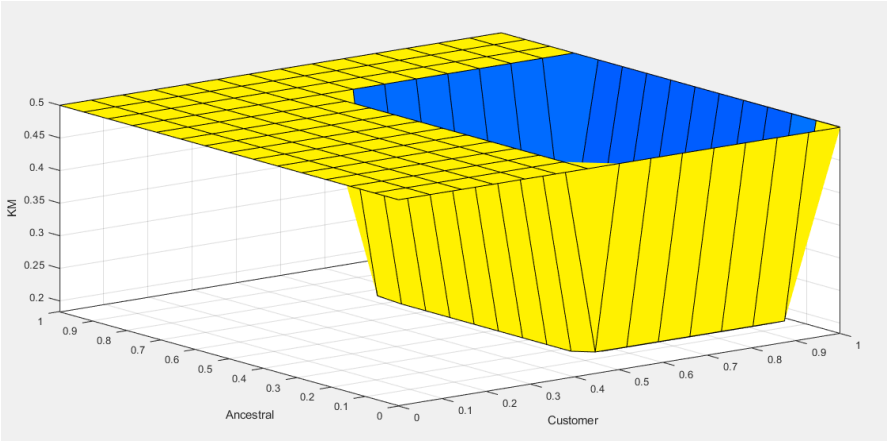


Figure 3: Surface Graph Customers Need Detection vs. Cultivation of raw Materials

For the surface plot corresponding to the Cultivation of raw materials vs. ancestral knowledge variables, it is observed that even if the values for the Cultivation of Raw-Materials variable have values in the range [0,1]. In contrast, the Ancestral Knowledge variable has values in a range of medium to high [0.4,1] to achieve high values in the KM variable (Figure 4).

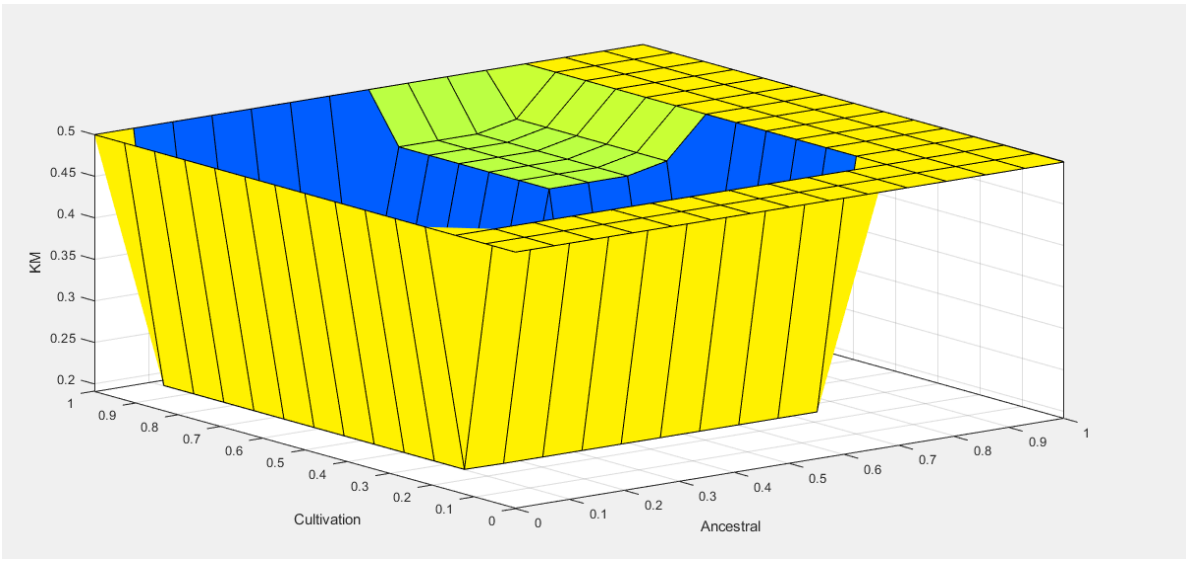


Figure 4: Surface Graph for Cultivation Raw Materials vs. Ancestral Knowledge Variables

Thus, given the characteristics of the complete system, the range of the values for variable Designation of Origin [0.5,1] allows variable KM to reach 85 if the Ancestral Knowledge range of values is in the [0.4,1] range (Figure 5.).

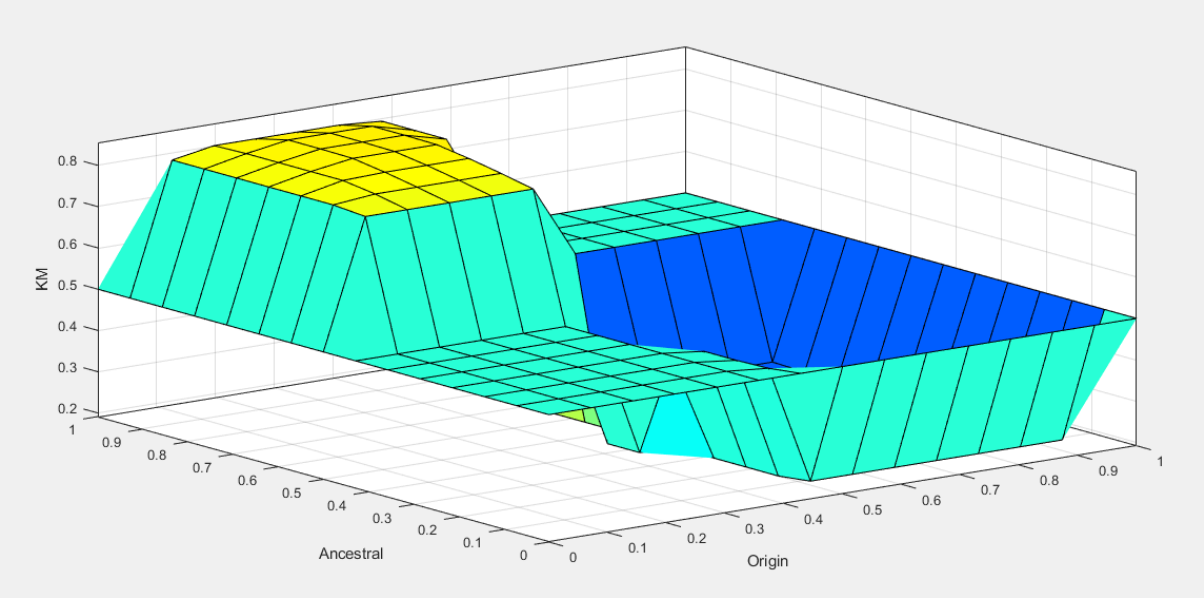


Figure 5: Surface Graph for Designation of Origin vs. Ancestral Knowledge Variables

Based on the results obtained, it is shown that it is possible to achieve satisfactory results in the output variable from the fuzzy sets established as a range for the input variables, considering that humans generally express their knowledge on scales that point values cannot represent.

In summary, the inferences from the system of five input variables and ten inference rules allow us to infer that the Ancestral knowledge variable is the most influential in attaining high values in the Knowledge Management output variable.

5. Conclusions

As can be seen, the Tequila sector has a great tradition in Mexico; it is a fundamental part of the national economy and various regions of the country. The knowledge generated from ancestral values is greatly valued in elaborating this distillate. Thus, it is essential to consider the necessary actions for decision-making for knowledge management in the Tequila sector and generate a model that allows innovation. Knowledge management – through the developer model – is a facilitating system that combines individual and collectible experiences and knowledge, as well as ancestral and technological, to achieve competitive advantages.

It is considering knowledge management as a tool that allows both companies and various sectors of a country to increase their capacity to respond to challenges, changes, crises, and the diverse circumstances of the present and future, with a positive effect on its value when it implies an adequate circulation of ideas and information.

Having a model that allows better decisions, optimal or non-optimal management of knowledge management and its various factors, through the causality of the variables, will enable us to improve decision-making when selecting the factors that better influence to achieve Knowledge Management.

The participation of the State plays the unquestionable role of knowledge and innovation for the development of the economy and society, but also from the specificities of agribusiness. n accordance with the above, the agricultural and scientific policies implemented by the State and the participation of various institutions, such as universities and research centers, which operate in the agribusiness environment, play a crucial role in the sustainability and quality of life of the community's people. For their part, institutes and universities allow and facilitate the link between the various actors while making the best use of the research potential to achieve it (Farrukh et al., 2017; Piotr, 2019).

In summary, an adequate knowledge management strategy in the Tequila sector in Mexico facilitates the appropriation and integration of knowledge from various sources, stimulates the creation of new knowledge and innovative action, and contributes to the generation of competitive advantages and sustainability over time both to the sector and to the various rural communities involved. At the same time, it allows decision-makers and public policymakers to generate programs that will enable the sustainability of this sector.

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Profiling European Consumers That Engage in Boycotting

Fernando Mata[1], Nuno Baptista[2,3,4], Maria Dos-Santos [2,5] and Natacha Jesus-Silva[6,7,8]
[1]CISAS – Centre for Research and Development in Agri-food Systems and Sustainability, Instituto Politécnico de Viana do Castelo, Portugal
[2]Escola Superior de Comunicação Social, Instituto Politécnico de Lisboa, Portugal
[3]NECE – Research Center for Business Sciences, Convento de Sto. António, Covilhã, Portugal
[4]Comegi – Centro de Investigação em Organizações, Mercados e Gestão Industrial, Lisboa, Portugal
[5]Instituto Universitário de Lisboa (ISCTE-IUL), Centro de Estudos sobre a Mudança Socioeconómica e o Território (DINÂMIA'CET), Lisboa, Portugal
[6]Universidade Portucalense Infante D. Henrique, Porto, Portugal
[7]REMIT - Research on Economics, Management and Information Technologies
[8]IJP – Instituto Jurídico Portucalense

fernandomata@ipvc.pt
nbaptista@escs.ipl.pt
msantos@escs.ipl.pt
natachajsilva@upt.pt

Abstract: Boycott involves abstention from buying specific products or brands for political, ethical, or ecological reasons. Boycott is usually framed as an expression of political consumerism and has been on the rise. Companies that suffer a boycott may endure severe consequences including long-term damaged brand image and harmed reputation. However, there is still an incomplete picture of the socio-political and demographic profile of boycotters. Most characterizations of political consumers are based on research that combines boycotters and buycotters under a single construct of political consumers, and yet these consumers are driven by different motivations. The objective of this exploratory study is to provide a general characterization of European political consumers that engage in boycotting. The data used was collected between the 25th of May, 2022 and the18th of September, 2022, and was retrieved from the 10th edition (2022) of the European Social Survey. The study employs binary logistic regression to assess the association between boycotting and various potential factors listed in extant literature. Results indicate that boycotting behaviour is affected by age and other life-cycle variables, gender, education, institutional trust, the degree of satisfaction with the political system and the government, the level of trust in information and communication technology, reported self-happiness and self-general health perceptions. In general, the parameters of the models suggest that European consumers that engage in boycotting behaviour tend to be female, young, well-educated, trust on national political institutions and make intensive use of digital media. The conclusions of the empirical study are discussed and interpreted in light of current theories of consumer behaviour that highlight the post-modern, fragmented and globalized characteristics of current western societies. The results of this study enrich the literature on consumer boycotts and confirm the predicting power of various socio-demographic, psychological and attitudinal variables. Avenues for future research are identified together with consideration of the study limitations.

Keywords: Political consumerism, Anti-consumption, Boycotting, Europe, European social survey

1. Introduction

Anti-consumption behaviour has received a fair amount of scholarly attention. The term spans across a wide variety of manifestations, including boycotting, brand avoidance, ethical consuming, voluntary simplification, brand rejection, consumer resistance, consumer rebellion and retaliating (Ozanne & Ballantine, 2010; Chatzidakis & Lee, 2012; Leipämaa-Leskinen et al., 2016). Consumers define their self-identity and their social references through what they choose to consume and also what they choose not to consume (Sandikci & Ekici, 2009). Distastes and dislikes manifest the undesired self, or a facet of the negative self that the consumer may be afraid of becoming (Hogg and Banister, 2001). According to Chatzidakis and Lee (2012), with overconsumption becoming the norm in Western societies, acts of consumption no longer possess the same unique symbolic value. In this context, acts against consumption, against the norms, are now understood to be powerful symbolic acts through which consumers may better express themselves.

This research focus on a specific form of anti-consumption manifestation that is consumer boycott and which involves voluntary abstention from buying specific products for political, ethical, or ecological reasons (Ferrer-Fons and Fraile, 2014). Consumer boycotts are usually framed under political consumerism, a concept that alludes to consumers recurring to market transactions as an instrument of protesting or rewarding desirable institutional behaviours (Koos, 2012; Gotlieb & Cheema, 2017). Targeted companies that suffer a boycott may

endure severe consequences that go beyond immediate reduced sales and profits, and include long-term implications on brand image and harmed reputation (Rim et al., 2020; Wang et al., 2021).

Although available data indicates that boycotts are becoming more prevalent (Seyfi et al., 2021; Tuominen et al., 2022) there is still an incomplete picture of the socio-political and demographic profile of boycotters (Endres & Panagopoulos, 2017; Schwalb et al., 2022). As noted by Kelm and Dohle (2018), most characterizations of political consumers are based on research that combines boycotters and buycotters under a single construct of political consumers, and yet these consumers are driven by different motivations - while boycotts aim to punish the organization, buycotts aim to reward the targeted organization. These factors highlight the importance of researching separately each nature of political consumption manifestation. This study addresses this research gap, by researching the characteristics of European consumers that engage in boycotting behaviour. To attain this objective, the study recurred to data provided by the European Social Survey (ESS ERIC, 2022a; ESS ERIC, 2022b) covering twenty-five European countries countries.

The article is organized as follows: the next section contextualizes boycotts within the anti-consumption and political consumerism literature. The following section outlines the methodological procedures. The main body of the article presents and discusses the study´s results. The final section offers conclusions, points the limitations of the study and identifies some avenues for future research.

2. Background

Contrary to the tendency verified in traditional political activities such as voting or participating in a political party, this century is characterized by alternative forms of political activity (Baptista and Rodrigues, 2018). This development has been related with globalization and the widespread use of information and communication technologies, which have triggered lifestyle politics and a sense of moral obligation (Acik, 2013). Political consumerism is generally understood as a form of political activity beyond the traditional manifestations, in which consumers use their purchasing power to attain political-related objectives (Koos, 2012). The concept of political consumerism is traditionally employed in reference to the boycott or buycott of products or services undertaken by consumers (Ferrer-Fons and Fraile, 2014).

Previous research indicates that political consumers tend to be prevalently female, young, well-educated and intensive users of digital media technologies (Kelm & Dohle, 2018; Grasso & Smith, 2022; Schwalb et al., 2022). However, most characterizations of political consumers are based on research that combines boycotters and buycotters under a single group of political consumers (Schwalb et al., 2022). The motivations of boycotters and buycotters are significantly different, while buycotting aims to reward the targeted organization, boycotting, which is the focus of this research, refers to actions intended to punish the organization. As such, it is important to characterize separately each group of political consumers. Furthermore, a dualistic approach to study anti-consumption, in which dominance/resistance models oppose consumption to anti-consumption is not suitable to understand the complex nature of the phenomenon in stake. As stressed by (Chatzidakis and Lee, 2012) the assumption that the “reasons against” are always the logical opposite of the “reasons for” is conceptually erroneous.

3. Materials and Methods

The data used in this study was collected between the 25th of May, 2022 and the18th of September, 2022, and was retrieved from the European Social Survey (ESS ERIC, 2022a) [dataset]. The European Social Survey (ESS) is a cross-national survey, that in its 10th edition (2022) covered several European countries. Data was collected through face-to-face interviews, however due to the COVID-19 pandemic some interviews were done via web or videoconference. The survey covers several aspects of the Europeans life, including social conditions and indicators, social behaviour and attitudes, general health and well-being, political behaviour and attitudes, political ideology, minorities, cultural and national identity, media, equality, inequality and social exclusion, language and linguistics, religion and values, family life and marriage (ESS ERIC, 2022b). The represented universe in the sample includes persons aged 15 and over resident within private households, regardless of their nationality, citizenship, language or legal status, in the following countries: Austria, Bulgaria, Switzerland, Czechia, Germany, Estonia, Spain, Finland, France, Greece, Croatia, Hungary, Iceland, Italy, Lithuania, Montenegro, North Macedonia, Netherlands, Norway, Poland, Portugal, Serbia, Sweden, Slovenia, and Slovakia. The survey contains a total of 18.060 entries.

With the aim of studying consumerism in the Europe, we have selected specific variables from the ESS. The surveyed individuals were asked several questions including a particular question of interest for this study and

herein used as independent variable: "Have you boycotted certain products in the last 12 months?". As independent variables we have selected questions related with demography, individual perception of the society and its policies, and exposure to internet and/or mobile communication systems. These variables were selected based on extant literature that profiles political consumers (Kelm & Dohle, 2018; Grasso & Smith, 2022; Schwalb et al., 2022). The following were used as independent variables:

- Demographic: age, gender, marital status, years in education, and household size;
- Individual perception of the society and its policies: trust in others, trust in the legal system, trust in scientists, satisfaction with the state of the economy, satisfaction with the government, satisfaction with the democratic system, satisfaction with the state of the education system, satisfaction with the state of the health services;
- Wellbeing: happiness, subjective general health;
- Online behaviour and individual perception of information and communication technology: time spent on the internet and individual perception about personal privacy and misinformation in online/mobile communications.

Due to the dichotomic nature of the dependent variable (Yes, No) we have used logistic models to explain it. The statistical package use was the IBM Corp.® SPSS® Statistics, Armonk, NY, USA. Version: 28.0.1.1 (15). The analysis was performed via the general linear model routine, using the binomial option and selecting the logit link.

4. Results and Discussion

Extant research indicates that political consumers are mostly female, young, well-educated and affluent and are intensive users of digital media technologies (Kelm & Dohle, 2018; Grasso & Smith, 2022; Schwalb et al., 2022). To confirm the validity of such general characterization we tested demographic variables and variables that reflect boycotters' trust in public institutions as well as the level of satisfaction with the government and perceptions of online and mobile communications. The model obtained is summarised in Table 1.

The parameters of the model indicate that the probability of boycotting is lower in males than females. The gender gap is theoretically supported by previous literature indicating that in general females tend to engage more frequently in political consumption due to traditional woman roles in provisioning (Yates, 2011; Koos, 2012). Results also indicate that the probability of boycotting decreases as age increases. The reduced prevalence of boycotting in older publics has been attributed to life-cycle and generational effects (Acik, 2013). Life-cycle effects are reconfirmed by this study´s results indicating that the probability of boycotting decreases as the household member numbers increases. It was found that the probability of consumers engaging in boycotting activities is lower in widows or if the civil partner has died, followed by legally separated, none of the stated or single, legally divorced or civil union dissolved, legally married, and legally registered civil union. The influence of digital communication on younger generations also seems to play a key role in explaining the prevalence of boycotting in younger publics. The internet provides improved access to information allowing political consumers to quickly disseminate information about boycotts and persuade peers to participate (Seyfi et al., 2021).

Table 1: Adjustment of the Independent Variables to the Dependent Variable "Have you Boycotted Certain Products in the Last 12 Months?" The Logistic Models Fit Use "Yes" As Response and "No" As Reference. The Akaike's Information Criterion for the Degree of Adjustment of the Models Is Given, Together with the Intercept and the Parameter. Gender and Legal Marital Status are Used as Factors and all the Others are Used as Covariates

AIC	Independent variable	Intercept	β
1812	Number of people living in the household***	No	-0.716***
345	Years of full-time education completed***	-4.001***	0.150***
531	Age***	-1.431***	-0.010***
3147	Gender***	No	
	Male		-1.7***

AIC	Independent variable	Intercept	β
	Female		-1.65***
3145	Legal Marital Status***	No	
	Legally married		-1.451**
	Legally registered civil union		-0.069 NS
	Legally separated		-1.998**
	Legally divorced or civil union dissolved		-1.588***
	Widowed or civil partner died		-2.202***
	None of the above or single		-1.663***
4078	§Time/day spent paying attention to news about politics & current affairs? ***	No	-0.017***
3120	§Time/day spent on internet (any device) (work or personal)***	-2.002***	0.0013**
157	ǂMost people try to take advantage of you, or try to be fair***	-2.651***	0.126***
126	łTrust in the legal system***	-2.328***	0.078***
152	łTrust in scientists***	-2.793***	0.095***
115	†How satisfied with present state of the economy in the country***	-2.112***	0.038***
133	†How satisfied with the national government***	-2.074***	0.033***
166	†How satisfied with the way the democracy works in the country***	-2.222***	0.059***
166	†How happy are you***	-2.722***	0.107***
1723	¥State of the education in the country nowadays***	No	-0.299***
137	¥State of the health services in the country nowadays***	-2.285***	0.078***
53	¦Subjective general health***	-1.678***	-1.678***
179	łOnline/mobile communication makes work and personal life interrupt each other***	-2.555***	0.107***
104	łOnline/mobile communication exposes people to misinformation	-3.252***	0.189***
120	łOnline/mobile communication undermines personal privacy	-2.613***	0.112***

Notes: *p>0.05, **p<0.01, ***p<0.001; §Time unit is minutes; ǂ0-10 scale, from “0” try to take advantage to “10” try to be fair; ł0-10 scale, from “0” completely no to “10” completely yes; †0-10 scale, from “0” completely dissatisfied to “10” completely satisfied; ¥0-10 scale, from “0” very bad to “10” very good; ¦0-5 scale from “0” very good to “5” very bad;

The model confirms that the probability of boycotting increases as the years of full-time education increase. This finding is consistent with the literature of critical consumption. Yates (2011) found that individuals with higher levels of education are more likely to critically consume. Verba and Nie's (1972) socio-economic status model offers a possible theoretical explanation for this result by suggesting that high levels of scholar education provide political consumers with the information, knowledge, and the capacities to interpret complex social issues, thus enabling them to be involved in politics. Individuals from higher socio-economic status are equally more likely to have the resources and interest to be involved (Acik, 2013). However, our study indicates that the probability of European consumers engage in boycotting decreases with the time spent paying attention to politics and current affairs. This result suggests that people may engage in extreme forms of political consumerism, such as boycotting, without proper information about the issues in stake. because of peer and group pressures.

The link between institutional trust and political consumerism is not clear: some research indicates that political consumption is positively associated with institutional trust (Stolle and Hooghe, 2004) and other studies conclude the inverse, that institutional distrust motivates political consumers (Aish et al., 2013). Our findings suggest that the probability of boycotting increases with the level of institutional trust, since it was found a positive relationship between past boycotting behaviour and consumers’ trust in the legal system as well as trust in science. This result was further explored by testing the satisfaction of boycotters with the

government. Results confirm that the probability of boycotting increases with consumers' satisfaction towards the government, the state of the democracy, the state of the health system and the state of the economy.

The data indicates that the probability of boycotting increases with the time spent on the internet and that is also positively affected by adverse perceptions about information and communication technology, including the notions that mobile communications and internet makes work and personal life interrupt each other, expose people to misinformation and undermine personal privacy. Mobile communications and the internet have increased consumers' awareness about boycott initiatives by allowing consumers to interact with like–minded individuals, consequently affecting the size of boycott initiatives and their effectiveness (Tuominen et al., 2022). Online social networks like Facebook, Twitter, Instagram, LinkedIn, online communities in Reddit, WhatsApp and other digital platforms, are making consumers more aware of their agency and active role as political consumers and constitute sources of information for consumers to learn about the boycott plans (Seyfi et al., 2021). On the other side, some of these digital platforms are also becoming the target of boycott actions. In recent years some big-tech companies have been accused of misuse of users' personal data, cancellation of services with minimal justification, interference in political life, programmed obsolescence of products, and the use of legal (although morally questionable) mechanisms to pay reduced taxes outside the countries of origin. For example, Facebook has repeatedly came under consumers' boycott due to misinformation on its platform as well as the way it handles information related to political issues (He et al., 2021; Bright et al., 2022).

The study´s results indicate that the probability of boycotting decreases with increased self-general health perception. Anti-consumption, at the individual level, is not necessarily the result of purposeful acts of altruism, ideological protest or the outward expression of countercultural sentiments (Nixon and Gabriel, 2016). Some consumers may oppose consumption of certain products for their personal well-being (e.g. unhealthy food). In addition, results also indicate that the probability of boycotting increases with declared self-happiness. The actual motives of boycotting are unlikely to divide themselves very precisely between a continuum of altruistic and egoistic motives. Previous research indicates that some practices of anti-consumption are motivated by individuals prioritizing their self-interests (Black and Cherrier, 2010). For example, voluntary simplifiers tend to adopt anti-consumption driven primarily by objectives of happiness and living the "good-life", and reject consumption of products or services that do not correspond to their projected lifestyle and self-concept (Craig-Lees, 2006). Consumers that reveal a concern for societal goods, such as sustainability, may also be motivated by self-interests. Studying anti-consumption practices, motivations and values within attempts to live a more sustainable lifestyle, Black & Cherrier (2010) empirically found that anti-consumption for sustainability is affected by the subjectivity of the consumer, due to consumers' multiple identities and conflicting values, and a focus on personal needs, including the need to secure a better world for their descendants, to save money and improve health conditions. Hence, these authors concluded that, contrary to the general notion that sustainability will be associated to socially-aware consumers, that are prepared to sacrifice personal pleasure for communal well-being, sustainability does not require sacrificing personal pleasure. In addition, and as highlighted by Soper (2007) we should not overlook the extent to which anti-consumption behaviour is also motivated by an interest in acquiring status and distinction rather than altruistic concerns for collective well-being.

By what was presented so far it can be tempting to dismiss all boycott manifestations as ultimately individualistic and egocentric. However, for some consumers, boycott decisions may indeed be an expression of altruistic principles. Soper (2007) alerts to the fact that in some genuinely altruistic motives underlying anti-consumption, the elements of self-pleasuring and self-happiness often extends to, and include, as a condition, an interest in the pleasures and well-being of others. For example, Iyer and Muncy's (2009) characterization of global impact consumers and market activists consists in individuals to whom their boycott decision is mostly motivated by societal concerns.

It is also possible to question the extent to which boycott, in the current post-modern, fragmented and globalized society, really reflects a disposition towards social ethos. Consumers' contact point with society has shifted from its once solid-modern and genuine community footings, based on shared identities expressed through consumption, to its present "liquid" and unstable simulacra of community (Colling et al., 2017). Drawing on Bauman's (2001) thesis on liquid modernity, Binkley (2008) proposed a theory of liquid consumption in which anti-consumption practices shape personal identities by mediating the conflicted demands for individual autonomy and collective belonging, and by highlighting consumer freedom from the structures imposed by social bonds, without completely abandoning the consumer to the risks and anxieties of solitary ventures. In the context of liquid modernity boycotting becomes a practice of "liquid consumption", in

which the tensions between freedom and security, or individual autonomy and group solidarity are increasingly disembodied from any binding social context. As expressed by Binkley (2008, p. 611) " for the liquid consumer, the elimination, or liquification of goods (in contrast to their solidifying accumulation), provides a much needed sense of personal mobility, changeability and fluidity".

According to Zukin et al. (2006) people engaged in consumer activism such as boycotting overwhelmingly understand it as an individual activity rather than as part of an organized effort. Earl and Copeland (2016) studied the distinction between self-directed and organizationally-directed finding that three distinct macro-social changes explain current preferences for self-directed political consumption: i) shifts toward movement societies, meaning that social movements became so embedded in contemporary society that these movements, and the tactics they use, are now commonplace and institutionalized; ii) lifestyle politics, meaning increasing levels of self-directed political activity as citizens embed politics in their daily life and do not require organizational cues or recruitment in order to take politics into their everyday lives and iii) changing citizen norms, specifically the rising of entrepreneurial values, that imply a decline in associational life and a move away from traditional models of citizenship and political engagement towards self-organization. These changes are facilitated by the development of digital media, allowing individuals to access countless opportunities to act entrepreneurially, unbinding the accessible supply of opportunities from organizations and traditional providers.

5. Conclusions

This research set out to characterize the profile of European political consumers that engage in boycotting actions. The parameters of the models suggest that European political consumers tend to be female, young and well-educated. European boycotters also tend to trust on national political institutions and make intensive use of digital media. However, and despite European boycotters' consumption of digital media technologies, it was found that these consumers have negative perceptions about digital media. The study also revealed that boycotting may be affected by self-centred reasons and not societal concerns, including subjective perceptions of health and happiness. The results of this exploratory study enrich the literature on consumer boycotts and confirm the predicting power of various socio-demographic, psychological and attitudinal variables. The present research is not without some theoretical and methodological limitations, which suggest the need for future research. First, we tested the general sample of boycotters without taking in consideration the specific characteristics of these consumers in each country. This limitation should be overcome by future cross-sectional studies, comparing the profile of boycotters in different countries. Second, the definition of the independent variables was supported on the literature, however, it is possible that some relevant explanatory variables are missing from the model. Third, given the nature of this study, causality relationships cannot be proven, although extant literature has hinted the explanatory power of the selected variables.

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Managing Human Capital With Employee Clustering through the Interplay of the Persona Concept

Anastasia Mikhlina and Juha Saukkonen
Jamk University of Applied Sciences, Jyväskylä, Finland

anastasiia.mikhlina@jamk.fi
juha.saukkonen@jamk.fi

Abstract: Nowadays, employees are seen as active Human Capital Management (HCM) consumers. Megatrends such as individualization and flexible work impact the workforce, especially generations Y and Z. Finding and retaining talent is a challenge that companies try to address, from employer branding to covering the whole lifespan of the company-employee relationship. Management is likely to know every employee in small and medium-sized enterprises (SMEs); however, larger companies need to categorize their human capital into certain entities. This paper explores the usability of the Persona concept for HCM. Persona is a service design approach widely applied in marketing, and a few research papers have argued that personas may have a role in improved people-oriented HCM. In short, personas aim to create a limited set of archetypes that differ from each other regarding demo- and psychographics. Generally, they are a mix of real-life people and some imaginary attributes. Different personas will likely request different services to feel fully motivated and supported. The core target of this article was to identify the common awareness of personas among HCM experts across industries and countries. Also, the ideation of future use of Personas was studied with marketing experts actively using personas in their professions. The qualitative study based on twelve semi-structured individual interviews was conducted in November-December 2022. The results indicate that the HCM community is well aware of the persona concept, which is widely used. However, the current usage of personas is mainly focused on employer branding and recruitment, and only in a few cases the usage covered the design of internal HCM processes. The study also revealed some limitations for HCM that are not present in the marketing field. Demands for transparency, equality, data privacy, and personal integrity set challenges in clustering the workforce. The results indicate the further need for research on best practices of creating and using Personas in a way that ethically serves the interests of both the company and the employee.

Keywords: Human capital, Persona, People clustering, Employer branding, HRM/HCM services

1. Introduction

While human resource management (HRM) covers employees' core needs and an administrative agenda, human capital management (HCM) represents the organization's overall human side of the organization, like skills, intelligence, and expertise (Hossain, Roy, 2016). HCM is of utmost importance in any organization, and its management requires constant optimization and development. The efficiency of HCM processes determines how well an organization can improve its results, extend goals, and increase competitiveness (Karahoca, 2008). The work environment has been changing rapidly in recent years due to factors such as globalization, an increased need for flexibility, a shift towards online environments, and a new generation entering the workforce. These factors contribute to the need to re-examine and re-evaluate traditional practices and approaches in HRM and HCM (Rodriguez - Fernandez, 2017). Also, a new generation entering the workforce brings change and challenges that organizations must adapt to attract new employees (D'Incerti, 2022). However, organizations still need help developing and improving their HCM services to respond and adapt to the abovementioned transformations. There has been a clear need for a more individual and personalized approach to employees in organizations and new solutions (Averbook, 2022). Organizations can individualize their policies and services through employee clustering to serve employees better (Sitaram, 2021). There are several employee clustering methods, but this research focuses on the method called the employee persona concept. The persona concept represents one of the clustering methods for user-centered design. Alan Cooper created the persona concept in the 1990s as a goal-directed design tool. According to Blomkvist (2002), the persona is a model initially used in product design. This tool is used to represent archetypical users instead of average users. The persona captures users' features such as behaviors, needs, and motives and combines them into a single individual representative.

The research questions of this study are 1) to identify the awareness of the persona concept among HRM/HCM professionals and 2) in what HRM/HCM processes personas can be used. This research paper is structured as follows. First, the authors overview and examine the existing research on the key concepts in the literature review. The authors explore employee clustering, its rationale, and the persona concept. The authors explain the research methodology in section three and the empirical findings in section four. The fifth section highlights the main conclusions and discussion.

2. Literature Review

The literature review represents a comprehensive review of existing literature about the topic in question and is used to strengthen the knowledge base (Paul, Criado, 2020). The subchapters below investigate the principal concepts of this research paper, such as employee clustering, the persona concept, and the rationale behind it.

2.1 Employee Clustering

Several global HCM trends, such as changing demographics, digitalization, flexibility, individualism, and skills shortage, urge organizations to adapt to changes and rethink their HCM processes (Farndale et al, 2022). This research concentrates on some significant trends that can be seen as the rationale behind employee clustering, which can be done using the persona concept.

The concept of flexible work has existed in professional and academic HCM discussions for most of the 2000s. Flexible work arrangements (FWA) have been seen as practices that help employees manage work and non-work responsibilities (Allen et al, 2013). FWA can be defined as work options that permit flexibility regarding where and when the work is done. (Rau & Hyland, 2002). Before Generation Z's entrance and the pandemic-driven shift to remote working, FWA practices were considered critical parts of the strategy to attract, motivate, and retain key talent (Hill et al, 2008).

A simultaneous trend to added HCM flexibility has been the rise of individualism as a larger societal current and as a trend directly impacting how HCM will be conducted. Linthorst and DeWaal (2020) note that "organizations need to address this increasing demand for individual attention. Client experience and employee experience have become key performance indicators that need close monitoring". As a result, corporate training and mentoring approaches are becoming more tailor-made to fit the employees' career ambitions better (Linthorst & DeWaal, 2020). According to Dundon and Rafferty (2018), this individualistic view has impacted organizations' reward systems, performance evaluation, and talent management practices. Mass tailoring companies aim to offer each customer a unique and individually considerate product/service. However, companies build these offerings by modularizing and standardizing some components to gain efficiency in their processes (Skjevdal & Idsoe, 2005).

The generational difference between Generation Z and Y has been actively researched in recent years as Gen Z enters the workforce, bringing change and challenges into the labor market. Although different sources define generation timeframes differently, it is often considered that people born in 1980–1994 belong to Generation Y and people born after 1995 belong to Generation Z. Pinto et al (2015) argue that the ageing population and new generation entering the workforce have a significant impact on human resource and human capital management processes. Each generation requires a different approach based on needs, characteristics, motivation, and expectations. The study by Urick, Hollensbe & Fairhurst (2017) argues that Gen Z is more prone to technology use, which can lead to challenges within the multigenerational team. According to Novotna (2019), Gen Z is the first interconnected generation, as its representatives have used the internet and digital tools throughout their lives. Gen Z shows a clear motivation for life-long learning, on-site training, location-independent work, flexibility, and focused work-life balance. Instead, they are looking toward changes in their roles, tasks, and education. Unlike Generation Y, Gen Z's career path is not linear as they will be changing employers frequently, and many will change their careers entirely. (Klein, 2020). For employers, it means that they have to adapt to the needs of a new generation and simultaneously develop processes to fit both Gen Z and Gen Y. All these factors call for more individual arrangements. Research by Sitaram (2021) argues that clustering techniques can help organizations develop personalized approaches.

Clustering is a statistical method that groups similar objects (or people) into categories based on set shared variables (Cornish,2007). This method can be used in many industries. For example, customer segmentation/ clustering has been used for many years in the marketing field to improve customer experiences, customer satisfaction, and increase customer quality. Similarly, this approach can be applied in HRM analytics since employees are increasingly seen as active customers of HCM (Sitaram, 2021). By clustering employees based on shared characteristics, organizations can make informed decisions to improve recruitment and retention, training, employee engagement, workforce diversity, and performance management. Several clustering algorithms have been used, for example, k-means or Fuzzy c-means. Such clustering algorithms divide massive chunks of data into smaller clusters based on shared similarities. Fan (2021) argues that the K-means clustering algorithm can be used to improve the employee performance evaluation process. A recent case study by Fernandes et al (2017) showed that it is possible to cluster employees into groups using multivariate clustering analysis using both algorithms.

Despite the societal trends and employee expectations, some forces are counteractive to the clustering of the human capital, i.e., the people that the organization employs and, as a result, offer these people differing levels and types of HCM services. These forces can be divided into ethical, (data) privacy, and legal matters. Generally, the concept of ethics can be understood by, e.g., how Cornock and Johns (1995) define its contents: acting with fairness, decisions on what is right and wrong, practices, and rules that stress responsible conduct between individuals and stakeholder groups. Ekuma and Akobo (2015) claim that "the ethics of HRM, while sharing many features with general organizational ethics, must at least be relatively unique in several respects". In HCM, ethical dilemmas have been described to cover the subcategories of misrepresentation and collusion, data misuse, manipulation and coercion, value and goal conflict, and technical ineptness. (Ekuma and Smith, 2012; Wooten, 2001). On the legal front, the frameworks and risks that set limits to the usability of some principles and techniques of modern employee clustering approaches, such as employee personas, are an inadvertent violation of Title VII of the U.S. Civil Rights Act, the Equal Employment Opportunities Act, the Americans for Disabilities Act (ADA), equivalent European Union regulations such as the Employment Equality Framework Directive (Hamilton and Sodeman. 2020). The European Union-wide General Data Protection Rights -directive (GPDR) and other job discrimination laws and regulations nationally and globally also impact how and how far organizations can use novel approaches and techniques. The non-legal guidelines and standards of sound and fair HCM operations, such as ISO Standard 30408:2016 on Human Governance (International Standardization Organization, 2016), as well as the more commercial approaches of Investors in People-analysis and Great Place to Work At-framework, stress the engagement of all members of the working community, fairness, and trust that the novel approaches may hurt, especially in case if not managed and communicated correctly.

To summarize, in HCM practice, the ethics, privacy, and law concerns oblige the companies to act based on equal treatment for all working community members. In the same vein, the objects of the HCM action, employees have a right to know what data is collected of their behavior and performance, how that data is used and by whom, what is the purpose of that data collection and analysis, and even up to the right to ask the personal data not necessary to the employer to be destroyed. All this is in the spirit of transparency. However, equity and equality are not the same things. According to Rodriguez & Morrison (2019), equity refers to implementing policies and practices that enable opportunities for success for everyone. For equality, treating every individual the same way would suffice. To be equitable, the organization needs to treat individuals according to their needs, and multiple opportunities for success must be created (Rodriguez & Morrison, 2019).

2.2 The Persona Concept

Personas are by origin a concept deriving from marketing discipline but have been increasingly used in generic design thinking processes with practical approaches of the method ranging from educational systems (Siricharoen, 2021) to cybersecurity systems (Almahri, Bell and Arzoky, 2019) and sustainable development (Carey et al., 2019).

According to Haak (2017), the concept of a user persona, traditionally used in marketing, has also been actively spreading to human capital management. Employee persona represents groups of employees with common characteristics in a fictional figure, which can vary from demographics to skills and competencies. When applying the persona concept, it is crucial to establish desired goals and objectives. For some companies, the goal may be developing a new talent acquisition initiative and, for some – strengthening the employer brand (McLeod, 2022).

Employee personas can be created using different methods depending on the end goal and available resources. It can be created by conducting surveys, interviews, or holding focus groups. Combining data collection methods, e.g., holding focus groups/interviews supplemented by a survey, is shown to improve the application of the employee personas (Brennan, 2017). Based on the research by Ditton, Swinbourne & Myers (2022), there is a tendency towards automated persona development since manual persona development can be both time and resource-demanding. That is especially relevant to larger companies. Currently, a semi-automated persona approach is based on manual guidance and data filters entered by a human. With increased data analytics in HCM, the persona concept can be fully automated using algorithms and big data analytics. A study by Jansen, Jung & Salminen (2021) shows that automated persona generation (APG) allows combining big data and persona concepts, creating a multi-layered cast of personas that can enrich the result in comparison to traditional data collection such as surveys or interviews. APG can identify unique behavioral patterns and associate them with demographic groups. Such solutions open new opportunities for decision-makers.

McLeod (2022) argues that the persona method can be used in talent acquisition and employer branding as it can help attract suitable candidates. Using personas in employer branding allows HR to identify key employee drivers, motivations, needs, and expectations of the workplace. A study by Zhao et al (2018) shows that

employee personas can be used in recruitment, training, performance appraisal, and employee engagement. According to Brennan (2017), there are several benefits that organizations can get from adopting a persona approach, such as a better and deeper understanding of the current human resource capital, its experiences from various processes like onboarding, performance reviews, and company policies; keeping the focus on what matters for HCM; more effective employee management; improved communication with stakeholders; mapping out existing and potential challenges; more appealing image for potential candidates; building a stronger employer brand to reduce bias in recruitment.

3. Methodology

This research is exploratory, indicating that its primary purpose is to explore the research questions and identify the current situation of the topic. Exploratory research does not imply any final solutions to the problem (Saunders et al, 2012). Chosen research approach enabled authors to change the direction based on the acquired data. The primary data was collected in the form of twelve semi-structured individual interviews. Semi-structured interviews are often used in qualitative research and allow discussion to evolve during the interview while following the structure (Magaldi & Berler, 2020).

Candidates for interviews were chosen from the authors' professional network. In order to increase validity, the authors selected candidates from different fields and in different positions. In addition, the work experience and the age of candidates varied a lot. Table 1 below provides an overview of the informants based on their field of expertise, the size of their company in terms of personnel number, and their current country of residence. The interview outline was designed and sent to all interviewees in advance. The interviews were conducted as face-to-face or online interviews lasting from 25 to 45 minutes. The authors recorded interviews with the interviewees' consent and transcribed them verbatim. The data was then analyzed, and the main findings were presented in the following chapter.

Table 1: Background of Informants

Field of expertise	The size of the company in terms of the personnel number	Country
HRM	500+	Canada
HRM	500+	Finland
HRM	20-49	Finland
Marketing	100-250	Netherlands
Marketing	11-50	Finland
HRM	500+	Finland
HRM	251-500	Germany
Marketing	500+	Finland
HRM	500+	Finland
Marketing	500+	Finland
HRM	500+	Finland
HRM	500+	Finland

4. Results

Results highlight the increasing need for a more individualized approach in organizations. More flexibility is expected from employers as the workforce is looking for more personalized solutions that would fit them precisely. Many informants outlined cultural differences occurring even within one country that requires certain employee clustering/ segmentation to accommodate their needs better. Results indicate a need for a mindful understanding of retainment, organizational culture development, and flexible work arrangements. Most informants from HR field confirmed that flexibility and individual arrangements are what matter for their employees. More and more employees take job positions that can offer flexibility, possibility for remote work, work-life balance, and other benefits. Employees more often appreciate the culture of individual arrangements and expect to be given the freedom of choosing own schedule.

Some informants noted that younger employees (Gen Z) have different career and work expectations than their older colleagues. While the research did not explore the generational differences in expectations, numerous informants touched upon this topic pointing out that Gen Z's way of work and work expectations differ drastically. For example, Gen Z expect more work-life balance, flexibility, and on-site learning, while being online 24/7. Informants highlight that when creating personas in multigenerational company, it is important to account for Gen Z differences and expectations.

As described in the literature review, the user persona concept can be perceived as a marketing tool. Based on the data collected from professionals from the marketing field, they have been actively using the user persona method to segment and identify their potential customers and their needs when designing new products. One informant noted that the user persona concept allows them to customize the approach and expand the customer base. Some experts have been using personas according to different markets, while others based on experience. Results indicate that before informants decide whether to use the user personas, it is necessary to understand the goal and objectives. Some HR experts pointed out that their current roles are interconnected with marketing, for example, when recruiting talent. One informant expressed a strong opinion that although not very popular yet, employee personas are coming to the HR field, and their use in HR and HCM will increase in the coming years. Below are some of the quotes from informants.

> *"Even before personas, we categorized our teams to get a better understanding. We used mapping and used categories."*
>
> *"We did think that in this case technology is better at making personas than a person because we are all biased."*
>
> *"When making personas, it's important to understand generational differences. With the new generation, we need to understand how they want to be led or hired."*
>
> *"Generation Z is completely different from others, so the persona thinking can be beneficial."*
>
> *"There's a big employee power now, and they need more autonomy, they want more flexibility, but at the same time, we see the rising need for support, for counseling, and we want to do things in equal and ethical way."*

Regarding HR, talent acquisition can be partly perceived as a marketing process since getting the best talents to the company requires effective and suitable marketing when advertising the position. Results highlight that some methods of employee segmentation are actively used according to several categories, such as employee types, roles, needs, skills, etc. Informants pointed out that employee personas allow the company to identify what matters to their employees. They discussed that for personas to work and add value to the business, they must be concrete and simple enough to be understood by employees and management and, simultaneously, not oversimplified or too generic. Table 2 below is based on the results and summarises the application of the persona concept across different HRM/HCM functions.

Table 2: Where and why to use Personas

Where to use personas	Why to use personas
Employer branding	For employer branding to strengthen the employer image and increase competitiveness, to modify the audience to target the suitable candidates
Recruitment	To tailor job descriptions/ advertisements to appeal to eligible candidates. Later, it can be used to tailor recruitment efforts
HR initiatives	To develop targeted initiatives and/or programs that respond to the unique needs/ expectations of different employee clusters
Training & career development	To gain a deeper understanding of the competencies and experiences employees have and would like to have
Diversity and inclusion	To better understand Gen Z, their expectations, motivations, and need for leadership to manage a heterogeneous workforce. To better respond to the needs of a diverse workforce

Results indicate that the persona concept has multiple advantages when used in HCM. It allows HR professionals to relate to groups of employees more personally and emotionally, creating personalized approaches and supporting individual career paths. The concept is visually simple, easy to use, scalable, and transparent and

allows employees to choose where they belong. Also, it improves the analysis of potential recruits and assists in decision-making. However, the results also underline several disadvantages of the concept. The concept might be misleading if oversimplified or too generic. It can lead to a more homogenous and one-minded workforce if recruiting processes rely only on this concept. It may require data analytics and AI skills, as well as it can be expensive and time-consuming. Another disadvantage is that it creates an unwanted possibility of comparing employees with each other, which can lead to missing out on their unique strengths and abilities. Also, it might be too restrictive and limited due to GDPR. If and when Personas are created systematically especially in a large organization, it should be rule-based/algorithm-based and working based on data of e.g. existing successful employees (in order to train others to reach the same potential or to recruit new ones who would be likely to succeed). Howewer, based on EU-wide General Data Protection Regulation (GDPR) the organizations have limitations on how to store and use such information about their employees. According to the regulation, sensitive data is a set of special categories that should be handled with extra security. These special categories are: 1) Ethnic or racial origin. 2)Political opinions. 3) Cultural or social identity 4) philosophical or religious beliefs. (GDPR, 2023). On the other hand, leaving out these debatable "soft issues" out of the personas would reduce the personas back to skill/competence listings, and thus offer no added value to earlier HCM practices.

To sum up, employee personas can be used as a supportive tool in decision-making but cannot be the only source of information.

5. Conclusions and Discussion

This study served as an introduction to the persona concept. It aimed at exploring the awareness of the personas among HRM/HCM experts and in what HRM/HCM processes personas can be used. In order to reach research objectives, a knowledge database was created based on the existing research. Previous research has identified the need for a more personalized approach and recognized the use of the persona concept for employee clustering.

Based on the results, the persona concept is well-known among HRM/ HCM professionals. It is used in the following processes: employer branding, recruitment, HR initiatives, and training. While the use of personas is mainly perceived as human-driven, the actual clustering cannot be done without the help of technology, including artificial intelligence. Some organizations use software to cluster the data. Based on the results, the following can be confirmed: the persona concept has been used for a while in marketing, and now HR is catching up with the concept. Also, results demonstrate a need for a more individualized approach and flexibility.

The research has certain limitations. Most interviews were conducted among companies with more than five hundred employees. The validity of the results is affected by a small number of interviews. Despite the limitations, the study provides the foundation for further research on this particular topic. Further research is needed to understand the real implications of the concept and how it can be applied efficiently in organizations. A larger data sample can increase the validity of the results and allow authors to explore the practical side of the persona concept more in-depth and to identify the process of persona development in HCM functions.

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Supporting Knowledge Communities: Examples From Organisations With Innovative Management Models

Ludmila Mládková
Prague University of Economics and Business, Czech Republic

mladkova@vse.cz

Abstract: The paper discusses how three organisations with innovative management models support the creation and work of knowledge communities. In the current unstable environment, knowledge, the ability to acquire it, create it and share it becomes one of the most critical aspects of the success of any organisation. Even though organisations may not be consciously aware of this, some adopt specific innovative management models that support their work with knowledge. The management model is how an organisation is managed, e.g. how managerial activities are executed, interlinked and organised into the systemic approach. Traditionally, management models were based on hierarchies and clear rules concerning managerial functions (planning, deciding, organising, leadership and controlling). Innovative management models are flatter; employees are empowered to decide and set objectives; control is decentralised. Some innovative management models are self-managing and look unusual, even crazy, as they deny our expectations about how organisations should be managed. Innovative management models help improve knowledge flow and sharing in an organisation. The paper provides examples of organisations whose unusual management models go even further and support or are intended to support the creation and work of knowledge communities. Knowledge communities usually benefit organisations by providing an environment where employees extensively interact, share and create knowledge. They are the silos of new knowledge, inventions and innovations. Organisations with unusual management models use different managerial tools and methods to support knowledge communities. Some organisations are successful, and some fail. In the paper, we show examples of both groups of organisations and explain why some management models work and support knowledge communities, and others do not. The paper uses secondary data about organisations available in the theoretical and managerial literature on these organisations and information from their web pages.

Keywords: Knowledge community, Knowledge, Management model

1. Introduction

The paper discusses how organisations with innovative management models support the creation and work of knowledge communities. In the current unstable environment, knowledge, the ability to acquire it, create it and share it becomes one of the most critical aspects of the success of any organisation. Even though organisations may not be consciously aware of this, some adopt specific innovative management models that support their work with knowledge. The management model is the way how an organisation is managed, e.g. how managerial activities are executed, interlinked and organised into the systemic approach. Traditionally, management models were based on hierarchies and clear rules concerning managerial functions (planning, deciding, organising, leadership and controlling). Innovative management models are flatter; employees are empowered to decide and set objectives; control is decentralised. Some innovative management models are self-managing and look unusual, even crazy, as they deny our expectations about how organisations should be managed.

Innovative management models usually help improve knowledge flow and sharing in an organisation. The paper provides examples of organisations whose unusual management models go even further and support or are intended to support the creation and work of knowledge communities. Organisations usually benefit from knowledge communities as they provide an environment where employees extensively interact, share and create knowledge. They are the silos of new knowledge, inventions and innovations. Organisations with unusual management models use different managerial tools and methods to support knowledge communities. Many organisations are successful, but many fail. In the paper, we show examples of both groups of organisations and explain why some management models work and support knowledge communities while others do not.

The paper uses secondary data about organisations available in the theoretical and managerial literature on these organisations and information from their web pages.

2. Background

2.1 Knowledge Communities

The term knowledge community is a covering term for different types of knowledge work supporting groups, from knowing communities, cooperative communities, occupational communities, learning communities,

innovative communities, and internal knowledge networks to communities of practice or question and answers communities, discussion boards and online forums or user innovation communities. Even though these communities were founded on different principles and for different concrete objectives, the primary reason for their existence is knowledge sharing and creation (Boland and Tenkasi, 1995).

In this paper, we understand knowledge communities as communities whose members interact and, via this interaction, share and create knowledge (Amin and Roberts, 2008; Boland and Tenkasi, 1995). Or as Harvey et al. (2015, p. 47) specify, "entities that rely on repeated and continuous interactions between individuals sharing a common interest or objective. Knowledge is at the core of both the activities and the outcomes of these communities, whose members actively exchange and accumulate knowledge. Through this regular exchange, group members come to share common mental schemas, social norms, and even a language, all of which can help to guide creative activities and accelerate innovation". Compared to traditional communities, knowledge communities are more professional, and users can exchange knowledge related to specialised topics such as health, academics and software development (Zhou, 2018). "Everyone can bring in the community her own view or perspective, as well as interpretations and values" (Cabitza et al., 2014, p.391), which influences the knowledge a community possess and works with. Knowledge communities are important, especially in a volatile environment where they serve as silos of knowledge creation, innovativeness and collective intelligence on one side and the other as places of stability and friendly environment.

As Harvey et al. (2015) mention, knowledge communities in organisations may be formal and informal. Formal knowledge communities are intentionally developed and managed by an organisation and may be part of its organisational structure. Informal knowledge communities emerge naturally from human interaction and communication.

Knowledge communities develop based on two mechanisms, common identity or common bonds. Some knowledge communities, for example, communities of practice, are based on both.

In common identity-based knowledge communities, "the attachment to the group is dependent foremost on the identification with the group as a whole, its goal, and its purpose" (Sassenberg, 2002, p. 28). Sassenberg (2002, p. 28) goes on: "An example of this type of group is a sports team: The common goal of the group members and the purpose of the group is much more important than the perceived interpersonal attraction between the single players." Alternatively, differently, "In these groups, the strength of group attachment depends first and foremost on one's commitment to the identity of the group" (Prentice et al., 1994, p. 85).

Common identity develops via social categorisation, interdependence, and intergroup comparisons (Ren et al., 2007; Turner, 1985; Turner et al., 1987). Social categorisation is based on the group's shared identity. Interdependence is supported via common tasks, common purposes or fate. Intergroup comparisons, e.g. community members comparing themselves to other groups and communities, increase people's commitment to their group (Ren et al., 2007).

In common bonds-based knowledge communities, "the bonds between group members primarily make up the attachment to the group. These groups can be characterised by the interpersonal conception of group cohesion, where the attraction of the group for the individuals does not play a role; rather, what is important is the attraction of the individuals to one another (personal attraction). An example is a group of friends" (Sassenberg, 2002, p. 28).

"Researchers have identified three main causes of bond-based attachment to a group: social interaction with others, personal knowledge of them, and interpersonal attraction toward them often through similarity." (Ren et al., 2007, p. 387). Social interaction helps people to learn about each other and to develop trust. Frequency is one of the factors that increase relationship development. Personal information builds understanding and interpersonal bonds. People like interacting with people with similar ideas, values, hobbies, ages, etc. (Ren et al., 2007).

Both common identity and common bonds support trust and openness toward others. They may cooperate in knowledge communities. "Further, despite their conceptual distinction, an identity-based attachment may evolve into bond-based attachment and vice versa" (Ren et al., 2007, p. 401).

In a volatile environment, the importance of knowledge is growing. Knowledge is not, and cannot, be concentrated in a single mind, and no single mind can specify in advance what kind of practical knowledge will be relevant, when and where (von Hayek, 1945). Therefore "firms would do well to understand the knowing

(knowledge) communities with which they are linked, the activities in which those communities engage, and the avenues through which they may be nurtured" (Harvey et al., 2015, p. 446).

2.2 Innovative Management Models

Management models can be defined as paradigms (Guillén, 1994), models of control (Ouchi, 1980), "the choices made by a company's top executives regarding how they define objectives, motivate effort, coordinate activities, and allocate resources; in other words, how they define the work of management" (Birkinshaw and Goddard, 2009, p. 82) or "distinct bodies of ideas that offer organisational managers precepts for how best fulfil their technical and social tasks." (Bodrožić and Adler, 2018, p. 86). Differently, a business model is what the organisation does; a management model is how they do it (Birkinshaw and Goddard, 2009).

Traditional management models used and recommended since the beginning of the 20th century (for example, by H. Fayol or M. Weber) were based on strict deciding hierarchies, bureaucracy, top-down planning, extrinsic motivation and centralised control (Birkinshaw, 2012). Traditional models fit well into a relatively stable economic environment. However, they turned out to be one of the limits in a volatile knowledge-focused environment.

Innovative management models, an alternative to the traditional ones, started to develop approximately from the 50thof the 20th century, some of them (for example, Semco and Gore models) inspired by the book of Douglas McGregor, The human side of enterprise (McGregor, 1960). Innovative management models changed hierarchies to empowerment in the field of deciding. Top-down planning was replaced by bottom-up planning that enables employees to express their ideas and comments on and participate in creating objectives and plans. Organisations discovered the importance of intrinsic motivation. Empowerment in decisions resulted in control decentralisation.

These days, organisations know the importance of knowledge and knowledge sharing for their businesses and try to support it with a knowledge-friendly environment. Many organisations (intentionally or intuitively) create new innovative management models that, as Alder (2015, p.446) notes, "support community work within and beyond firm". In this paper, we provide examples of companies with alternative management models and discuss how they support the work of knowledge communities in these organisations.

3. Objective and Methodology

This paper discusses how three organisations with innovative management models support the creation and work of knowledge communities.

The data used in this paper are secondary data from the literature. The literature on knowledge communities and innovative management models was collected by WOS search. We searched the following keywords: "knowledge community", "knowing community", and "management model". 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. Our previous research on these topics collected literature on common identity and common bond theories.

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. The 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 company's name, the company's name with the word management model and the company's name with the word case. This search provided us with research papers on companies. The third step was the Google search which allowed us to collect data from professional journals and blogs.

4. Findings

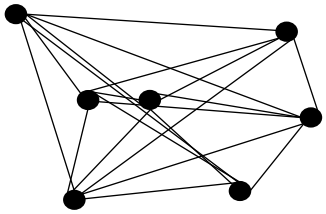
In this part of the paper, we would like to provide examples of how organisations with innovative management models support the creation and work of knowledge communities. We introduce three management models; up till now, a fully functional model of W. L. Gore & Associates, the Semco model that worked under the company owner R. Semler (he sold the company, and there is no information about the management model now) and the Spotify model that, even though well prepared, failed to work.

4.1 W. L. Gore & Associates

W. L. Gore & Associates (Gore) was founded in 1958. The founders, Bill and Vieve Gore, influenced by D. McGregor's theory Y, created the company with a fundamental belief in the individual, the collaboration of small teams, a long-term view and guiding principles of freedom, fairness, commitment, and so call waterline (rule to discuss with colleagues whatever may be dangerous for the company) (Gore, 2023).

Knowledge communities are supported by organisational structure, a limited number of teams and employees in plants, teams built from different professions, cooperation of people from different teams, and the hiring system.

Gore's "lattice" organisational structure builds on the principle of an informal network of relationships and connects every individual to every other. Therefore, as Hamel (2010, A lattice, with self-managed teams) writes: "At Gore, there would be no layers of management, information would flow freely in all directions, and personal communications would be the norm. And individuals and self-managed teams would go directly to anyone in the organization to get what they needed to be successful".



(Source: Author)

Figure 1: Lattice Organisational Structure

"The Gore Company limits the size of teams to facilitate direct communication. In addition, each Gore Company site contains only a small number of teams to promote interaction between associates and the pursuit of common goals. Also, in some locations, production occurs in multiple small plants clustered together rather than in one large factory. The teams may, in those cases, pursue their day-to-day work within their mini-plant but may also collaborate occasionally with associates or the teams in another nearby mini-plant if this makes sense in connection with, for example, a development project. Such clustering thus encourages interaction among unrelated teams" (Grønning, 2016, Challenges That the Gore Company has Experienced). Each plant has different professions (engineers, chemists, salespeople, etc.) to support cross-functional knowledge sharing and cooperation. Plants are not allowed to grow over 200 people so that people could know each other and decide together. Teams from different plants meet regularly to ensure employees know each other and cooperate.

Job descriptions are general, and employees negotiate their roles and responsibilities with their teams. Once negotiations are finished, the result becomes an unbreakable commitment, and the individual is accountable to his team. The negotiation process can be time-consuming, but it helps to bring together different talents, perspectives, and knowledge. People work in different teams, and teams also always cooperate, which may look chaotic from the outside. Employees get mentoring and support; new employees get a sponsor who helps them to understand the Gore management model, its rules and how it works.

Compensation is based on the evaluation of co-workers. Employees can use 10% of their working hours for their personal projects. They are encouraged to implement the idea if they persuade their colleagues to join them and create a team for implementation. This rule supports knowledge sharing and creativity.

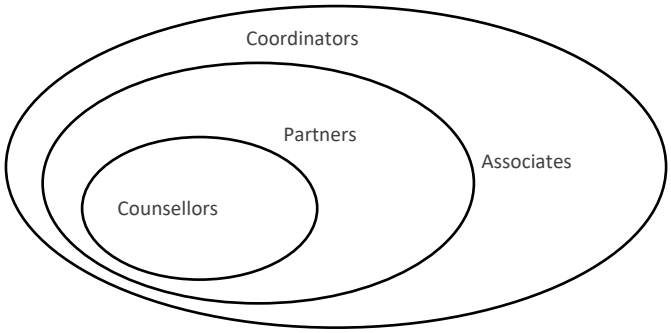
Gore is cautious about new employees. The hiring process is very long and challenging to ensure that only people who match and can sustain the specific Gore management model are hired. Applicants are interviewed and observed by members of involved teams who decide whether to employ the person.

4.2 Semco

Semco, a Brazilian industrial equipment manufacturer, was founded in 1953 as a traditional company. Since 1980 its management model was transformed by Richard Semler, the son of the founder, to a self-managed model based on employee participation in planning, decision-making and implementation. Semco adopted the management model first used by groups responsible for technical innovations, which turned out to be knowledge-work supportive (Semler, 1998).

The organisational structure, the limited size of units, open meetings, open communication and the hiring process, supported knowledge communities.

Three circles created the structure of the company; a circle of counsellors and partners, coordinators and associates. "Counsellors are like vice presidents and co-ordinate the general policies and strategies; partners run the business units; coordinators comprise the first level of management, such as marketing, sales, and production supervisors or engineering and assembly-area foremen; associates are the workers" (Petersson and Spängs, 2006, p. 34).



(Petersson and Spängs, 2006, p. 58)

Figure 2: Semco Circles

The company structure was replicated to individual business units organised in fully autonomous small units (max 150 so they could know each other). Units developed on different criteria (product, market, etc.), but each unit had full accountability for their business, including finances and communication with suppliers and customers. Each unit had a committee (5-10 workers, engineers, executives, and support clerks) that discussed its production issues. About two-thirds of employees worked in such units. (Semler, 1998). There was voting in case of important decisions, and all employees were empowered to vote. Once a month, there was a meeting focused on new ideas.

Managers became facilitators whose role was to support employees. All meetings in Semco were open to all employees, and whoever was present could vote. The management model was endorsed by the hiring process. Employees decided about new hires and could bid for new positions every half a year. Applications were evaluated by managers and the company as a whole (Semler, 1998).

4.3 Spotify

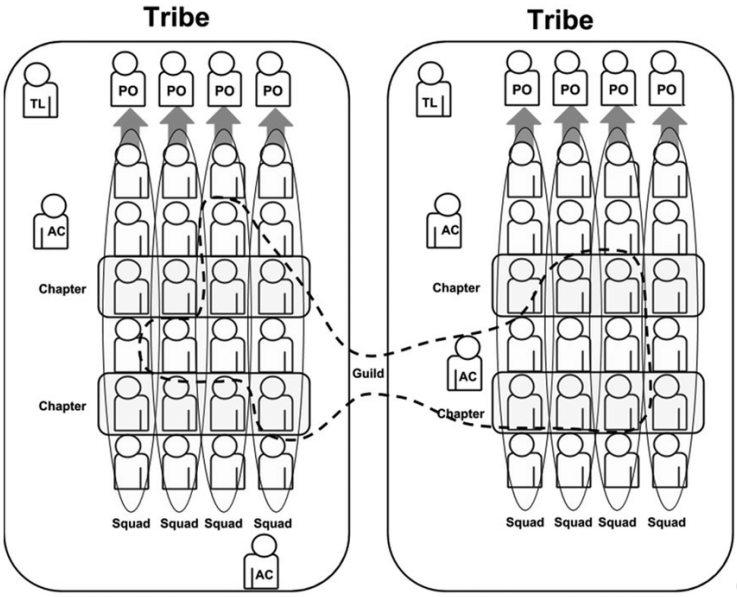
Spotify developed and tried implementing a sophisticated matrix-type management model to support knowledge communities in horizontal and vertical dimensions. Even though the model never worked in the company (Michou, 2020), it was an interesting attempt.

The Spotify management model comprises squads, tribes, chapters, guilds, and trios. The vertical level is built of stable teams of squads and trios where people with different skills collaborate. Due to extensive collaboration and stress on face-to-face communication, the team have the potential to transform into a knowledge community. Horizontal level, chapters and guilds were intended to become and work as knowledge communities.

Squads are cross-functional, autonomous, self-managing teams of experts (typically 6-12 individuals) focusing on one feature area. They are the primary value creators understood and treated as mini-startups (Knitberg and Ivarsson, 2012). "Each squad has a unique mission that guides the work they do, an agile coach for support, and a product owner for guidance" (Cruth, n.d., Squad). Product owners prioritise the work in the squad and collaborate with other product owners on coordination among their squads. They are not responsible for how the work is done. Agile coaches help to improve how squads work. Squads are encouraged to spend about 10% of their work time on their ideas and knowledge sharing. Squads are supposed to cooperate with squads in their tribe but not with squads from a different tribes.

Tribes are groups of squads that work in a similar area. Tribes consist of 40-100 people. They are located in one place and have a tribe leader. Squads and tribes meet regularly and informally when they need to. Chapters are groups of experts in specific areas and help to keep engineering standards in place across a discipline. Chapters are led by a senior technology leader, who may also be the manager for the team

members in that chapter. Guilds are communities of interest. Members are from different squads but meet to share knowledge, tools, and practices. They have a guild coordinator (Knitberg and Ivarsson, 2012; Cruth, n.d.). The trio combines a tribe lead, a product lead, and a design lead. Each tribe has a trio to ensure continuous alignment between these three perspectives when working on feature areas. Alliances are a combination of tribe trios (typically three or more) that work together to help their tribes collaborate on a bigger goal than anyone's tribe (Cruth, n.d.).



(Bäcklander, 2019, p. 45)

Figure 3: Spotify Structure

The model is supported by stress on face-to-face communication and a long and careful hiring process.

The Spotify knowledge work supporting model was never fully implemented in the company. It turned out to be very complicated, and required extensive communication among employees, shared responsibilities and cross-team collaboration (Michou, 2020). It was implemented quickly in the period of extensive company growth, which probably caused problems with implementation.

4.4 Developing Knowledge Communities via Common Bonds and Common Identity

This chapter summarises how innovative management models of three organisations discussed in this paper support creation and work of knowledge communities via common bonds and common identity.

Table 1: Developing Knowledge Communities via Common Bonds and Common Identity

Company	Gore	Semco	Spotify
Common identity			
Social categorisation (group shared identity).	Employees are called associates and are company owners through the associate stock plan.	Vote of all employees on important decisions.	Based on squads perceived as startups. Squad mission.
Interdependence (joined tasks).	Associates are encouraged to cooperate with other associates on different projects and ask for help.	Possible to participate and decide in any meeting.	In tribes. Chapters. Guilds.
Intergroup comparisons.	Comparison to other companies – a feeling of exclusivity.	Comparison to other companies – a sense of exclusivity.	Comparison to other squads/tribes. A feeling of exclusivity.
Common bonds			

Company	Gore	Semco	Spotify
Common identity			
Social interaction with others.	Supports frequent interactions.	Supports frequent interactions.	Supports frequent interactions.
Personal knowledge of them.	Factories max 200 people.	Units max to 150 people.	Tribes max 100 people.
Interpersonal attraction toward them, often through similarity.	The careful and demanding hiring system.	Careful and challenging hiring system (including reallocation to different work).	The careful and challenging hiring system.

5. Discussion

"If we can agree that the economic problem of society is mainly one of rapid adaptation to changes in the particular circumstances of time and place, it would seem to follow that the ultimate decisions must be left to the people who are familiar with these circumstances, who know directly of the relevant changes and of the resources immediately available to meet them. We cannot expect that this problem will be solved by first communicating all this knowledge to a central board which after integrating all knowledge, issues its orders. We must solve it by some form of decentralisation. But this answers only part of our problem. We need decentralisation because only thus can we ensure that the knowledge or the particular circumstances of time and place will be promptly used" (von Hayek, 1945, p. 524). This over seventy years old quote supports the fact that organisations are searching for ways how to intensify their knowledge, its utilisation, creation and sharing because "knowledge is not the inalienable product of each individual's own reasoning. It is essentially transmissible, capable of being made a common possession" (Welbourne, 1981, p. 305). "Research has shown that a firm's creativity and innovation depend heavily on its knowing communities, which reach beyond formal RandD activities or individual employees' initiatives" (Harvey et al., 2015, p. 46).

Organisations discussed in this paper understand that "A firm is seen as the repository of knowledge and the physical locus of its creation and deployment because it provides the social, political, and economic context under which knowledge is constructed" space (Lee and Cole, 2003, p. 634). Therefore they introduced innovative management models where "the lateral-flexible organizational form relies on peer-to-peer collaboration (as opposed to a vertical hierarchy) in achieving organizational objectives" (Boland and Tenkasi, 1995, p. 350). Their management models support "face-to-face interactions among knowledge developers to facilitate trust building over a long period of association and through sharing a common space" (Lee and Cole, 2003, p. 634).

Management models of organisations presented in this paper prove the statement that "Many of new management models support community work within and beyond firm" (Adler, 2015, p. 446) and that "knowledge-intensive firms are composed of multiple communities with specialized expertise, and are often characterized by lateral rather than hierarchical organizational forms" (Boland and Tenkasi, 1995, p. 350).

6. In Conclusion

The objective of this paper was to show the example of three companies and how they adapted their management models to support the development and work of knowledge communities. W. L. Gore & Associates created the management model that proved its viability through decades. The Semco model successfully helped the company in years when R. Semler owned it. Spotify model, though only partially implemented in Spotify, offers an interesting option for developing knowledge communities in organisation and supporting their interaction.

Companies discussed in this paper are not the only companies that adopted specific management models to support knowledge communities; we can name Google, Facebook, Morning Star, Buurtzorg, and Favi, among many others. The number of such companies will be growing because of the pressure of the economic environment on knowledge sharing. Therefore it will be necessary to research these organisations, their management models and how they support knowledge communities.

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The Transition of Higher Education for Continuous Lifelong Learning: Expert Views on the Need for a new Infrastructure

Peter Mozelius[1], Martha Cleveland-Innes[2,3], Marcia Håkansson Lindqvist[3] and Jimmy Jaldemark[3]

[1]Mid Sweden University, Östersund, Sweden
[2]Athabasca University, Canada
[3]Mid Sweden University, Sundsvall, Sweden

Peter.Mozelius@miun.se
martic@athabascau.ca
Marcia.HakanssonLindqvist@miun.se
jimmy.jaldemark@miun.se

Abstract: In the contemporary need for continuous upskilling and reskilling, higher education has an important role to play. While the traditional university programmes are designed for students in their early twenties our knowledge society has a demand for lifelong learning in a wider age span. This paper is a part of a Delphi study on the ongoing transformation of higher education for lifelong learning. A qualitative Delphi study has been carried out in the four steps of 1) A literature study to explore the chosen topic, with the selected publications sent out to an expert panel, 2) A survey with questions to the experts based on the findings in the literature study, 3) Email interviews to dig deeper into the answers from the survey, and finally 4) Focus group interviews. The aim of the paper is to analyse, present and discuss the international expert panels' views on the infrastructural needs in the transformation of higher education. Data gathered from the three first steps, with a focus on the email interviews, have been analysed according to the Grounded Theory concepts of open, axial coding and confirmatory coding. The categories from the Open coding analysis were later, in the axial coding, grouped around the central axis of 'Higher education transformation for lifelong learning'. The confirmatory coding found the common denominator of 'Infrastructure', and its interrelationships with the attributes of 'Multimodal delivery', 'Pedagogical change', 'Quality and organisation', 'Equity, diversity and inclusion', 'Digital literacy', 'Accessibility', and 'Financial aspects'. Findings align to the Anna Karenina principle in the sense that a happy and healthy infrastructure for continuous lifelong learning in higher education, depends on all the attributes listed above. This leads to the Tolstoyan conclusion that every variation of failing attributes would result in its own state of unhappiness.

Keywords: Higher education reform, Lifelong learning, Technology enhanced learning, Inclusive education, Delphi study

1. Introduction

Lifelong learning and its place in higher education has been frequently debated in the 21st century. In the new knowledge society today, most countries face a high demand for retraining and reskilling. This requires a continuous professional development where the traditional university programmes are redesigned to support a continuous lifelong learning. This is a transition that higher education has to address (Lang, 2023), a reform that also must ensure inclusion and support equitable quality education (Atchoarena, 2021). The study presented in this paper is part of a larger Delphi study on the ongoing transformation of higher education for continuous lifelong learning. The aim of the study is to analyse, present and discuss the views on the infrastructural needs in the transformation of higher education, based on structured interviews with the Delphi expert panel.

The complete Delphi study was carried out with the four steps of 1) A literature study to explore the chosen topic, with the selected publications sent out to an expert panel, 2) A survey with questions to the experts based on the findings in the literature study, 3) Email interviews to dig deeper into the answers from the survey, and finally 4) Focus group interviews, extended with a pre- and a post step. Data from the three first steps of this Delphi study, and with a strong focus on the email interviews in Step 3, have been analysed according to the Grounded Theory concepts of Open, Axial coding and Confirmatory coding. The results from the Open coding were used as an input to the Axial coding and the results from the Axial coding have been refined in the Confirmatory coding phase.

2. The Transition of Higher Education for Continuous Lifelong Learning

The transition of higher education for lifelong learning has been in focus during several decades. This research field was initiated long before the Covid-19 pandemic outbreak (Schuetze & Slowey, 2013). However, the pandemic has acted as a catalyst for the transformation of lifelong learning and higher education, and highlighted the need for technology-enhanced lifelong learning (Davidović, 2020; Ivenicki, 2021; Mozelius, 2021). A development that involves the adjustment of lifelong learning structures within higher education in

regard to educational design and the model of content distribution. Reflected and well-designed changes in the structure of lifelong learning could provide beneficial outcomes. At the same time, there are critical aspects of the higher education transformation that are crucial to address for a successful lifelong learning in a digital era.

As the contemporary societies become increasingly dynamic, socio-economically complex, and globally connected, the need for technology-enhanced lifelong learning in virtual environments grows stronger (Nygren et al., 2019; Hansen et al., 2020). This is one of many challenges that higher education institutions must address. Jarvis (2014) defines lifelong learning as a process in which humans of any age, and with a broad range of needs and interests, together should acquire new knowledge and skills. To establish well-designed teaching institutions such as universities might be seen as one source of delivery, but are not the only one (Jarvis, 2014). In the growing field of lifelong learning, higher education institutions could take on two different roles. One role would be to ensure that graduates of formal, credit, and accredited programs are empowered with the skills required for a lifelong learner. At the same time higher education institutions can also offer continuous and adapted courses and programs designed for meeting the specific needs of prospective and lifelong learners. In both scenarios, higher education will play a main role, but together with other important actors.

3. Method and Materials

The Delphi method is a structured communication strategy to capture an expert panel's view of complex phenomena (Okoli & Pawlowski, 2004). This study was based on the adapted four-step Delphi method described in (Mozelius et al., 2023), as ' The Alberta approach'. A four-step approach that also involved a pre- and a post-step as listed in Table 1 below.

Table 1: The Steps in the Adapted Delphi Approach

Pre-step	**2020-2021**	**Literature review** **Invitation to experts**
Step 1	Dec, 2021	Online survey
Step 2	Jan, 2022	Reading assignment
Step 3	May, 2022	Structured email interviews
Step 4	June/July, 2022	Focus group interviews
Post-step	September, 2022	Validation of focus group summary Preliminary conceptual framework

4. Data Collection

This study was based upon the data from the answers to the email interviews in Step 3, in which eight selected experts on lifelong learning answered a questionnaire with open ended questions. Experts have been selected with the idea of a purposive expert sampling (Rai & Thapa, 2015), involving informants that all have a long experience of teaching in higher education. All experts have several research publications in the field of lifelong learning and lifelong education. Moreover, these experts have a wide geographical spread, and are representing five countries and three continents. A geographical spread that resulted in a variation of socio-cultural contexts. Before the email interviews the experts in the Delphi panel were given a reading assignment with the five texts in Table 2. The texts have been analysed in detail in an earlier literature study on lifelong learning and higher education (Håkansson Lindqvist et al., 2020).

Table 2: The Reading Assignment in Step 2

Publication and authors	Relevant topics for the Delphi study
Santos, L., Bago, J., Baptista, A. V., Ambrósio, S., Fonseca, H. M. and Quintas, H. 2016. Academic success of mature students in higher education: a Portuguese case study. *European journal for Research on the Education and Learning of Adults*, *7*(1), 57-73.	Presents European lifelong learning policy for economic development, personal development, social inclusiveness and democratic understanding
Kasworm, C. 2020. Adult Workers as Learners in the USA Higher Education Landscape. In *Inequality, innovation and reform in higher education* (pp. 221-235). Springer, Cham.	Discusses a rethinking of the mission of higher education with a specific focus on adult undergraduate students who more often are both workers and students
Boyadjieva, P., and Ilieva-Trichkova, P. 2018. Lifelong learning as an emancipation process: A capability approach. In *The Palgrave international handbook on adult and lifelong education and learning* (pp. 267-288). Palgrave Macmillan, London.	Presents a theoretical outline of the heuristic potential of the capability approach in conceptualising lifelong learning and the capacity of this approach to guide empirical studies on lifelong learning
Weil, M., and Eugster, B. 2019. Thinking outside the box. De-structuring continuing and higher education. *Disciplinary Struggles in Education*.	Promotes a stronger relationship between higher education research and continuing education training (CET). More collaborative engagement between higher education and CET is necessary to include the importance of an applied, practitioner research in professional fields
Jamaludin, R., McKAY, E., and Ledger, S. 2020. Are we ready for Education 4.0 within ASEAN higher education institutions? Thriving for knowledge, industry and humanity in a dynamic higher education ecosystem?. *Journal of Applied Research in Higher Education*.	Presents challenges that have been identified in higher education and the need for a new dynamic higher education ecosystem. The concept of Education 4.0.

5. Data Analysis

Interview answers have been analysed according to the Grounded theory method of data being 1) fractured and labelled, 2) conceptualised around a central category, and 3) integrated with a description of their interrelationship for further theory building (Moghaddam, 2006). In the first analysis phase, referred to as Open coding, data were broken down into units of meaning to label and conceptualise data as outlined by Khandkar (2009). The open coding was conducted with an investigator triangulation approach where three of the authors collaborated in a 'triangulating analysis' to find preliminary categories based on codes and subcodes that were identified in the interview answers. The next phase of Axial coding was guided by the idea of *"coding that treats a category as an axis around which the analyst delineates relationships and specifies the dimensions of the category"* (Bryant & Charmaz, 2007, p. 603). The first version of preliminary categories were built around the most frequent codes, but later some categories were merged and renamed.

In the Axial coding the preliminary categories from the Open coding were reassembled into more abstract conceptual categories around the central axis of 'Higher education transformation for lifelong learning'. Finally, the third phase that sometimes is referred to as Confirmatory coding (Cleveland-Innes and Campbell, 2012), and sometimes as the phase of Selective coding (Walker and Myrick, 2006). In this study the choice was to use the term Confirmatory coding, but with the same fundamental approach as when Vollstedt and Rezat (2019, p. 89), described Selective coding as "the process of choosing the core category and relating it with the other categories from axial coding". This third analysis phase should also involve a strive to answer the important questions "What seems to be going on here?" and "What is the research all about?" (Corbin and Strauss, 2008; Teppo, 2015; Vollstedt & Rezat, 2019).

6. Findings and Discussions

With the Grounder theory idea of an iteratively refined analysis data, have been reread and discussed among the authors in the phases of Open coding, Axial coding and Confirmatory coding. The overall aim was according to the main idea in the Gioia method to begin the development of "a theory that explains, at a broad conceptual level, a process, an action, or interaction about a substantive topic" (Magnani & Gioia, 2023).

6.1 Results from the Open Coding

In the Open coding data were broken down units of meaning or subcodes. Out from the subcodes or data extract, codes and preliminary categories were created in three different analyses conducted separately by three of the Delphi study researchers. Later, the results from the different analyses were discussed in research team meetings where the preliminary categories were split, merged and renamed. An example of how subcodes and codes aggregated the category of 'Pedagogical change' is illustrated in Figure 1 here below.

Pedagogical change Codes: ***Pedagogy - Instructional design – Interaction - Social presence – Learner centred design***
Subcodes / Data extracts: Improved learning design based on affordances of digital technology/ digital interaction instead of converting f2f modes into digital pedagogy. have transformed their pedagogy to make it more focused on students' learning, by using in their course synchronous and asynchronous activities. They also were able to provide their students with the advantages described in the literature on blended and online courses: flexibility, accessibility, complementarity between synchronous and asynchronous activities using pedagogical approaches such as problem-based or project-based learning by integrating technologies and in particular Internet research. However, in some developing countries, these resources are weaker or even non-existent problem-based or project-based learning, emphasize the acquisition of skills and

Figure 1: A Preliminary Category Aggregated by Codes with Some Examples of Subcodes/Data Extracts

The final categories in the Open coding phase were aggregated into 1*) ' Digital literacy'* with the subcategories (or codes) of 'Rich media tools', 'Learner digital literacy ' and ' Teacher digital literacy¸ 2) *'Multi-modal learning delivery'* with the subcategories of 'Content development', 'Instructional design', and 'Rich media tools, 3) *'Infrastructure'* with the subcategories 'Blended learning', 'Policies', 'MOOCs', 'Instructional design', 'Open Source', 'Open learning' and 'Internationalisation', 4) *'Quality considerations'* with the subcategories 'Aim', 'Outcomes', 'Credits', 'Certificates', and 'Quality assessment', 5) *'Pedagogical change'* with the subcategories 'Pedagogy - Instructional design – Interaction - Social presence – Learner centred design as in Figure 1 above, 6) *'Continuous lifelong learning'* with the subcategories 'Lifelong learning', 'Work-integrated learning', 'Lifelong learning' 'Collaboration with society', 'Social aspects', and 'Employability', 7) *'Accessibility'* with the subcategories 'Anytime-Anywhere', 'Older adults', 'Inclusion policies', 'Open Educational Resources', 8) *'Equity, diversity, inclusion (EDI)'* with the subcategories 'Inclusion', 'Open Education', 'The Mathew Effect', 'Older adults', 'Women', 'Disaffected youth' and 'Diversity', and finally 9) Miscellaneous.

All categories and subcategories had a relation to the central theme for the Delphi study, 'The Transition of Higher Education for Continuous Lifelong Learning'. However, their focus and their interrelationship needed to be further analysed in the Axial coding phase.

6.2 Results from the Axial Coding

In the Axial coding the Open coding category 'Continuous lifelong learning' was merged with parts of the category 'Miscellaneous', and extended to the new axial category. This new central category for the analysis was 'Higher education transformation for lifelong learning'. A central axis connecting the categories of, 'Multimodal delivery', 'Pedagogical change', 'Financial aspects', and 'Quality and organisation', 'Infrastructure', 'Digital literacy', 'Accessibility', and 'Equity, diversity and inclusion (EDI)' as depicted in Figure 2.

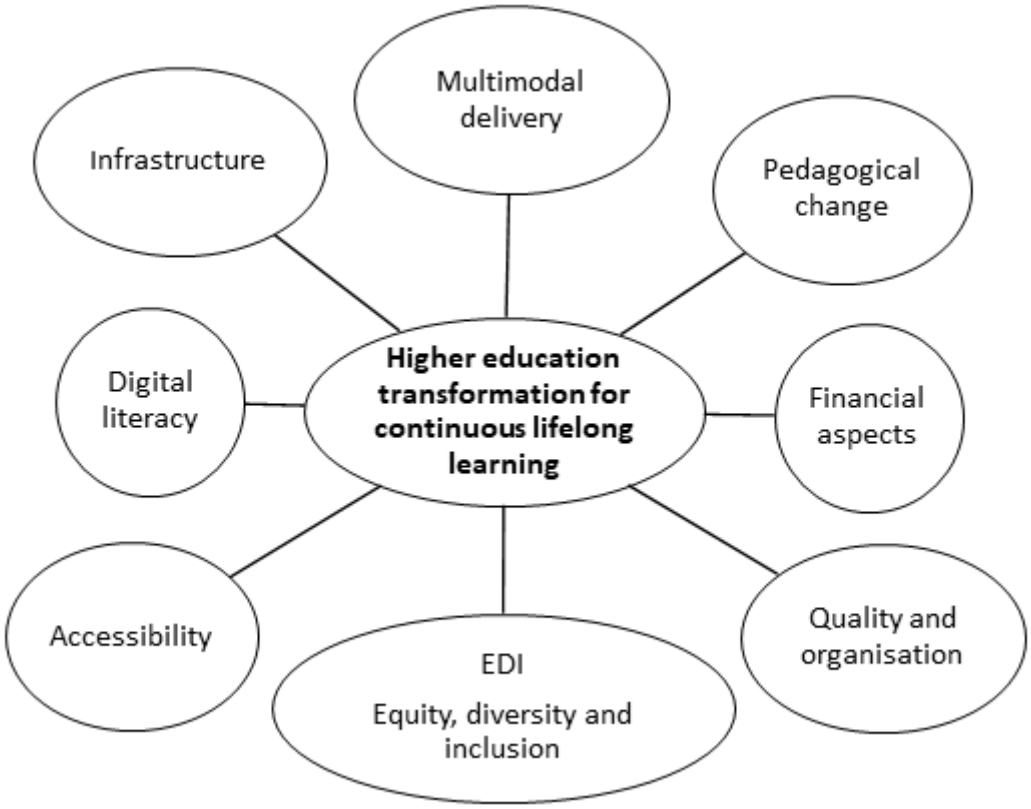


Figure 2: Critical Aspects of 'Higher Education Transformation for Lifelong Learning' and its Dependencies

6.3 Higher Education Transformation for Lifelong Learning

The found central category, that the axial coding focused on was Higher education transformation for lifelong learning. A new category that is a merge of the earlier category of 'Continuous lifelong learning' and its subcategory of 'Transformation of higher education'. Several experts brought up the pandemic as a catalyst for this transition, and as expressed in an interview answer *"I think we have learned a number of important lessons during the pandemic, some of which provide insights about future drivers for change in HE"*. Another transition driver mentioned by some experts were the new demands in the contemporary knowledge society and the labour market. There were comments on the currently huge needs for reskilling and upskilling. One of the experts highlighted the importance of a more demand driven lifelong learning, and to *"increase research-led education to focus on innovation, increase engagement, and focus on capability"*. Furthermore, one expert brought up the ongoing climate change as a driver *that "will continue to be a backdrop for many initiatives, policy shifts, etc"*. An essential part of the transition is that lifelong learning in higher education has to use more of technology and online learning in the future. However, as pointed out by an expert:

> *"I don't think it's wise to say that technology is itself a driver. Better to say that improvements in the capabilities of affordable digital devices + enhancements to networking infrastructures are entangled with changing habits and expectations"*

The implementation of educational technology is an ongoing process, but what might be more important, and mentioned by the experts is the effort to enrich the traditional higher education with other experiences such as work-based experiences, and work integrated education. Another trend that was brought up was the request for shorter courses, smaller modules or so-called micro credentials. There were also comments on MOOCs and non-credit offerings, and that these already are pushing the boundaries between academy and industry, with

the aim of employability and 'job readiness'. An advice from an expert was to "*Be clear about the added value of education in the context and meaning of lifelong learning. Re-define what educational institutions are in the context of emerging corporate training and industry academies"*. Another given advice was *about "favoring the integration of practice into training, such as, internships in companies or in the industry, projects carried out in partnership with industry and joint supervision between university faculties and professionals"*, with the idea of a *"focus on both the development of the canonical knowledge required, for instance a set of occupational capacities, but also some variations of how that knowledge will be applied, for instance in a particular workplace setting."*

Moreover, there was several remarks on the importance of opening up the university to a hybridity where the professional development and lifelong learning are built around the evolving needs in companies and societal organisations. A constantly evolving field mentioned in the interview answers is healthcare, with a need for continuous lifelong learning, involving the fact that *"healthcare workers must keep up to date with this new knowledge, and must quickly integrate it into their practices''*. The expert panel recommendation was to build courses around *"These kinds of activities that individuals face every day in their working life, and having the capacities to respond to them both those that are routine and those that are none routine"*. Panel experts point out many challenges in the transition of lifelong learning, but there is also answers with positive expectations and of hope that *"the deeper structures and values of lifelong learning as well as the long history of how to do technology-enhanced learning in ways that foster human flourishing, learning fulfilment and worth-while fusions of academic and professional development*".

To foster this human flourishing the expert recommendation was to involve both the aspect of lifelong education for improved employability, and lifelong learning for personal development. This should be "thought about in ways that encompass the whole life course", comprising the idea of enriching participants daily life and to empower participants. These two aspects should be combined, and as expressed by one of the experts: *"on the one hand, functional lifelong learning in the form of upskilling with a focus on socio-economic value, and, on the other hand, personal lifelong learning in the form of 'life-world becoming'"*. Finally, experts raised the idea of a human centred lifelong learning, and: *"putting human flourishing before efficient or smart tech set-ups, worth-while learning before technological upskilling of the workforce the deeper purpose of lifelong learning before the construction of massive technology-enhanced lifelong learning courses*".

To outline a continuous lifelong learning that is not only about professional development and employability is also the recommendation by Boyadjieva. and Ilieva-Trichkova (2018), a publication that was part of the earlier mentioned reading assignment.

6.4 Results from the Confirmatory Coding

In the beginning of this phase the aspects in Figure 2 were discussed among the authors in online meetings. An emerging idea was that all the categories around 'Higher education transformation for lifelong learning' could be classified as 'Infrastructure'. This idea was later confirmed in the coding, and that 'Infrastructure' was one of the largest and dominating categories early in the Open coding. In the Axial coding 'Infrastructure' was aggregated and presented as below.

6.5 Infrastructure

The transformation of higher education for lifelong learning seems to be clearly dependent on the transformation of the overall infrastructure. According to one of the panel experts this should be developed as an "open learning environment where new formats, forms and formations emerge". Another expert's opinion was to *"Hybridizing learning experiences and interactions through opening up learning environments for the public"*, with the lifelong learners *"participating in courses with people in different roles, contexts and localities or having institutions that are open to all and offer valuable knowledge or products for the public"*. An ongoing transition at several universities in many regions of the world. However, as one of the experts pointed out, this could be met with *"the idiotic but often repeated claims that university education hasn't changed since the middle-ages"*. Attitudes are different in different parts of the world, and many politicians and policy makers in other continents could have the diametral opinion to *"In Australia, we had a prime minister asserting that only face-to-face classes really 'count' as education; 'screen time' is wasted time"*. There are certainly some identified advantages with technology enhanced learning, and an expert highlighted the global aspect of *"Educational provision for international students interacts in an interesting way with use of online/blended learning"*.

Other possibilities with a user-friendly technology enhanced redesign of the infrastructure could be what one of the experts expressed as the "*development of a computed curriculum and further automation of the delivery of*

education", and that this could *"likely further increase in the area of educational consumption and supply driven individualised learning pathways"*. In all transition, the aim must be to combine de desired individualisation and accessibility with new forms of collaborative learning based on, what was brought up in an answer as *"technological systems and tools to technology-enhanced learning communities"*. The main objective ought to be what an expert expressed as to *"foster technology-enhanced places for lifelong learning that 'vibrates' and make learners flourish"*. Several experts mention that ongoing technology enhancement, and the general digitalisation of society definitely will change the way higher education is outlined and practised. One of the interview answers brings up the OECD vision from 2020 for education systems in the future. An expert vision involves four alternative scenarios: schooling extended, education outsourced, schools as learning hubs, and learn-as-you-go. Each of these sketched scenarios would require infrastructural changes, where the expert sees that:

> *"The first two scenarios would require less transformation of the school system, while the latter two would require greater change in how we design and deliver education — and unless institutions are able to adapt agilely to this change, other providers will step in to fill the gap"*

'Infrastructure' is depending on 'Quality and organisation' with the two subclasses of 'Pedagogical change' and 'Multimodal delivery'. A hasty and careless transition could result in lower quality and an organisation that would not benefit either learners or teachers. Furthermore, there is a dependency on 'EDI – equity, diversity, and inclusion' and its two subclasses 'Accessibility' and 'Digital literacy'. Finally, as depicted in Figure 3, all infrastructural categories are depending on 'Financial aspects'.

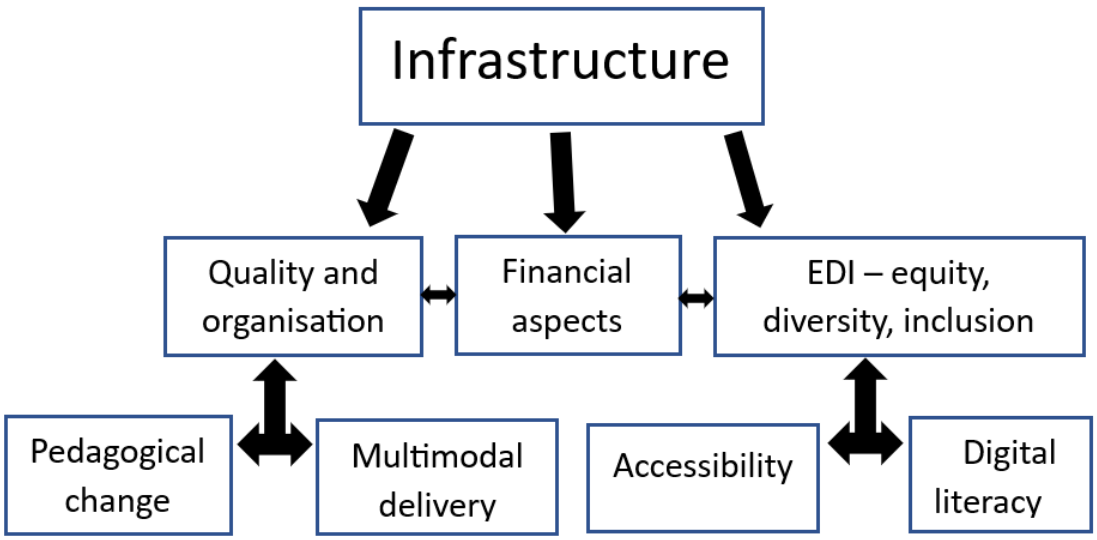


Figure 3: Important Aspects of a New Infrastructure for Continuous Lifelong Learning

7. Conclusion

To answer the questions posed in the end of the method chapter "What seems to be going on here?" and "What is the research all about?". The transition of higher education for continuous lifelong learning has started and is an ongoing process, and the umbrella phenomenon that needs attention is a transformed infrastructure adapted to the need for a continuous lifelong learning for all. A quality transformation will not be for free, but probably with a decent return on investment in the longer perspective. The categories and their interdependencies in the presented conceptual model align to the Anna Karenina principle: "success in complex undertakings does not depend on a single factor but requires avoiding many separate causes of failure" (McClay and Balciunas, 2005, p. 197). A happy and healthy continuous lifelong learning in higher education, depends on a successful transformation of all the involved aspects. All in all, this leads to the Tolstoyan conclusion that every variation of failing attributes in this relationship would result in its own state of unhappiness, and in this case dysfunctional lifelong learning.

8. Future work

With the Grounded theory idea of developing hypotheses and theory, the results from this study should be further elaborated in Step 4 and the Post-step of this Delphi study (see Table 1).

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Drivers of Environmental Responsibility in Family Firms: The Role of an Environmental Manager

Kateřina Myslivcová, Nikola Hausmannova and Lucie Zapletalová
University of Pardubice, Faculty of Economics and Administration, Czech Republic

katerina.myslivcova@upce.cz (Corresponding author)
nikola.haumannova@student.upce.cz
lucie.zapletalova@upce.cz

Abstract: Despite the significant role of family firms in economies throughout the world, their academic research is relatively young. Furthermore, previous empirical studies in the field have focused on general topics, rather than examining how family firms are similar or different from other types of organisations in the decision-making process. Little is known about what drives family firms to implement environmental concerns in their strategies. Based on the above-mentioned findings, the research aims to analyse what the main drivers of environmental responsibility are in family firms in Central and Eastern Europe (CEE) countries. The empirical study uses logistic regression that examines how selected important factors influence the adoption of strategic objectives that mention environmental or climate change issues. The study uses a data set from the World Bank Enterprise Survey 2019 and examines the attitudes of family businesses in four CEE countries (Czech Republic, Slovak Republic, Poland, and Estonia). The findings revealed a significant influence of the environmental manager, the customer's environmental requirements, and the energy performance standards on adopting strategic environmental objectives in family companies. We also consider the environmental manager as a key factor in terms of knowledge transfer and management of environmental responsibility in the firm. The results of this research provide a new perspective on the environmental responsibility of family businesses and explain which drivers should be considered when deciding to establish strategic objectives related to environmental issues. Managers should take these findings into account when deciding which tools to use to increase pro-environmental behaviour and implement environmental strategies.

Keywords: Environmental strategy, Family firms, Knowledge management, Drivers, Environmental manager

1. Introduction

The concept of sustainable development has been at the forefront of global discourse since 1987, when the World Commission on Environment and Development published its report "Our Common Future" (Brundtland, 1987). In recent years, this push for sustainability has put pressure on businesses to behave in a responsible and sustainable manner, which is often at odds with shareholder objectives (Barnea and Rubin, 2010).

Previous studies have found that family businesses with diverse values are more likely to innovate and adopt sustainable practices than businesses with homogeneous values (Giachetti and Marchi, 2015). Additionally, research has shown that family businesses are more concerned with environmental responsibility issues than other types of firms (Ludeke-Freund and Dembek, 2017). Ultimately, family firms have the potential to contribute to the Sustainable Development Goals (SDGs) given their commitment to long-term sustainability and their focus on stakeholder relations (Cheng and Krumwiede, 2012). Although research in this area is still lacking, evidence suggests that family firms can be at the forefront of sustainable development efforts.

The existing literature on the factors that lead family businesses to introduce environmental aspects into their strategies has been significantly influenced by developments in Western countries (USA, Canada, Western European countries). A gap in existing research can be seen in the lack of published studies on family businesses in the transition economies of Central and Eastern Europe (CEE) countries (Duh, Tominc and Rebernik, 2009).

The contribution of this paper is the identification of factors that influence environmental responsibility and can serve for the successful implementation of environmental strategies in family firms in CEE countries. The empirical study is framed under the umbrella of knowledge management, since knowledge management has a long-term orientation, it fits well with sustainability and sustainable management (Chow and Chen, 2012).

This paper has been divided into the following parts: the second chapter provides theoretical background, chapter 3 presents the data and methodology, and chapter 4 shows the empirical results and describes the discussion of results. The last chapter considers conclusions and limitations.

2. Theoretical Background

2.1 Environmental Responsibility of Family Firms

Family businesses are an increasingly common form of entrepreneurship around the world. According to a survey conducted by PricewaterhouseCoopers (PwC), family businesses account for 85% of all businesses

worldwide and generate more than 70% of gross domestic product (GDP) (PwC, 2018). With the growing number of family businesses, it is important to research and address these issues so that family businesses can maintain their competitive advantages and survive in the marketplace.

One of the key advantages of family businesses is strong family ties and loyalty, which translates into long-term strategy and greater stability of the business (Hussain et al., 2017). Another advantage can be seen in flexibility and quick adaptation to market changes (Jaskiewicz et al., 2017). On the other hand, these family ties can lead to conflicts and unprofessional behaviour, especially when a new generation joins the leadership of the firm (Dawson et al., 2017; Berrone et al., 2012). It is important to ensure adequate preparation and training of potential successors so that they are able to take over the leadership of the firm without major problems (Miller and Le Breton-Miller, 2017).

Brundtland (1987) emphasizes the principles of sustainability and environmental protection in economic development. Shareholders prioritize profit maximization and increasing shareholder value, while corporations face pressure to be responsible and sustainable (Barnea and Rubin, 2010). Family firms may have higher levels of environmental responsibility than non-family businesses due to their long-term focus and nurturing of customer and community relationships (Cheng and Krumwiede, 2012). Many authors agree that family firms are more concerned with environmental responsibility issues than other types of firms (Ludeke-Freund and Dembek, 2017; Giachetti and Marchi, 2015). Craig and Dibrell (2015) observed that environmental sustainability and a positive attitude towards innovation positively affect firm performance.

However, the impact of family involvement on environmental responsibility can vary depending on cultural and institutional factors (De Massis et al., 2018). Bianchi et al. (2018) noted that family involvement in the role of CEO or chairman is significantly related to environmental responsibility. Family businesses can play a significant role in addressing environmental issues and promoting sustainable development, but research in this area is still lacking (Rondi and Tognoni, 2018). Díaz-Garcia and González-Márquez (2019) found that family influence, organisational culture, stakeholder pressure, and resource availability can affect innovation in sustainability of family firms. Patuelli et al. (2022) suggest that family companies have the potential to contribute to achieving SDGs, considering their commitment to long-term sustainability and their focus on stakeholder relationships.

2.2 Role of Different Stakeholders in the Implementation of Knowledge Management in Environmental Responsibility

It is known that strategic commitment and integration of sustainable aspects into the existing business system and corporate strategy is necessary to enhance the environmental benefits of a company's operations (Evangelista and Durst, 2015). Sandberg and Aman (2010) also argue that organisational learning is a key element for achieving competitive advantage based on environmental responsibility. Knowledge management can be seen as crucial to achieving sustainability goals (Gloet, 2006; Robinson et al., 2006) and to developing environmentally sustainable strategies (Evangelista and Durst, 2015).

The issue of environmental responsibility cannot be dealt with by just one body. This means that companies must seek to involve other stakeholders to increase the success of any environmental activities. As knowledge management should not only have an internal focus, companies should also consider how best to involve different stakeholders in the knowledge management approach to improve the effective use of existing and future knowledge (Evangelista and Durst, 2015). Given the interconnectivity of the economic, environmental, and social issues that form the pillars of sustainability, organisations must adapt to even greater involvement of different stakeholders (Van Kleef and Roome, 2007). Stakeholders can be viewed not only as internal or external, but also as primary and secondary (Sarkis et al., 2010). Primary stakeholders (shareholders and investors, employees, customers) are essential to the survival of the business (Helmig et al., 2016); secondary stakeholders (central government, local government, and pressure groups) have influence on the implementation of environmental responsibility through regulation and other sanctions to create and maintain a safe environment (D'Souza et al., 2022). Implementing environmentally sustainable practises can help organisations improve stakeholder relations (Singh and Mittal, 2019). Korsakienė and Raišienė (2022) state that the influence of stakeholder groups differs between firms, sectors, and countries, and future research could focus on understanding different stakeholders and their impact on environmental responsibility.

On the basis of the above-mentioned, a research question was determined: What are the main determinants of environmental responsibility in family businesses in CEE countries?

3. Data and Methodology

This study uses data from the World Bank Enterprise Survey (WBES) 2019, which provides firm-level cross-sectional data from a representative sample of companies in the private manufacturing and service sector. The survey covers a wide range of topics related to the business environment, including access to finance, environmental issues, corruption, infrastructure, competition, research and development, knowledge, performance measures, and others.

The research is based on a multi-industry sample of 1,176 family firms in the transforming economies of CEE, Czech Republic, Slovakia, Poland, and Estonia. These countries have gone through similar developments since the 1990s, and some studies suggest that family businesses are becoming the main driving force behind economies in former socialist, or transition, countries (Dana and Ramadani, 2015; Duh et al., 2009; Duh and Tominc 2005; Galetic 2002).

The family business field has traditionally employed several definitions of family firms (Miroshnychenko et al., 2022; Duh et al., 2009; Chua et al., 1999; De Massis et al., 2012), and there is no generally accepted definition of a family business in either developed economies or transition countries. For the purpose of our research, we rely on definitions (European Commission, 2009) that simultaneously capture family ownership and the presence of family members in firm management positions. Thus, we consider a family-owned firm to be one where more than 50% of the firm is owned by a single family, and at the same time more than 10% of key managerial positions are occupied by family members.

As the explained variables are dichotomous (binary; 1: yes, 0: no) for the estimated model, we used a binary logistic regression, that examines how selected important factors influence the adoption of strategic objectives that mention environmental or climate change issues.

For the dependent variable, a question was chosen from the Green Economy Module of the WBES, which determines whether the company had strategic objectives that mention environmental or climate change issues. Successful integration of environmental concerns into corporate strategy cannot be achieved without clear leadership, resource allocation and active support from top management (Fugate et al., 2012). The absence of strategic objectives for environmental and climate change issues and related strategies is likely to have a dual impact on the enterprise, i.e. externally and internally. It may lead to difficulties in terms of informing employees about the environmental stance of the business, as well as managing and structuring environmental work within and across the business (Evangelista and Durst, 2015).

The independent variables are divided into two groups, primary and secondary stakeholder pressure. Primary stakeholders include employees, customers, suppliers, and shareholders in the research, and secondary stakeholders mainly include government, local government, and pressure groups (D'Souza et al., 2022; Hillman and Keim, 2001; Maon et al., 2009).

Table 1: Description of Variables

Variable name	Notation	Variable Definition
Dependent variable	DV	
Strategic objectives for environmental and climate change issues.	Strat_obj	
Independent variable	IV	
Primary stakeholder pressure		
Environmental Manager	Env_manager	Existence of a manager responsible for environmental and climate change issues.
Meetings with the top manager	Engag	How often does the top manager meet with employees involved in production activities in a typical working week?
Female owner	Fem_own	There is a woman among the owners of the firm.
Female top manager	Fem_manager	There is a female top manager in the firm.
Market pressure	Mark_pres	A request from any of the customers for environmental certification or compliance with

Variable name	Notation	Variable Definition
		certain environmental standards as a condition for doing business with this business.
Secondary stakeholder pressure		
Energy standard	Ener_stand	The establishment was subject to an energy performance standard in its operations.
Energy tax	Ener_tax	This establishment was subject to an energy tax or levy.
Control variable	CV	
Country	Country	CZE – Czech Republic EST – Estonia POL – Poland SVK - Slovakia

4. Results and Discussion

The results in Table 2 show that it is possible to identify drivers that impact environmental responsibility in family businesses. The greatest influence is the existence of a manager responsible for environmental and climate change issues. His presence increases the chance of environmental responsibility 15 times. This corresponds to Greenwood et al., 2012 who says that environmental managers play an important role in an organisation's pursuit of environmental sustainability. Similarly, Daily and Huang (2001) state that environmental managers must provide adequate training to all employees in terms of reducing negative environmental impacts, since this requires active and knowledgeable participation from all employees at an organisation. In connection with this, Šperková and Skýpalová (2020) state that employees, especially the Y generation (born in the 1980-90s), have begun to require more employer activity in the field of corporate social responsibility. This result is also consistent with the findings of Jang et al. (2017) who report that environmental managers prioritise environmental issues when developing strategies and operational procedures and incorporate environmental stakeholder demands into corporate strategies.

Table 2: Results

Variable	Level	Coeff.	OR	P-value	Sign. Code
(Intercept)		-2.4401		< 2e-16	***
Env_manager	1	2.7085	15.006705	< 2e-16	***
Mark_pres	1	0.8194	2.269029	0.0009466	***
Ener_stand	1	0.7913	2.206328	0.012871	*
Fem_own	1	0.4360	1.546448	0.0185444	*
Country(ref:CZE)	EST	-0.4073	0.665446	0.190277	
	POL	-0.4609	0.630719	0.070936	
	SVK	0.8451	2.328161	0.000517	***

Signif. codes: '***' 0.001; '**' 0.01; '*' 0.05; '.' 0.1

Then, a request from any of the customers for environmental certification or compliance with certain environmental standards as a condition for doing business with this business increases the probability by about 2.27 times. This is confirmed by Johnstone and Labonne (2009), who state that customers, if they do not have enough information about suppliers, may choose to purchase goods from firms that have Environmental Management System certification. In the area of customer satisfaction measurement, companies do not focus only on past performance, but seek a comprehensive understanding of their customers' needs and attitudes (Striteska and Jelinkova, 2015). In the context of growing concerns about the quality of the environment, customers have started to put pressure on companies to address the environmental impact of their activities (e.g. Henriques and Sadorsky, 1996; Buysse and Verbeke, 2003; Horbach, 2008; Delmas and Montiel, 2009; Guoyou et al., 2013). As part of their research by Canadian companies, Henriques and Sadorsky (1996) confirmed

that the adoption of an environmental plan is positively influenced by customer pressure. Buysse and Verbeke (2003) and Guoyou et al. (2013) observed that pressures from customers motivate environmental proactivity. Khanna and Anton (2002) found that firms that are more exposed to consumer pressures to their environmental performance are more likely to adopt a comprehensive environmental management system. Researchers (Rueda-Manzanares et al., 2008; Carballo Penela and Castromán-Diz, 2015; del Mar Miras-Rodriguez, 2018) point out that general awareness and interest in the environment are growing among customers, who are increasingly taking environmental factors into account in their purchasing decisions. Although the authors of empirical studies do not always show identical results, most of them have agreed on the importance of customer pressure on environmental responsibility (Carballo-Penela and Castromán-Diz, 2015), which is in line with our results.

Similar results to the influence of customers are achieved by the influence of the energy performance standard, which increases the chance of environmental responsibility in family firms by 2.2 times. This result agrees with D'Souza et al. (2022), who report that governments are influential in implementing environmental responsibility using energy performance standards and other regulations to create and preserve a safe environment.

Similarly, the variable of the female owner also appeared to be significant, increasing the probability by more than 1.5 times. Similar results were obtained in empirical evidence that suggests (Nadeem et al., 2020) that women on boards are associated with better corporate social responsibility ratings (Bear et al., 2010; Nadeem et al., 2017; Post et al., 2011) and that female representation on corporate boards is considered a significant determinant of corporate policymaking (Levi et al., 2014; Mohan, 2014). Nadeem et al. (2020) also found that female representation on boards is positively associated with the creation of environmental values in family firms, but it has no impact on the creation of economic and social values.

Regarding our control variables, we show that the differences between the examined CEE countries are also significant. Our model shows that the countries that are the least likely to adopt strategic environmental and climate change goals are Estonia and Poland, which are basically the same. This is followed by the Czech Republic, where there is about 1.5 times more chance than Estonia (and Poland), which is not significant. In Slovakia, there is almost 3.5 times greater chance than Estonia (and Poland). In Slovakia, there is a significantly higher chance than in the Czech Republic, about 2.3 times.

Other variables (Female top manager, Meetings with the top manager, Energy tax) are no longer significant (at level α=0.05) in this model.

5. Conclusion

This paper reveals the relationships between the variables examined that may serve to successfully implement environmental strategies through knowledge transfer and provides new insights into environmental behaviour through the lens of family business. Using the logistic regression method, we identified the determinants that influence environmental responsibility in family firms in selected CEE countries. We found that the presence of a manager responsible for environmental issues increases the chance of environmental responsibility 15 times. We also found that customer demands for environmental compliance increase the likelihood by 2.27 times, and the influence of energy performance standards increases the chance of environmental responsibility in family firms by 2.2 times. The presence of a female owner still emerged as a statistically significant variable, increasing the odds by more than 1.5 times. The other variables examined do not have a statistically significant effect on the dependent variable.

The benefits of this research are that the results provide a new perspective on the environmental responsibility of family businesses and explain which factors should be considered when deciding to set strategic goals related to environmental issues. The findings of this study have several applications for family business owners, managers, and policy makers in other transition countries. Managers should take these findings into account when deciding what tools to use to increase pro-environmental behaviour and implement environmental strategies. The presence of an environmental manager has been found to increase the likelihood of adoption of environmental sustainability programmes. From this perspective, employee education and training plays a vital role in the creation and development of environmental knowledge both inside and outside of the company. Therefore, it is important for managers to focus on training and education programmes that anchor environmental sustainability thinking in the minds of employees. The expected benefits that knowledge management can bring to the field of environmental responsibility open up the potential for researchers from different disciplines.

This study has its own limitations as well, which in turn provide an opportunity for future research. First, our study is based on a sample of firms from selected CEE countries, whose historical development after 1990 is similar. A further study could be extended to other post-communist countries. Second, the study does not consider the effect of company size. Further research could focus on the determinants of environmental responsibility in small and medium-sized enterprises and large enterprises. Third, it would be interesting to carry out research to compare the behaviour of family and non-family firms in terms of environmental responsibility issues. To conclude, more input variables can be added, and a different analysis method can be used in the future.

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Knowledge Sharing and Lean Manufacturing in Companies: An Empirical Investigation

Justyna Maria Myszak
Department of Logistics, Institute of Management, University of Szczecin, Poland

justyna.myszak@usz.edu.pl

Abstract: Manufacturing companies seeking to be competitive in the market must, in particular, accomplish time saving through precisely planned production processes. One of the main routes to reaching higher production efficiency is Lean Manufacturing (LM) by way of the methods and tools that it brings. However, the key to successful implementation of LM is the employees' approach to knowledge sharing, an essential component for continuous improvement. This paper is an empirical study whose purpose is to answer the following question: Is knowledge sharing more widely adopted (and if so, how exactly) by companies who have implemented Lean Manufacturing, compared to those who have not? As a result of literature studies, six types of knowledge sharing were identified, related to the way knowledge is shared (formal and informal knowledge sharing), knowledge sharing strategies (codification and personalization strategies) and the scope of knowledge that the company focuses on in its core business (broad and deep knowledge). The relation between the use of LM and knowledge sharing types was examined based on a questionnaire survey conducted among 219 small, medium and large manufacturing enterprises operating in North-West Poland. The data analysis was performed using the ANOVA and post hoc tests. The results demonstrated a significant correlation between the companies' use of the Lean Manufacturing concept and certain types of knowledge sharing. In particular, it was observed that, compared to the other companies, the companies showing wider use of LM practiced formal ways of knowledge sharing, used the knowledge codification strategy, and were more focused on development and dissemination of broad rather than specialized knowledge. The results also demonstrated that the knowledge sharing approach adopted by the companies was largely determined by other approaches and management methods. It also means that the processes related to knowledge sharing are components of Lean Manufacturing solutions applied in practice.

Keywords: Knowledge sharing, Lean manufacturing, Production companies, Formal and informal knowledge sharing, Codification and personalization strategies, Broad and deep knowledge

1. Introduction to Lean Manufacturing (LM)

Manufacturing enterprises operating in a highly competitive market have noticed that offering high-quality products with higher performance and shorter delivery lead times than competitors while reducing operation costs may become a key to their success. However, such measures have forced companies to seek far more flexible processes and a larger variety of products, which in turn has generated various wastes in the manufacturing processes (Cortez et al, 2020). An effective solution to these problems seems to be the Lean Manufacturing concept (Nallusamy, 2021).

Lean Manufacturing is a methodology of production management, which consists in proving value that is expected by the customer. From the customer perspective, value (in LM) is understood as everything for which a customer is willing to pay (Rodríguez et al, 2012). This refers for example to a physical process which actually transforms a product or service (e.g. welding, assembly) or to an activity done according to the "first time right" concept (i.e. flawlessly). However, any other activities which directly do not add value to the offered product or service are considered by the customer to be wasteful. Therefore, to meet the customer's demanding expectations, manufacturing companies seek the highest possible production efficiency which is obtained via continuous optimization of the manufacturing process by reducing redundant activities. Hence, Lean Manufacturing focuses primarily on reducing 7 wastes (*muda* in Japanese) from all company processes, such as: overproduction, inventory, defects, waiting time, transportation, motion and excess processing (Ohno, 2008).

What is interesting, since only recently the literature on the subject has been enumerating one more waste: non-utilized human talent or potential. The reason for earlier disregard of this waste among the 7 cardinal *muda* can probably be attributed to the Japanese culture. As suggested by Nicholas, for the Japanese, or more precisely the Toyota Motor Company, for a long time, recognizing employees as its most valuable assets and encouraging them to learn, develop their skills, and to engage in process-improvement activities (Nicholas, 2018) is something natural.

It is therefore worthwhile to view Lean Manufacturing from a wider perspective. On the one hand, LM is a concept of an approach to business operations management focused on improving the processes and taking measures aimed at elimination of redundant activities. On the other hand, LM emphasizes the importance of knowledge and skills of the people employed in the organization. Hence, it may be concluded that LM shows a

somewhat more extensive approach to business management, which contains elements of other concepts, e.g. knowledge management. An ability to gather and apply appropriate resources of knowledge and information plays an invaluable role in manufacturing companies (Berawi, Woodhead 2005; Cortez et al, 2020), hence this issue is an important focus of this study.

2. Knowledge Sharing (KS) in Lean Manufacturing Contexts

Although there have been many independent studies on Lean Manufacturing and knowledge sharing in organizations, "studies that integrate lean thinking in dynamic knowledge research are still absent in the literature" (Tyagi et al, 2015). When analyzing the existing body of research related to knowledge management in Lean Manufacturing implementation, Zhang, Niu and Liu (2020) noticed that among 341 full-text academic articles from Science Citation Index Expanded, only 65 were empirical. Moreover, amongst them only nine articles were related to Knowledge Management. Furthermore, it is worth noting that the issue of knowledge in the Lean Manufacturing context was usually addressed in relation to the overall concept of Knowledge Management, and only in few cases in relation to the SECI model (e.g. Nordin et al, 2020, Tyagi et al, 2015, Lindlöf, Söderberg, Persson, 2013) authored by Nonaka and Takeuchi, which focuses on conversion of explicit knowledge into tacit knowledge (Nonaka, Takeuchi, 1995). Hence, a research gap was identified in the literature, as there are no research studies focused on selected processes of the knowledge management concept (i.e. the process approach) in the lean context, including i.a. the knowledge sharing process. Consequently, this paper is an attempt to bridge this gap.

Dombrowski et al (2012) claimed that "the development of a detailed reference model of knowledge flows is not possible so far, because Lean Production Systems implementation offers too many possible knowledge flows". Moreover, they added that in such a case it might be worthwhile just to identify adequate methods for single knowledge flows. Also Babaei Meybodi et al (2018) drew attention to the fact that "the majority of the lean production execution processes explain sequences of required works, but they fall short of taking knowledge blending into consideration". In view of the above, an interesting proposal of such a solution was presented in the study completed by Tyagi et al (2015) who indicate a specific list of lean tools/methods supporting the knowledge generated in SECI models. One of the findings of their analysis was that Scrum, PDCA, and the 5 Whys can fit and support knowledge creation and sharing mechanisms in every SECI model.

Vlachos et al (2019), in turn, found out in a single-case study analysis that knowledge sharing plays a key role when an organization wants to transform from the traditional to Lean Management. However, the authors stressed the need to depart from the more operational view of lean to a "softer" paradigm.

Also Zhang et al (2020) noticed that adoption of lean tools had a positive impact on knowledge acquisition, knowledge integration and knowledge application. The authors also noticed that knowledge is an indispensable factor in the application of lean tools. Due to the special importance of knowledge in Lean Manufacturing implementation, the following section deals with the definition of knowledge sharing and different approaches to it.

3. Knowledge Sharing in an Organization

In the literature on management, the term "knowledge sharing" is very often used interchangeably with "knowledge transfer". However, it should be noted that many researchers increasingly oppose to taking this approach and propose that these terms be distinguished from one another. For example, Cavaliere and Lombardi (2015) pointed out that "while knowledge transfer describes the identical or partial replication of knowledge from one place to another, knowledge sharing is more than transferring knowledge: it is about creating it through social interaction". Moreover, King (2006) underlined that knowledge may be shared in unintended ways (around a specific issue or otherwise), and, as knowledge sharing is a multi-directional process, usually there is no clear, a priori goal. A knowledge transfer, in turn, implies focus, a clear objective, and unidirectional communication of knowledge between individuals, groups, or organizations such that the recipient of knowledge has a cognitive understanding, has the ability to apply the knowledge, or applies the knowledge (King, 2006). Summing up: as opposed to a knowledge transfer, knowledge sharing focuses strictly on individuals (in particular on the knowledge sharer) and social interactions, and it concentrates on the mechanisms and practices of knowledge communication. It therefore entails the need to create appropriate conditions to entice employees to make decisions on communicating their personal knowledge, whereas in the case of a knowledge transfer more focus is laid on the knowledge recipient, i.e. whether the transferred knowledge has been effectively received. Therefore, in research on knowledge transfers it is important to pay attention to absorption capabilities and specificity of the recipient (Rudawska 2013).

4. Approaches to Knowledge Sharing

The literature on knowledge management comprises many research studies on various approaches to knowledge sharing in an organization. The studies most often show the approach using two independent, opposite types of knowledge sharing (Figure 1), characterized by specific features. Moreover, even though the scope is increasingly explored, it still has not been systematized.

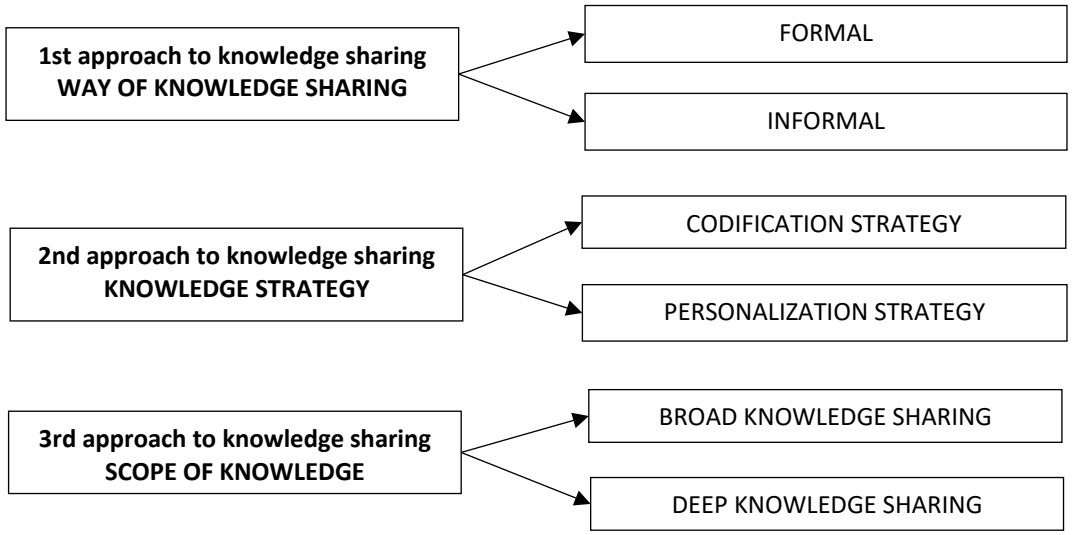


Figure 1: Approaches to Knowledge Sharing in Organizations

Each approach, including each type of knowledge sharing, has a different impact on employee behavior in the organization. In view of the above, the next section outlines various types of knowledge sharing.

4.1 Formal and Informal Approach to Knowledge Sharing

Formal and informal knowledge sharing refers to the situation and circumstances in which employees exchange knowledge among each other. A formal approach to knowledge sharing encompasses behaviors that are institutionalized by management by creating specific opportunities that enhance and enable knowledge exchange. These are practices (e.g. procedures, instructions, regular meetings, brainstorm sessions) and services (e.g. communication and resource sharing platforms), that have been designed and organized by the company in such a way that knowledge sharing or organizational learning occurs in a systematized way (Taminiau et al, 2009). Thus, these take the form of certain practices developed by the organization, which designate areas and channels of interaction as well as its frequency.

In turn, informal knowledge sharing encompasses all forms of knowledge sharing "by which individuals communicate on issues that are not directly laid down and governed by management" (Schwaer et al., 2012). These are resources (e.g. meeting room), services (e.g. chats, telephones), and activities (e.g. casual face-to-face conversations) (Taminiau et al, 2009). Employees voluntarily engage in these types of actions for the purpose of knowledge exchange, at the time and in the form that are the most suitable for them. It is a knowledge sharing system that often emerges ad hoc within an organization.

Rudawska (2019) noted that informal and formal mechanisms of knowledge sharing compete with each other, as according to her "while the informal mechanisms are used in current problem solving, the formal ones help create shared knowledge, develop a common language and the *who knows who* knowledge map". It is also worth noting that the formal and informal types of knowledge sharing should blend with the adopted knowledge management strategy, for that reason the second approach was identified.

4.2 The Strategy for Knowledge Codification and Personalization

Hansen et al (1999) distinguished two knowledge strategies, namely codification and personalization. The knowledge codification strategy refers to the development of the electronic system that enables knowledge codification, storage, dissemination, and reuse (the "people-to-document" approach). In this strategy, the knowledge of how to work or how to behave in a specific situation is well-defined and it is shared in the formal way. In view of the above, employees know which documents they should use, where they can find them quickly

(easy access) and they remember to regularly document their work progress (storage). The codification strategy will therefore be applied in organizations that offer standard products and/or services, i.a. mass production, but also products that in fact are based on standardized components, e.g. Dell (Hansen et al, 1999).

The personalization strategy "seeks to capture and share tacit knowledge that resides in human minds, behavior, and perception" (the "person-to-person" approach) (Chang, Yen, 2019). In this strategy, knowledge is mainly obtained from experienced and qualified co-workers, and also via face-to-face help provided by experts (Choi, Lee, 2003). The strategy consists in obtaining and sharing tacit knowledge first and foremost via informal social interactions (Choi, Lee, 2002). The personalization strategy works perfectly in organizations that offer personalized and innovative products and/or services. In this kind of organization, people in search of innovation must share their knowledge that would otherwise "get lost" in the documented form (Hansen et al, 1999).

4.3 Broad and Deep Knowledge

The third approach draws attention to the knowledge scope on which the organization focuses in its core business operations, therefore a distinction was made between broad knowledge and deep knowledge. Broad knowledge "refers to the extent to which the firm's knowledge repository contains distinct and multiple domains" (Zhou, Li, 2012). This means that the enterprise taps into heterogeneous knowledge, which in turn translates into creating more diversified products (Asoh, 2004). Also Yang et al (2016), when analyzing the impact of the knowledge scope on the product efficiency, noticed that due to "broad knowledge covering various areas, a firm can gain new ideas, insights and expertise from multiple disciplines".

The idea of deep knowledge sharing "refers to the level of sophistication and complexity of knowledge in key fields" (Zhou, Li, 2012). Deep knowledge should be understood as homogeneous, complex and unique knowledge in a given area. De Luca and Atuahene-Gima (2007) stated that technical knowledge depth is the amount of within-field knowledge the firm possesses. Hence, as Asoh (2004) pointed out, this type of knowledge sharing applies to more specialized products.

5. Research Methods and Data Collection

In order to collect the research data, a structured and standardized questionnaire was applied. The survey encompassed two interviewing techniques: CAWI (*Computer Assisted Web Interview*) and PAPI (*Paper&Pen Personal Interview*). The survey involved small, medium and large production companies operating in North-West Poland. The reliance of the research on industrial enterprises was due to the fact that this sector employs the highest number of people (both on the national and regional scale). Moreover, the selected kind of business operations is also connected with the complexity of their technological processes that require specific standards of conduct and continuous improvements. Hence, an issue of key importance for them should be developing appropriate attitudes so that employees readily share their knowledge. The survey questionnaire was addressed to persons who manage and/or co-manage the industrial enterprises (i.e. the ones that coordinate other people's work, e.g. production managers). A total of 643 survey questionnaires were distributed and 254 were returned. Finally, 219 correctly completed questionnaires were used for the purposes of the research study (the total response rate amounted to 34%).

To examine the six types of knowledge sharing, 27 measurement items were adapted from the existing scales found in the literature. The tool for measuring the formal way of knowledge sharing contained four statements, based on Willem and Buelens (2007), Wei and Li (2014), and Schwaer et al (2012). A sample item was: "I usually share my experience in a meeting or through other official channels" (Cronbach's α=0.714). The variable regarding the informal way of knowledge sharing was also measured using four statements based on Yi (2009) and Schwaer et al (2012). These included e.g. "I usually spend time in personal conversation (e.g., discussion in hallway, over lunch, on the telephone) with others to help them with their work-related problems" (Cronbach's α=0.741). The tool for measuring the codification and personalization strategies encompassed the total of ten statements, five for each of the knowledge sharing type, based on Choi and Lee (2002), Azyabi et al (2012) and López-Nicolás and Meroño-Cerdán (2011). For the codification strategy, (Cronbach's α=0.884) the statements included e.g. "Results of projects and meetings are regularly documented in my company", whereas in the case of the personalization strategy (Cronbach's α=0.745) e.g. "It is easy to get face-to-face advise from experts in my company". Broad knowledge sharing was measured with five items (Cronbach's α = 0.728) and deep knowledge sharing was measured with four items (Cronbach's α=0.447). In both cases, the statements were taken from the studies by Zhou and Li (2012), Asoh (2004) and Azyabi et al (2012). With regard to broad knowledge, there were statements such as "The company focuses on organizing trainings to support employees in performing multiple tasks", and in the case of deep knowledge - e.g. "The company invests in developing specialized professional

skills". The five-point Likert-type scales were used in the questionnaire, ranging from ''1'' (totally disagree) to ''5'' (totally agree). As for measures in the area of Lean Manufacturing, they were examined in the context of the degree of LM implementation in the given enterprise, therefore the surveyees were asked to select one out of five statements as follows: "I don't know what LM is", "no interest in LM", "preparing for implementation of selected LM tools and methods", "yes, we're applying selected LM tools and methods" and "yes, we fully implemented LM".

The statistical analysis started with examining the validity of the survey questionnaire by means of the Exploratory Factor Analysis (EFA) and Confirmatory Factor Analysis (CFA). The completed analysis at the level of the measurement model verification rejected only one type of knowledge sharing, i.e. deep knowledge (which did not meet the criteria of convergent and discriminant validity). Next, for all the statements which were not rejected as a result of CFA, an analysis of measurement reliability was conducted applying Cronbach's α, standardized α, and Composite Reliability (CR).

Table 1: Reliability Measures for the Measurement Model

Types of knowledge sharing	Cronbach's α	standardized α	CR
Formal approach to knowledge sharing	0.714	0.718	0.728
Informal approach to knowledge sharing	0.741	0.744	0.744
Codification strategy	0.884	0.886	0.786
Personalization strategy	0.745	0.763	0.877
Broad knowledge	0.728	0.731	0.747

As for the five types of knowledge sharing shown in Table 1, all of them met the reliability criteria, i.e. exceeded the assumed threshold value of 0.7 for both Cronbach's α and standardized α (Taber, 2018) as well as for CR >0.6 (Lombardia et al, 2019).

6. Results

In order to show correlations between various types of knowledge sharing and the Lean Manufacturing concept, all the analyses were done with the use of the ANOVA test and the post hoc Scheffe test. The ANOVA (Analysis of Variance) test showed significant relationships between various degrees of engagement in Lean Manufacturing in five types of knowledge sharing, i.e. excluding the informal knowledge sharing. Next, in order to examine the detailed relationships, the multiple comparison test (i.e. post hoc Scheffe test) was performed. The obtained results are presented in Table 2.

Table 2: Types of knowledge Sharing in Relation to Degrees of Engagement in Lean Manufacturing – Results of the Post Hoc Scheffe Test Analysis

	Types of knowledge sharing				
	Formal KS	Informal KS	Codification strategy	Personalization strategy	Broad KS
Engagement in Lean Manufacturing	F=5.910; p=0.000	F=1.871; p=0.117	F=4.413; p=0.002	F=3.517; p=0.008	F=3.746; p=0.006
I don't know what LM is {1}	$\overline{Y}$=2.686{5}	$\overline{Y}$=3.765	$\overline{Y}$=3.219	$\overline{Y}$=3.990{3}	$\overline{Y}$=3.295{5}
no interest in LM {2}	$\overline{Y}$=2.780{5}	$\overline{Y}$=3.760	$\overline{Y}$=3.520	$\overline{Y}$=4.073{3}	$\overline{Y}$=3.250{5}
preparing for LM implementation {3}	$\overline{Y}$=2.542{5}	$\overline{Y}$=3.740	$\overline{Y}$=3.117{5}	$\overline{Y}$=3.458{2; 4}	$\overline{Y}$=3.417
yes, selected LM tools {4}	$\overline{Y}$=3.146	$\overline{Y}$=3.776	$\overline{Y}$=3.676	$\overline{Y}$=3.985 {3}	$\overline{Y}$=3.561
yes, fully implemented LM {5}	$\overline{Y}$=3.733{1; 2;3}	$\overline{Y}$=3.250	$\overline{Y}$=4.040{1; 3}	$\overline{Y}$=4.000	$\overline{Y}$=4.067{1; 2}

Note: {1,2,3,4,5} – significant difference between groups based on post hoc test p<0.05

It was found that the enterprises which had fully implemented LM tools and methods were characterized by a far more formalized approach to knowledge sharing ($\overline{Y}$=3.733) compared to the companies that were still preparing for LM implementation ($\overline{Y}$=2.542), were not interested in the concept ($\overline{Y}$=2.780) or did not know about LM ($\overline{Y}$=2.686).

Moreover, the companies that had fully implemented Lean Manufacturing used the codification strategy to a greater extent ($\overline{Y}$=4.040) than the enterprises still preparing for LM implementation ($\overline{Y}$=3.117) or those not knowing what Lean Manufacturing means ($\overline{Y}$=3.219).

In turn, among the enterprises which were not interested in LM, the knowledge personalization strategy was applied to a greater extent ($\overline{Y}$=4.073) in comparison with the companies that were still preparing for LM implementation ($\overline{Y}$=3.458). The enterprises that had already implemented selected LM tools ($\overline{Y}$=3.985) also used the personalization strategy to a greater extent than the companies that were still preparing for LM implementation.

The data analysis has also shown statistically significant differences in the extent of knowledge used. The enterprises that had fully implemented Lean Manufacturing used broad knowledge more often ($\overline{Y}$=4.067) than the companies that showed no interest in the LM concept ($\overline{Y}$=3.250) or did not know about LM ($\overline{Y}$=3.295).

7. Conclusions

The specificity of industrial enterprises, production processes complexity, and also the ageing society contribute to the fact that nowadays organizations increasingly often take more and more interest in knowledge sharing, and first and foremost in the ability to identify the process within the organization. Each organization has its own, learned and practiced, individual way of knowledge sharing. Nevertheless, the results of this study have shown that companies that had implemented the Lean Manufacturing concept were characterized by a far more formalized approach to knowledge sharing, application of a knowledge codification strategy and use of broad knowledge, compared to the enterprises that were still preparing for LM implementation, did not show interest in LM or did not know the LM concept.

It is worth noting that Lean Manufacturing is a concept connected with measurement, control and continuous implementation of improvements in production processes. In view of the above, companies that have implemented the LM concept will keep striving for unification and replication of the hitherto developed organizational solutions in a formal manner, i.a. communicating the knowledge via reports or exchanging information and best practices within the framework of IT systems adapted specifically for this purpose. Moreover, in addition to providing space for formal knowledge sharing among the employees, organization of regular meetings or teleconferences ensures a specific rhythm of work.

An important role in Lean Manufacturing is played by the knowledge codification strategy which makes it possible to write down the obtained results of meetings, studies, projects, experiences or insights of employees, so that it is feasible to quickly retrieve and standardize them. In production enterprises, collection of data regarding the production process, the process analysis and the ensuing documentation are aimed at “structuring the knowledge and (…) presenting it in an accessible form so that it is comprehensible for all the employees” (Kąkol, 2010). Thus, the strategy of codification of various LM tools prevents the knowledge dispersion e.g. in case an employee suddenly quits the company. What is more, the strategy helps retain the process repeatability, as it makes it possible to write down the detailed knowledge regarding performance of individual operations by employees directly involved in production (e.g. development of standard operating procedures).

It has been further found that broad knowledge is used more than deep knowledge in production companies which implemented Lean Manufacturing. This means, among other things, that enterprises with the implemented LM concept encourage their employees to obtain universal competences and skills so that they are able to work in various positions. Thus, any unplanned absence will not disturb the rhythm of work.

This research study provides information on various approaches to knowledge sharing emphasized by enterprises that have implemented the LM concept. Moreover, the presented data analysis is appropriate and consistent with the idea of Lean Manufacturing. Therefore, from a practical viewpoint, enterprises planning to switch to Lean Manufacturing should pay attention to various possibilities of knowledge sharing and focus in particular on those that are strongly connected with LM, whereas the companies that are already operating in accordance with the LM concept should make sure the said types of knowledge sharing are continuously improved and enhanced, e.g. via creating appropriate corporate policies.

This study has several limitations that also suggest directions for future research. Firstly, the research sample is limited only to companies operating in North-West Poland. In addition to that, the sample firms operate only in the production sector. For this reason, it would be advisable to conduct future research with a research sample based on various sectors from various countries, which would make it possible to carry out comparative analyses and provide a more international perspective to the subject. Secondly, this study was performed only at the organization level and was based on information obtained from key persons in the entities, predominantly the owners and line managers. Future research studies should also be multi-level, which would make it possible to unearth any differences in the types of knowledge sharing at various positions within the organizations. Thirdly, the analyses described herein constituted a part of a larger research project where the Lean Manufacturing concept was not examined in detail. However, the obtained findings have shown there is a research gap in this area.

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Knowledge Sharing and Transfer Frameworks: Lessons From Sub-Saharan South Africa

Donovan Nadison, Obafemi Olekanma and Viwe Mgedezi
Teesside University, International Business School, UK

donny@newafrica.co.za
O.Olekanma@tees.ac.uk
Viwem@gautrain.co.za

Abstract: The success of Sub-Saharan South Africa's public sector could be deemed dependent on context-relevant knowledge sharing and transfer (KST) frameworks to facilitate knowledge exchange. Knowledge sharing and transfer frameworks which facilitate knowledge management (KM) are still largely influenced by Western research studies, these contributions dominate the field. The extant knowledge sharing and transfer public management frameworks increasingly reflect a predominantly western oriented bias towards objectivist perspectives on knowledge, the alternate practice-based knowledge sharing and transfer frameworks, considered responsive to Sub-Saharan African knowledge exchange problems are under-investigated. This paper thus aims to understand 'what KST framework factors enhance public management in Sub-Saharan South Africa'. The research was designed as a qualitative study underpinned by interpretivist philosophy. Qualitative data were collected from 15 public sector practitioners, using the semi-structured interview technique. Thematic Analysis and Trans Positional Cognition Approach was used to analyse the data collected. The findings from this study yielded four themes namely, Unique antecedent performance factors; Human performance factors; Organisational performance factors and Continuous learning performance strategies. Rahman's knowledge sharing and transfer conceptual model was adopted as a theoretical framework and used to better understand the findings of this work. Applying the theoretical framework, we note elements within Rahman's model could be deemed more applicable in a Western context as it only confirmed two of the study's four findings. We therefore propose the output of this study as new knowledge within the Knowledge sharing and transfer frameworks' domain. Our contribution is compatible with the Sub-Saharan South African organisational context. The implication of this within context is that KST implementation in sub-Saharan South Africa could deemed bottom up oriented as against the western approach which is top-down. This study thus contributes to a better understanding of KST Framework implementation in Sub Saharan South Africa and provides opportunity for future research work in this field.

Keywords: Knowledge; Knowledge sharing and transfer, South Africa, Qualitative research, Performance management, Performance innovation, Innovation nablers

1. Introduction

Public sector administrators in Sub-Saharan South Africa in recent times have given priority to knowledge transfer partnerships (KTPs), some, in the form of private-public partnerships (PPP) to achieve their knowledge sharing and transfer priorities in public management with their internal research and development units and employees playing leading roles to innovate performance (Fan et al., 2010). Osborn et al (2013) supported this idea, noting that effective public administration of sub-Saharan South Africa, should be underpinned by a well-managed state-based public sector organisation. Agreeing Levinthal & March (1993), postulated that for effective management to happen, there should be contextual congruence between knowledge flow and innovation performance sought devoid of myopia output if the goal of institutional knowledge sharing and transfer is to be met. Therefore, it is inconceivable within context to postulate about effective public management without understanding the factors which facilitate effective knowledge management in the public sector. Massaro et al. (2015) point out that factors which facilitate effective knowledge sharing and transfer in the public sector service, have not been systematically investigated in Sub-Saharan Africa. Glaser et al (2019) further postulated that existing knowledge management practice studies in the public sub-sector like the transport sector is characterised by traditional engineering, and objectivist management approaches. These authors argue this area is over-analysed while practice-based knowledge sharing, and transfer management needs to be studied more deeply, particularly within sub-Saharan African countries context where it is under-researched. It is hoped that findings from this study could provide new understandings of how to better facilitate knowledge sharing and transfer in the public sector through public management practice. Werr (2013) observed that applying knowledge sharing and transfer in its local context would hold the potential of developing interesting insight when it comes to knowledge management more generally.

Using public sector operators in South Africa as a study lens, this work seeks to answer the question; 'what knowledge sharing, and transfer framework factors enhance public management in Sub-Saharan South Africa'. It is hoped that this study contributes new knowledge that will provide opportunity for future research

direction for academician and practitioners. This paper started with an introduction, while the remaining sections include literature review, followed by research methods, presenting the findings, discussion and conclusion.

2. Literature Review

2.1 Effective Public Management in Sub-Saharan Africa

Effective public management is dependent on knowledge as a critical resource, both private and non-profit sectors, including the government, to capitalise on this knowledge, must understand how knowledge like performance innovation is created and shared to be effective (Nonaka and Takeuchi, 1995). A large body of literature produced extensive research on KM frameworks and explanations of knowledge-sharing factors which facilitates knowledge transmission to understand public management practices (Heisig, 2019). These frameworks and factors paid much attention to developed country frameworks, they are over-investigated while Sub-Saharan Africa KM frameworks and their categories of influential success factors is under-investigated. In addition, public administration scholars have not provided clarity on what the term public management and the related concept of New Public Management (NPM) precisely mean. Scholars suggest the concepts deserve closer scrutiny to understand them (Mirit and Vigoda-Goda, 2017). Scholars, Christensen and Laegreid (2011a; 2011b) confirm that the public management literature and public sector organizations understand it to be about the role of political actors with dynamic internal and external relations operating in society (Christensen, Fimreite, and Lægreid 2007). Public sector organizations, Rainy (1990;2009) posits, have specific decision-making capacity because of factors such as political interventions, political constraints, and their diffuse objectives. This traditional definition emphasizes a rational approach to decision-making which is mostly applicable to stable public sector organisations. Though this earlier NPM definition, emphasized inter-organisational management, it did not capture the Sub-Saharan African intra-organisational dimensions, its diversity, institutional instability, and fragmented nature of its public sub-sector. Hood's (1991, 1995) concept of New Public Governance (NPG) has now been incorporated into NPM. According to Osborne (2011), it is less fragmented, the new definition incorporates governance such as knowledge strategy which integrates intra-organisational management processes of public management. The combination of terms is more appropriate to capture the South African diverse nature of public management and its multiple state actors, it offers a lens to understand knowledge management factors which facilitate effective knowledge sharing and transfer in Sub-Saharan South Africa.

According to Nooshinfard and Nemati-Anaraki (2012), the literature has not developed a KM framework to understand the diverse factors which influence knowledge sharing and transfer. This gap is more pronounced in Sub-Saharan Africa, this paper intends to address this gap by exploring the knowledge sharing and transfer factors that enhance public management in Sub-Saharan South Africa, which may result in developing a knowledge management framework for organisations in South Africa which can serve as a roadmap of significant factors for African researchers and managers considering options to foster KM within the context of New Public Governance. In this study, the New Public Management (NPM) approach has been adopted for the GMA investigation, because the dynamism of the new economy of Sub-Saharan South Africa requires an integrated concept of public management so KM professionals should not only create knowledge but must transfer it quickly through knowledge sharing and transfer, to not lag their European counterparts. In addition, the NPM does not treat KM and its enabling factors as technocratic, it is about engaging employees in innovative ways, it's a practice-based approach because it combines both tacit and explicit factors in contrast to technocratic objectivist knowledge practices that suggest knowledge sharing and transfer strategies (tactic and explicit) are binary.

NPM through the application of the practice-based approach is relevant to this study because it could offer this study a further lens to explore and potentially develop a KM framework based on performance innovation enablers to enhance the following public management Sub-Saharan Africa principles: Managerialism: the reduced size government; Decentralization: devolving government functions like the rail to the provincial state level; Efficiency: flexible structures to improve decision-making to benefit service recipients ; Modernised state: restructuring government delivery through a partnership with business.

These principles provide context so knowledge sharing and transfer framework for sub-Saharan South Africa, is derived from African public sector knowledge sharing and transfer practices which continue to modernize the public sector. Given the priority to implement knowledge transfer partnerships (KTPs) in South Africa, a requirement of the new economy, to direct services to outside firms (Weikart, 2001), the framework of

performance innovative factors, must capture soft internal and hard competitive factors which facilitate effective knowledge sharing and transfer.

2.2 KST in Public Sector Management

Scholars Leisink and Knies (2018), suggest definitions vary and there is no clarity on what the term public sector and its domain entail, pointing out that the term public sector does not exist. Bozeman (1988: 2004) supports this view, however, also posits common criteria that can be used to bring clarity to the concept, such as government ownership, sources of funding, and degrees of political control, used to distinguish public and private sector organizations. Scholars have argued public sub-sectors exist, and include sectors such as the transport sector, etc., which are regulated by legislation (Rainey, 2009). The focus of this study sheds light on this under-investigated area of the existing public sector literature on knowledge management, it will examine the antecedent and enabling framework factors which facilitate effective knowledge sharing and transfer in the public sector, in a transport management research setting. While contributions of scholars on public sector studies and its public sector transport management context are extensive in developed markets (Vigar, 2017; Glaser et al., 2019), Bharba (1994) the post-colonial theorist confirms the public sector and its various context setting are under-investigated in Africa, as models from developed countries are often mimicked in emerging markets. The field is preoccupied and focused on more technocratic Western objectivist engineering, centred on the means-end rationality approach to transport management (Vigar, 2017; Glaser et al., 2019). Practice-based approaches to public sector KST transport management is a knowledge gap, worth exploring. Moreover, Glaser et al., (2019) suggest that a shift from Western conventional objectivist transport management to a less technical and more subjective interactive approach is needed.

2.3 KM Theoretical Frameworks Brief Overview

Literature review show various frameworks that exist which explains and provides context for implementing knowledge sharing, and knowledge transfer (Nonaka and Takeuchi 1991; Heisig, 2009; Wang and Noe 2010; Rahman et al.,2018), and many others. These frameworks comprise elements that explains what knowledge sharing and knowledge transfer are. They also enable understanding how these concepts are implemented albeit from a western lens perspective. Of particularly interest is the Rahman postulations about Knowledge sharing presented in their model (see model in figure 1) which highlighted factors such as organisational culture, organisational leadership, organisational structure and organisational commitment with top management support and ICT support as a moderating and mediating factor if knowledge sharing in organisation is to be achieved.

Thus, this study seeks to employ this model as a lens to answer the question, ‘what knowledge sharing, and transfer framework factors enhance public management in Sub-Saharan South Africa’. As this study involve collection of subjective views from public sectors practitioners a qualitative study was used to enable answering the research question.

3. Research Methodology: Data Collection and Analysis

This study designed as qualitative research adopts an interpretivist philosophical approach, it supports subjective views and inductive approach (Saunders et al., 2016; Olekanma and Soomro, 2020; Olekanma, et al., 2022). The study adopted a single case study approach as focus was on South Africa public sector only. Single case study is relevant because it explored the phenomenon in depth in its natural context (Yin, 1984). The study seeks to understand ‘what KST framework factors enhance public management in Sub-Saharan South Africa’. Purposeful sampling was used to interview fifteen public sector practitioners, to answer the research question ‘what knowledge sharing, and transfer framework factors enhance public management in Sub-Saharan South Africa’. Participants were drawn from a single public sector organisation, consent was obtained from participants, before the commencement of this work.

Data Collection

Semi-structured interviews questions were used to collect data from the 15 participants, each interview lasting 45-90 minutes (Creswell, 2013). The questions were open ended to allow the participants to describe their experiences participating in a knowledge sharing and transfer project. Where it is believed that questions were not fully answered prompts were used to elicit further information. Interviews for data collection for this study were stopped when saturation point were reached. The key inclusion criteria were that participants would have participated in successful and failed knowledge exchange projects. They would also have had a minimum of five years of working experience in the KT/KS public sector environment. Analysis of the demographics of

the participants show of the 15 people interviewed, 53% were male while 46% were female, however, analysis of qualifications revealed that 100% held graduate degrees. The reliability and validity of the data was enhanced because of the perspectives from multiple well-informed participants. All interviews were recorded and transcribed verbatim; all ethical considerations were duly observed (Saunders, 2019; Olekanma et al, 2022; Olekanma, 2023).

Data Analysis Tools

The study data collected through semi-structured in-depth interviews were initially analysed using Braun and Clarke's (2006) thematic analysis method (TA) to obtain study participants themes. After initial text analysis, using Braun and Clarke's (2006) thematic analysis method, this study diverged and adopted Trans Positional Cognition Approach (TPCA) stepwise analytical method (Olekanma, et al., 2022). The rationale for this diversion, was based on Braun and Clarke's (2006) method which is considered too complex, with no clear guidelines on how to go about the researcher's interpretation of the study participants' themes (Todres and Holloway, 2010). Thus, TPCA analytical Stage 3, steps 11 and 12 (Olekanma, et al., 2022) were adopted and used to analyse study participants themes. The outcome of this divergence led to the emergence of 4 researchers' themes namely Unique antecedent performance indicators, Human performance factors, Organisational performance factors, Continuous learning performance factors as key drivers of knowledge sharing and transfer in Sub Saharan South Africa public sector Step 13 were adopted and used to enable emergence of the essence of the study (Table 1 – Data display structure). The next section presents the study findings.

4. Findings

The four key findings shown under researchers' interpretation column in Table 1 to be presented in this section that include Unique antecedent performance indicators, Human resources performance factors, Organisational performance factors, and Continuous learning performance factors were sent to 10 out of the 15 purposively selected participants for validation. All the 10 participants confirmed that the outcome of the analysis as showing in Table 1, represented their descriptions and experience delivering KST related projects in Sub Saharan South Africa public sector.

Table 1: Study Findings

Study Participant themes	Researchers Interpretations	Essence of study
Knowledge Strategy (hard antecedent factor)	**Unique antecedent performance factors**	**Enabling Factors of Knowledge Sharing and Transfer in Sub Saharan South African Public Sector for effective service delivery**
Change Management (soft antecedent factor)		
Coupling Knowledge strategy and change management		
Trust	**Human resources performance factors**	
Individual intrinsic motivation		
Individual extrinsic motivation		
Culture	**Organisational performance factors**	
Rewards and Incentives Systems		
Partnerships and networks		
Adult learning practices		
Knowledge integration		
Continuous learning requires an open KST climate, performance measures and incentives	**Continuous learning performance factors**	
Continuous learning requires a Knowledge Management unit with a new mandate and budget; integrated technology; interaction with industry		

Source: Adaption from TPCA stage 4 data display structure (Olekanma et al., 2022)

4.1 Theme 1: Unique Antecedent Performance Indicators

There was overwhelming agreement about unique performance antecedent indicators. The responses to interview questions highlighted the three unique factors, knowledge strategy, change management and coupling knowledge strategy and change management. The participants expressed the view that they were originating factors for effective KST implementation and performance management. All the participants

emphasized coupling of antecedent factors, that a new knowledge strategy happens when knowledge strategy and change management converge. Respondent 1 summed it up, "the knowledge strategy initiatives led to reducing distrust and helped all understand how the strategy as the first step for knowledge sharing and inter organisational transfer supports the organisation's goals' (M1). Participants 8, 11 and 1 explained the coupling of factors thus, 'You need to bring the Knowledge strategy with change management for people to buy into it (M8). "We need to link knowledge strategy and change management because historically it showed one without the other do not facilitate knowledge sharing and transfer" (M11). "When organisation puts knowledge strategy and changes management together it allays fears" (M1)

4.2 Theme 2: Human Resources Performance Factors

While all participants expressed support for trust, views on motivation varied, the majority accepted extrinsic motivation as positive for knowledge exchange while a few resisted, suggesting intrinsic motivation was more desired. The people performance factor, accounted for the importance of all three human-related factors, namely trust, individual motivation, and organisational motivation. These people enablers were reported to be critical, after the antecedent factors. Respondent 13 explained why their trust was a people enabler. 'Trust is a very effective enabler that encourage knowledge exchange, I think its primary because for any person to share knowledge it is a moment of great vulnerability, the environment must be one of trust (M13). Participants summed up intrinsic and extrinsic motivation; thus, participants 1 and 2 said, 'Motivation is a personal factor for me, I am moved by the organisations goals to do it'(M1); 'In project knowledge sharing there is a need to be motivated through rewards and incentives, categories for rewards must be created to acknowledge those who knowledge share and transfer' (M2).

4.3 Theme 3: Organisational Performance Factors

The process organisational enabling factors were aggregated by four issues culture; rewards and incentives; partnerships and networks; adult learning. Some of the participants did see rewards and incentives as negative drivers for knowledge transmission, however the majority considered it as positive for KST implementation and performance improvement. While participants placed the onus of successful organisational enablers on leadership, they all expressed the desire as a recurring theme for the adult education principles, not identified in the public sector KM literature reviewed. Culture was described as contingent and linked to trust. M12 said, 'Culture is influenced by how people behave, it must be nurtured, it is related to trust. One of the participants summed up the importance of rewards and incentives and said, 'Incentivising people through a rewards policy to knowledge sharing is important, it is the big question that comes up, not only in the studied organisation but in many organisations, we should consider it' (M1). All the participants also referred to the growing list and varying types of networks and partnership. Participant M12 said, 'Both social networks and partnerships are important, no one is more important than the other. Participants repeatedly indicated the importance of adult learning principles, participants M11 said 'adult learning methods are positive as it improves the content shared and delivery method used, that works for us as adults.' (M11).

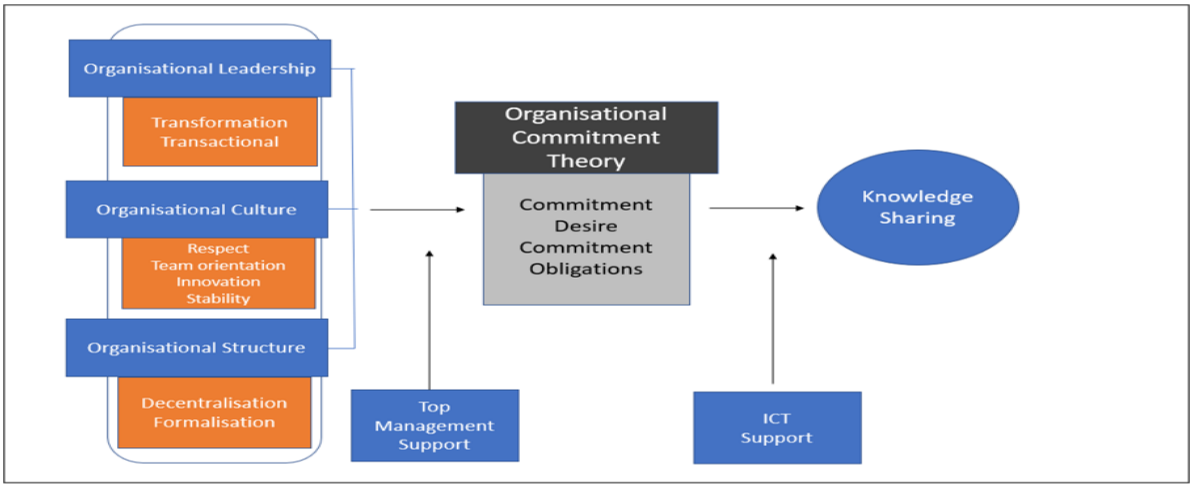
4.4 Theme 4: Continuous Learning Performance Factors

This fourth theme, continuous learning was seen as the quintessential knowledge strategy and was a recurring theme raised by all participants. It was aggregated by (1) lessons learnt from knowledge exchange successes and (2) lessons learnt from knowledge exchange failures and difficulties. Participants M5 said, 'We should continue linking people through MOUs or SLA's, these agreements are important success factors (M5)'. A unique industry related knowledge transfer obstacle was linked to learnings from error, described by M7, "There appear a mismatch between what organisations want and what industry needs, experience reveal this mistake. Our organisation needs an industry repository of knowledge, the sector repository is not good enough.

5. Discussion

Results from the current empirical work identified as performance innovation enablers; Unique antecedent performance indicators, Human resources performance factors, Organisational performance factors, and Continuous learning performance factors as elements underpinning knowledge sharing and transfer for effective public management and performance innovation in the studied South African public sector organisation. Wang and Noe (2010), Knowledge sharing framework study also found that people and organisational factors, including motivation and culture, are interrelated factors which facilitate knowledge sharing and transfer albeit globally. The result of the current study confirms two out of the four enablers put forward by Wang and Noe (2010) study. To better explain the study findings, Rahman, et al., (2017, p.280), a

framework of knowledge sharing, adopted as theoretical study framework was employed. The theoretical framework, presented in Figure 1 below provides a western perspective lens with which to compare the current sub-Saharan South Africa work setting findings. Rahman et al (2017) framework identified organisational leadership, culture, structure; and organisational commitment factors as key enablers of knowledge sharing and transfer. It also shows the relationship between top management and organisational commitment as moderators and mediating factors during knowledge sharing and transfer activities in organisation.



Source: Rahman et al. (2018, p.280)

Figure 1: Conceptual Framework of Knowledge Sharing for Business Organisation

The implication is that the organisational commitment theory which mediates the knowledge sharing and transfer enablers suggests the willingness of social actors to participate in knowledge sharing and transfer is dependent on the Top management and ICT support, commitment factors. The current study findings identified factors not considered enablers of knowledge sharing and transfer by the Rahman et al., (2018) study framework. First, context, and purpose factors which are preconditions for knowledge sharing and transfer to happen identified in the current study are not included in the theoretical framework. These are the antecedent factors, (knowledge strategy, change management, and coupling knowledge strategy and change management) factors. Secondly, the theoretical framework elements lack reference and inclusion of human - related factors, which engenders trust and motivation, essential commitment factors to facilitate knowledge sharing and transfer between knowledge actors. It also does not include the implementation factor – continuous learning culture from success and failure. Despite several antecedent and enabling factors which facilitate knowledge sharing and transfer in the literature (Ipe, 2003; Wang and Noe, 2010) most studies such as Rahman et al. (2018, p.280) framework separated the leadership antecedent factor from organisational enablers in knowledge sharing and transfer models in the literature. Rahman et al., (2018) framework did not include change management as a bottom up antecedent, ignored the influence of people factors (trust and motivation) and implementation strategies (continuous learning) to boost antecedents and enablers. Rahman et al., (2018) framework considered the business sector, Bangladesh and its eastern zone factors. The Sub-Saharan region was not its focus. While the work is a contribution to the field, it creates a gap in knowledge, particularly for the sub-Saharan African practitioner still dependent on the Western models for guidance. The South African framework identified bottom antecedents, people and continuous learning factors, not identified in previous studies. To bridge this gap, this work proposes Sub-Saharan South African Public Sector Practitioners' Knowledge Sharing and Transfer Model presented in Figure 2 below.

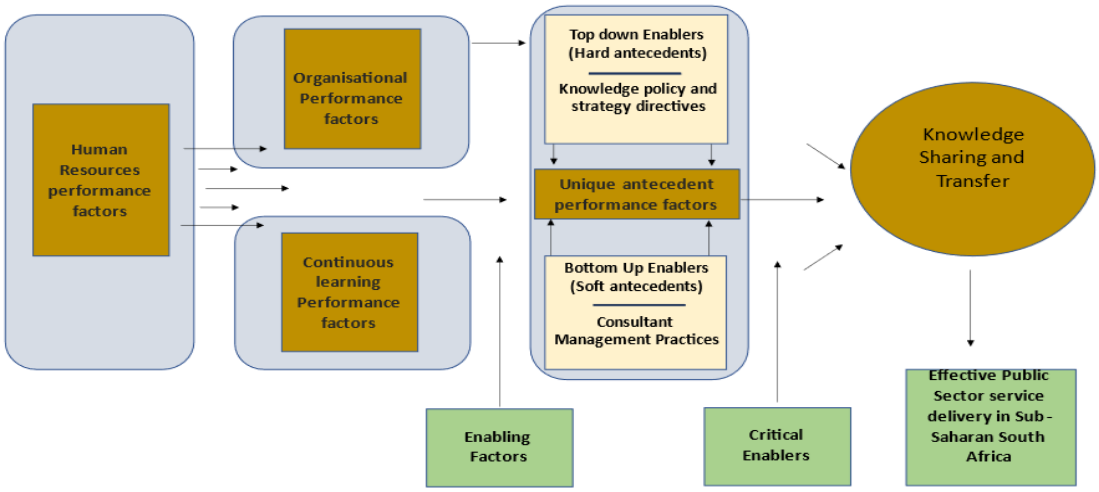


Figure 2: Sub Saharan South African Public Sector Knowledge Sharing and Transfer Conceptual Model

6. Conclusion

The research sought to answer the question; what knowledge sharing, and transfer framework factors enhance public management in Sub-Saharan South Africa? The study fully achieved its set aim and answered the research question, through exploring lived experiences of 15 public sector practitioner managers working in Sub Saharan South African public sector. Data collected yielded four key themes namely, Unique antecedent performance indicators, Human resources performance factors, Organisational performance factors, and Continuous learning performance factors. These findings represented factors that enhance public management in Sub-Saharan South Africa, it does point to further study in this area. The study results extended the extant Rahman conceptual theoretical framework, which is a contribution to knowledge. The novel model also potentially contributes to practice as it will help practicing public sector managers understand the enabling factors which facilitate effective knowledge sharing and transfer, particularly in South Africa, which is a major economic powerhouse in Africa, only second to Nigeria. The limitation of this work is its sample size (15 participants) used in the study the findings may not be generalisable. While it makes a valid contribution to the field, it is also not a representative study across Sub-Saharan Africa. The study provides future studies opportunities for knowledge share and knowledge transfer academics, practitioners and researchers that include considering the studied organisation as a unit of analysis to compare the novel KST model within a different organisation in any South Africa public sector research setting.

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The Mediating Role of Knowledge Management in the Relationship Between Organizational Memory Building and Human Resource Management.

Munawwar Najim, Iyad Edajani, Fayez Shaldan and Safinaz Kh. El Sheikh Khalil
The Islamic University of Gaza, Palestine

mnajim@iugaza.edu.ps
edajani@iugaza.edu.ps
fshaladan@iugaza.edu.ps
safinazkh74@gmail.com

Abstract: This paper aims for verify the role of knowledge management as a mediator in the relationship between organizational memory building and human resource management to develop high education institutions into human resource management organizations. In this study, the researchers relied on empirical study to test the relationship between the variables. Therefore, a survey questionnaire was conducted. The study population consisted of faculty members in Palestinian universities, whose number is (7,367) members. The study sample consisted of (360) professors from Palestinian universities. The results show that the mediating variable (KM) affects the dependent variable (HRM) by (0.675); and it is statistically significant at a significance level less than (0.001). Including the independent variable (OM) in the same model, its effect on the dependent variable (HRM) vanished, and the value of the statistical significance became (0.051).

Keywords: Mediating role, Knowledge Management (KM), Organizational Memory Building (OM), Human Resource Management (HRM)

1. Introduction

To ensure the organizational strength of higher education institutions, it is necessary to increase the strength of their organizational immunity, which requires three processes (organizational learning, organizational memory, and organizational genes). Hence, the importance of (OM) is significant to the strength of the organization's immunity (the body of the institution). There must be a strong human resource to ensure the effectiveness of organizational immunity; and knowledge management facilitates this human resource. Thus, this research paper consists of three variables: Knowledge Management (KM), Organizational Memory (OM), and Human Resource Management (HRM).

Organizational immunity is a virtual concept that shows the organization's ability to cope with crises through the framework of an action plan consisting of a set of processes that include (organizational learning, organizational memory, and organizational genes) in order to determine appropriate strategies for crisis management. (Aladdin, 2021: 9)

Organizational memory is defined as frameworks of common meaning among members of the organization. This definition represents the focus of the organizational learning process model in order for individuals within the organization to learn how to think and act like other members. (Al-Faroukh, 2010:28)

As for knowledge management, Antunes and Pinheiro view it as managing the processes of creating, storing, accessing, and disseminating the intellectual resources of an organization (Antunes and Pinheiro, 2020: 141). (Saha et al.) define human resource management as a distinct personnel management that seeks to achieve a competitive advantage through the strategic development of a highly capable and committed workforce, through the application of a combination of cultural, structural, and personnel techniques.

Organizational memory is an important concept in the study of organizational behavior and performance. It refers to the ability to store and retrieve information, experiences, and knowledge obtained in the past; and to use it in the future. Organizational memory is formed through organizational processes that identify, store, aggregate, and distribute important information in the organization. It is used to support decision-making processes, improve institutional performance, and promote innovation and development.

Many studies indicate that organizational memory is an important element in achieving organizational success. Organizations that invest in forming a strong organizational memory have a greater ability to adapt to institutional transformations and the challenges they face. Therefore, understanding the concept of organizational memory and its importance can help improve Institutional performance and promotion of innovation and development in organizations.

Organizational memory constitutes a broad cognitive process that takes place within a general framework interacting among its parts, consisting of a mixture of tangible and intangible assets, working to extract new knowledge from its sources in order to store and retrieve it when needed (Al-Baghdadi, 2007). Also, organizational memory is the creation of organizational learning that takes place within the organization. What this learning leads to can only be tangible after it is embodied in the organization's outputs. For their work, they are poured into molds referred to as organizational memory receptacles or stores (Jawadi, 2020, p. 28). Organizational memory contributes significantly to the creation of value for the organization. It enhances the routine operations of the organization by reducing the transaction costs associated with the repeated selection of alternatives that have been proven effective in the past. It is the basis for recycling organizational knowledge and a source of competitive advantage. It is a strategic resource that cannot be replaced due to its implicit and abstract nature (Dahinen and Ibn Sahel, 2022).

Characteristics of organizational memory: It enables the use of information based on the organizational context; and represent it in the cognitive context, especially with regard to solving problems, processes, and decision-making. It increases the automating ability to assist the user in decision support, by providing access to the accumulated cognitive stock. It stores diffused, unstructured, and documented knowledge, and expresses processes that include maintenance, research, and access, which indicate the importance of organizational memory for the organization. It enables the retrieval of knowledge, which aims to locate important knowledge in the organization, and use it to support decision-making processes and solve various organizational problems through communication and interaction (Qawsi and Anan, 2021, page 196).

Dimensions of organizational memory: It is based on professional knowledge, including technology, and related experiences that support and strengthen the regular operations of the organization. It includes variables and systems for product development, production control methods, information technology, the Internet, equipment, and technical method used. The organization should innovate and be interested in the technologies that occur in the environment, and learn from them (Dashash and Zaydi, 2022, pg. 30). It also includes frameworks, policies, rules, programs, and strategies tending to the knowledge that controls the operations within the organization, which refers to the organization's structure, management, human resources training, documentation management, and knowledge management.

Human resource management must enjoy flexibility and respond to new variables in light of developments within the internal and external environment of the organization; and thus develop policies and systems, and design programs and rules of its own in several areas, such as selection and employment, empowerment, training and development, compensation, and Performance evaluation (Abu Anza, 2021, p. 27).

Dessler dealt with the most important dimensions of human resource management, namely recruitment, selection and appointment, training, employee performance evaluation, compensation and benefits for human resources (Dessler, 2015, p. 70).

Al-Salami believes that the most important dimensions of human resource management are human resource planning, organizing human resource affairs, directing human resource affairs and work, procuring the necessary resources to handle human resources, monitoring and following up of human resource affairs, and evaluating performance in the field of human resource affairs (Salmi, 1997, p.134).

The contemporary world is witnessing a great development in the field of knowledge, which contributed to the development of various institutions and the change of their administrative methods. In addition, the discovery of new methods brought about a quantum leap in the field of work and production. Universities were not far from this transformation. Rather, the knowledge revolution affected them, and contributed to their development; and to dissemination of their three functions: education, scientific research, and community service.

The university and knowledge are inseparable. The concept of the university has been linked through its long history to the concept of knowledge. On this basis, it is seen as representing the knowledge resources of society. As much as society needs natural resources to build its economic entity, it also needs resources to build its cognitive and intellectual entity. This is the function of the university. It is a source of knowledge. It derives its identity and the legitimacy of its existence from this important role. Therefore, it is the responsibility of universities to enrich and develop the knowledge structure of society (Al-Aidarous, 2012 AD, p. 16). Knowledge management as a new concept for higher education institutions is considered one of the available administrative solutions that give them the opportunity to keep pace with the accelerating changes. The effective application of knowledge management strategies and techniques inevitably leads to improving the

ability of these institutions in decision-making, encouraging creativity, increasing competitiveness, and achieving goals. In addition, it improves their strategy, value, and performance (Sabrina, Hada, 2018 AD, p. 250).

Knowledge management may gain its importance through the goals it seeks to achieve. It provides knowledge to the organization permanently. It translates knowledge into practical behavior that serves the goals of the organization. Thus, it helps organizations achieve efficiency and effectiveness through planning and organizing knowledge efforts, in a way that leads to achieving its strategic goals. In addition, it works to provide distinctive competitive capabilities to reflect on the behavior of individuals in the organization. It affects work methods and adopted technology, which works in harmony with current and future practices and directions. (Al-Malkawi, 2007).

2. Study Problem

The researchers formulated the study problem with the following main question:

- What is the role of knowledge management as a mediating variable between organizational memory building and human resource management?

2.1 Study questions:

In light of the main study question, the sub-questions were:

- What is the level of organizational memory building in higher education institutions in the governorates of Gaza?
- What is the level of human resource management in higher education institutions in the governorates of Gaza?
- What is the level of knowledge management in higher education institutions in the governorates of Gaza?
- Does knowledge management as a mediating variable affect organizational memory building and human resource management in higher education institutions in the governorates of Gaza?

2.2 Objectives

- Clarifying the role of (KM) as a mediating variable between (OM) and human resource management.
- Determine the level of (OM) in higher education institutions in the governorates of Gaza.
- Determine the level of (HRM) in higher education institutions in the governorates of Gaza
- Determine the level of (KM) in higher education institutions in the governorates of Gaza
- Exploring the impact of (KM) as a mediating variable on (OM) and (HRM) in higher education institutions in the governorates of Gaza.

3. Literature Review

- *Kordab et al. (2020) study entitled* "Mediating Role of Knowledge Management in the Relationship between Organizational Learning and Sustainable Organizational Performance." This study aimed to examine the impact of the whole knowledge management cycle on the relationship between organizational learning and sustainable organizational performance in intensive knowledge-based sectors, specifically the audit and consulting companies in the Middle East region. Systematic scientific literature analysis, expert evaluation (structured questionnaire), and structural equation modeling (SEM) technique were used to develop and verify the research model.
- *Antunes and Pinheiro (2020) study entitled* "Linking Knowledge Management, Organizational Learning and Memory." It aimed to understand the link and evolution between the concepts of knowledge management, organizational learning, and memory. Seeking a better clarification of concepts; discussing them in the theoretical field; and understanding their evolution in the last decades. A systematic literature review was developed by synthesizing concepts. From two databases, a total of 2511 scientific articles between 1960 and 2017 were analyzed and divided into two studies.
- *Almomani et al. (2019) study entitled* "Organizational Memory, Knowledge Management, Marketing Innovation and Cost of Quality: Empirical Effects from Construction Industry in Jordan." It aimed to achieve fourfold objectives. First, to explore the effect of organizational memory (OM) on marketing

innovation (MI). Second, to recognize the effect of OM on cost of quality (COQ). Third, to verify the effect of knowledge management (KM) on MI. Finally, to find out the effect of KM on COQ.

- *Dahinen (2017) study entitled* "The Contribution of Knowledge Management to the Development of Organizational Memory: An Applied Study on a Group of Institutions." It aimed to discover how knowledge management can build and develop organizational memory. The case study was a group of Algerian companies (Sonatrach, Saidal, Condor). The study highlights the most important criteria that can be used as a tool to assess and compare best practices in knowledge management.
- *Sudharatna (2015) study entitled* "Organizational Memory System as a Foundation of Knowledge Management." This study aimed to certify the organizational memory system as an essential part of Knowledge management in the Thai Bank Industry. It focused simply on methods of memory system being applied in the sample bank. Aiming to develop an organization towards a Learning Organization, 'managing knowledge' is compulsory.

4. Methodology

The researchers in this study will adopt the empirical study to test the relationship between the variables. A questionnaire survey will be conducted for this study. The research is divided into three parts. In the first part, the independent variable is characterized by the organizational memory building, and the dependent variables are characterized by the (KM) processes (knowledge acquisition, creation, storage, sharing, and application). In the second part the five (KM) processes represent the independent variables, and the (HRM) represents the dependent variable. In the third part, the effect of (OM) on (HRM) is addressed, where (OM) represents the independent variable, and (HRM) represents the dependent variable.

Study population: The study population consisted of faculty members in Palestinian universities, whose number is (7,367) members.

Figure (1) shows the distribution of educational academics by type of institution.

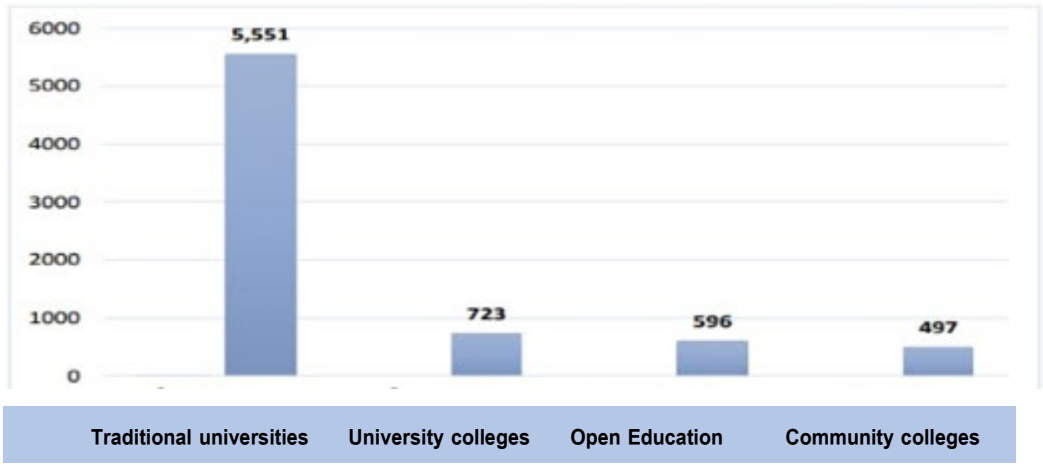


Figure 1: Number of Educational Academics by Type of Institution 2021- (Statistical Book, 2022)

4.1 Study Sample

The exploratory sample: The exploratory sample consisted of (40) members of the teaching staff in Palestinian universities from the targeted study population, and from outside the study sample, in order to verify the validity and reliability of the study tool.

Actual sample: The study sample consisted of (360) professors from Palestinian universities. The sample was selected in a simple random way, where the researchers presented the study tool through Google Forms to all members of the study population, and the number of respondents reached (360) individuals. Table (1) shows a description of the study sample:

Table 1: Description of the Study Sample

Variable		Frequency	Percent
Region	Gaza strip	249	69.2

Variable		Frequency	Percent
	West Bank	111	30.8
Gender	Male	288	80.0
	Female	72	20.0
Years of Experience	Less than 5 years	12	3.3
	From 5 to ten 10	45	12.5
	More than 10 years	303	84.2
Specialization	Human sciences	255	70.8
	Applied Sciences	105	29.2
Academic degree	Assistant professor or less	246	68.3
	Associate Professor or more	114	31.7
Position	Yes	192	53.3
	No	168	46.7
University type	Government	105	29.2
	Eligibility	162	45.0
	Specialized	93	25.8

Study tool: For research purposes, a questionnaire was prepared according to the following steps:

Defining the purpose of the questionnaire: The questionnaire aimed to identify the mediating role of knowledge management between organizational memory and human resource management in Palestinian universities.

*Sections of the questionnaire***:** After reviewing the previous studies that dealt with the variables of the study: knowledge management (KM), organizational memory (OM), human resources management (HRM), the areas of the questionnaire were identified. The questionnaire included two sections as follows:

The first section: includes the basic data of the respondents, which are (university location, gender, years of service, specialization, academic degree, administrative position, and type of university).

The second section: contains (57) items distributed over (11) areas as follows:

Table 2: The Distribution of the Questionnaire Items

Variable	Dimensions	Number
Independent variable (organizational memory)	The first domain: technical organizational memory	4
	The second domain: administrative organizational memory	4
	The third domain: cultural organizational memory	4
Dependent variable (human resource management)	The first domain: selection and employment	4
	The second domain: empowerment	4
	The third domain: training and development	4
	The fourth domain: compensation	4
	The fifth domain: performance evaluation	4
Mediating variable (knowledge management)	The first domain: knowledge organization and management	8
	The second domain: knowledge generation and storage	9

Variable	Dimensions	Number
(knowledge acquisition, creation, storage, sharing, and application)	The third domain: sharing and applying knowledge	8
Total		**57**

Formulation of the questionnaire items: The questionnaire items were formulated in the light of the researchers' review of the studies and research that dealt with the three variables of the study (organizational memory, human resource management, and knowledge management., The researchers considered that items were formulated in a clear and specific manner, and measure what was set to be measured. The initial form of the questionnaire consisted of (57) items.

*Determining the method of estimating the questionnaire***:** a five-point Likert scale was used to estimate the respondents' answers to the questionnaire items. The answer is graded in five levels (very high, high, medium, low, very low). And it corresponds quantitatively (1,2,3,4,5) respectively. Three levels (high, medium, low) were adopted for the mean for each domain of the questionnaire. and Table (3) shows the levels of the approved criterion:

Table 3: Levels of Approved Criterion

High	Medium	Low
5 - 3.67	3.66 – 2.34	2.33 – 1

*The validity of the questionnaire***:** The validity of the questionnaire means that it measures what it was set to measure. The validity was measured in the following ways:

- *The veracity of the arbitrators***:** The initial draft of the questionnaire was shown to a group of (5) professors with specialization in educational administration. The required modifications were made. Thus the questionnaire consisted of (57) items distributed over (11) domains in three variables.
- *Structural validity***:** It means that there is a statistically significant positive correlation between each domain with the total score of the variable. The results showed that the correlation coefficients are all statistically significant at the level of significance (0.01), which indicates that the questionnaire has acceptable internal validity.
- *Stability of the questionnaire scores:* The stability of the questionnaire scores was confirmed using Cronbach's alpha coefficient for the resolution items. Table (4) shows the correlation coefficients and stability coefficients for the questionnaire domains:

Table 4: Stability Coefficients of the Questionnaire using Cronbach Alpha

Variable	Dimensions	Number	Correlation coefficient	Cronbach's alpha
Independent variable (organizational memory)	The first domain: technical organizational memory	4	0.904**	0.889
	The second domain: administrative organizational memory	4	0.956**	0.939
	The third domain: cultural organizational memory	4	0.928**	0.941
	total	12	--	0.962
Dependent variable (human resource management)	The first domain: selection and employment	4	0.928**	0.890
	The second domain: empowerment	4	0.950**	0.966
	The third domain: training and development	4	0.946**	0.950

Variable	Dimensions	Number	Correlation coefficient	Cronbach's alpha
	The fourth domain: compensation	4	0.934**	0.970
	The fifth domain: performance evaluation	4	0.933**	0.966
	total	20	--	0.984
Mediating variable (knowledge management)	The first domain: knowledge organization and management	8	0.953**	0.965
	The second domain: knowledge generation and storage	9	0.948**	0.963
	The third domain: sharing and applying knowledge	8	0.992**	0.968
	total	25	--	0.985

The stability coefficients for the domains ranged between (0.889 - 0.971), all of which are high values indicating that the questionnaire has high stability. The correlation coefficients between the domains of the questionnaire with the total degree of its variable ranged between (0.928 - 0.992), all of which are statistically significant at the level of significance (0.01).

*The final version of the questionnaire***:** After confirming the validity and reliability of the questionnaire, the final version consisted of (57) items, distributed over (11) main areas in three variables: organizational memory (the independent variable), human resource management (the dependent variable), and knowledge management (the mediating variable).

*Statistical methods***:** The researcher used the statistical package for social sciences (SPSS) and the (AMOS) program to process the data. Descriptive statistical methods and simple linear regression were used to test the hypotheses of the study.

Answering the research questions:

The first question: What is the level of (OM) in higher education institutions in the governorates of Gaza?

To answer this question, the mean averages and standard deviations of the organizational memory domains were extracted, as shown in table (5)

Table 5: The Means and Standard Deviations for the Level of Building Organizational Memory in Palestinian Universities

Domain	Mean	SD	Weight	Rank	Level
Technical organizational memory	4.223	0.669	84.46 %	1	Large
Administrative organizational memory	3.996	0.755	79.92 %	3	Large
cultural organizational memory	4.100	0.749	82.00 %	2	Large
OM	4.106	0.662	82.13 %	--	Large

It is clear from table (5) that the mean for the organizational memory variable was (4.106), with a standard deviation of (0.662), and a relative weight of (82.13%), with a high degree of agreement. This indicates that the level of building organizational memory in Palestinian higher education institutions is high from the point of view of faculty members in higher education institutions. The domain of technical organizational memory ranked first with a mean of (4.223), while the domain of cultural organizational memory ranked second with a mean of (4.100), and in the third and last rank came the field of organizational-administrative memory with a mean of (3.996).

The fact that the domain of technical organizational memory ranked first indicates that universities have an integrated technical infrastructure to achieve their requirements and goals. Furthermore, it shows that they are constantly updating the content of their website; have a database for all their information; and their workers have access to stored data and information.

The domain of administrative organizational memory in the third (last) rank indicates that institutions need to store ideas and knowledge in developed methods, to document the experiences and expertise of the institution, and transform tacit knowledge into explicit and structural one. They also need to employ information in planning and setting priorities.

The second question: What is the level of human resource management in higher education institutions in the governorates of Gaza? To answer this question, the means and standard deviations of the human resource management domains were extracted, as shown in table (6).

Table 6: Means and Standard Deviations for the Level of Human Resource Management in Palestinian Universities

Domain	Mean	SD	Weight	Rank	Level
Selection and employment	3.879	0.815	77.58 %	1	Large
Empowerment	3.748	0.929	74.96 %	3	Large
Training and development	3.717	0.916	74.33 %	4	Large
Compensation	3.454	1.018	69.08 %	5	Large
Performance evaluation	3.792	0.918	75.83 %	2	Large
HRM	3.718	0.839	74.36 %	--	**Large**

It is clear from the table (6) that the mean for the (HRM) variable was (3.718), with a standard deviation of (0.839), and a relative weight of (74.36%), with a high degree of agreement. This shows that the level of (HRM) in Palestinian higher education institutions is high from the point of view of faculty members in higher education institutions. The domain of selection and employment ranked first with a mean of (3.879). While the domain of performance appraisal ranked second with a mean of (3.792). Third came the domain of empowerment with a mean of (3.748). Fourth came the domain of training and development with a mean of (3.717). Finally in the fifth rank was the domain of compensation with a mean of (3.454).

In the light of these results, it is clear that there is satisfaction among faculty members in higher education institutions about the policy of selecting and employing of faculty members. This indicates that these institutions seek to obtain highly qualified individuals through advertisements and interviews that are transparent and objective.

The third question: What is the level of knowledge management in higher education institutions in the governorates of Gaza? To answer this question, the mean averages and standard deviations of knowledge management domains were extracted, as shown in table (7).

Table 7: Means and Standard Deviations for the Level of Knowledge Management in Palestinian Universities

Domain	Mean	SD	Weight	Rank	Level
knowledge organization and management	3.818	0.123	76.37 %	3	Large
knowledge generation and storage	3.939	0.825	78.78 %	2	Large
sharing and applying knowledge	4.017	0.817	80.33 %	1	Large
KM	3.919	0.782	78.39 %	--	**Large**

It is clear from the table (7) that the mean for the knowledge management variable was (3.919), with a standard deviation of (0.782), and a relative weight of (78.39%), with a high degree of agreement. This indicates that the level of knowledge management in Palestinian higher education institutions is high from the point of view of faculty members in higher education institutions. The domain of knowledge sharing and its application ranked

first with a mean of (4.107). The domain of knowledge generation and storage ranked second with a mean of (3.939). Third and final rank was the domain of knowledge organization and management with a mean of (3.818).

The domain of sharing knowledge and its application ranked first indicates that the universities administrations encourage faculty members to participate in scientific meetings and conferences to enhance the process of sharing knowledge and encourage the provision of an appropriate environment for the exchange and sharing of knowledge among faculty members.

that the third and last rank of the domain of knowledge organization and management indicates the need to define performance levels for faculty members based on the integration of knowledge, and work to provide a high-quality system in information technology, that institutions need to enhance the capabilities of faculty members to be able to obtain knowledge and manage it.

The fourth question: Does knowledge management as a mediating variable affect organizational memory building and human resource management in higher education institutions in the governorates of Gaza?

To answer this question, the (AMOS) program was used to explore the effect of knowledge management as a mediating variable between building organizational memory and managing human resources in Palestinian higher education institutions. The validity of the formulation of the hypothesis was tested, which states: Knowledge management does not play an intermediate role between building organizational memory and managing human resources in Palestinian higher education institutions.

To test this hypothesis, a causal model was built on a theoretical basis by extrapolating previous studies and related models. The causal model was relied upon for its suitability to the subject of the study, as building organizational memory is related to human resource management in Palestinian higher education institutions. If knowledge management was introduced as an intermediate variable between them, it might affect the nature of the relationship between building organizational memory and human resource management.

In order to verify that knowledge management is a mediating variable between building organizational memory and managing human resources, the researchers relied on the Baron & Kenny (1986) model, which indicated that in order to consider a variable as a mediating variable, three conditions must be met:

1. The independent variable (building organizational memory) should affect the dependent variable (human resource management); and this represents the regression equation of the dependent variable on the independent variable.
2. The independent variable (building organizational memory) must affect the mediating variable (knowledge management); and this represents the regression equation of the mediating variable on the independent variable.
3. The mediating variable (knowledge management) have to affect the dependent variable (human resource management); and this represents the equation of regression of the dependent variable on both the independent variable and the mediating variable together, i.e. the influence of the two independent and mediator variables together on the dependent variable.

If the three conditions are met, the direct effect of the independent variable on the dependent variable must be less in the third equation than it was in the first equation.

The test of these three conditions is illustrated in the tables below:

1. The effect of the independent variable (OM) on the dependent variable (HRM):

Table 8: The Path of Direct Influence between (OM) and (HRM)

			Estimate	S.E.	C.R.	P
HRM	<---	OM	1.606	0.072	22.213	0.001

It is clear from table (8) that the independent variable (OM) affects the dependent variable (HRM) by (1.606), which is statistically significant at a significance level less than (0.001), meaning that (OM) affects (HRM), and thus the first condition is fulfilled.

2. The effect of the independent variable (OM) on the mediating variable (KM):

Table 9: The Path of Direct Influence between (OM) and (KM)

			Estimate	S.E.	C.R.	P
KM	<---	OM	2.081	0.069	30	0.001

It is clear from table (9) that the independent variable (OM) affects the mediating variable (KM) by (2.081), which is statistically significant at a significance level less than (0.001), meaning that (OM) affects (HRM), and thus the second condition is fulfilled.

3. The effect of the mediating variable (KM) on the dependent variable (HRM) in the presence of thendependent variable (OM):

Table 10: The Path of Indirect Influence between (OM) and (HRM)

			Estimate	S.E.	C.R.	P
KM	<---	OM	2.081	0.069	30	0.001
HRM	<---	KM	0.675	0.042	16.101	0.001
HRM	<---	OM	0.202	0.103	1.953	0.051

It is clear from Table (10) that the intermediate variable (KM) affects the dependent variable (HRM) by (0.675), with a significance level (0.001), and it is statistically significant at (0.01), meaning that the effect of (KM) on (HRM) statistically significant. Thus, the third condition is fulfilled.

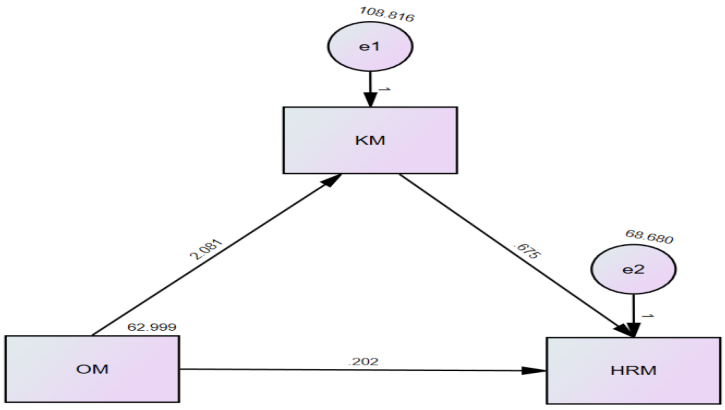


Figure 2: The Mediation Model of the Intermediate Variable (KM) between the Independent Variable (OM) and the Dependent Variable (HRM). In Order to Determine the Type Of Mediation (total or partial)

Many studies like: Aladdin, Y. (2021), Antunes and Pinheiro (2020), Kordab et al. (2020), Al-Saidi, (2020), Almomani et al. (2019), Shabat, j. A., & Al-Masry, N. H. (2020), Dahinen (2017), Saha et al. (2016), Amer, B., & Dahinen (2016), Sudharatna (2015), Vrîncianu et al. (2009), and Karreman (2002) dealt with the subject of knowledge management. However, this study alone linked the knowledge management variable (KM) as an intermediate variable with the independent variable (OM) and the dependent variable (HRM).

It is noted from the results in Table (10) and Figure (2) that the mediating variable (KM) affects the dependent variable (HRM) by (0.675), and it is statistically significant at a significance level less than (0.001). Including the independent variable (OM) in the same model, its effect on the dependent variable (HRM) vanished, and the value of the statistical significance became (0.051), meaning that a statistically significant effect was found at the level of significance (0.001) for the intermediate variable (KM) on the dependent variable (HRM). There is no statistically significant effect at the level (0.05) of the independent variable (OM) on the dependent variable (HRM). Thus, the third condition of the test conditions for the mediation of the mediating variable (building organizational memory) is achieved. The mediation of the intermediate variable (KM) is entirely between the independent (OM) and dependent (HRM) variables.

This means that the direct effect of the independent variable (OM) on the dependent variable (HRM) in the third equation has become less and is not statistically significant than it was in the first equation. Therefore knowledge management is a mediator in the relationship between (OM) and (HRM) in Palestinian higher education institutions. Thus, it is confirmed that knowledge management plays a mediating role between (OM) and (HRM) in Palestinian higher education institutions.

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Vulnerabilities and Knowledge Risks in Knowledge Processes

Andrei Ștefan Neștian and Alexandra Luciana Guță
Department of Management, Marketing and Business Administration, Faculty of Economics and Business Administration, Alexandru Ioan Cuza University of Iași, Romania

nestian@uaic.ro
luciana_guta@yahoo.com

Abstract: This study aims to put forward measuring scales for two central concepts – vulnerabilities and knowledge risks – and identify the factors composing the two constructs. The research presented in this paper is part of a larger project investigating knowledge vulnerabilities and risks appearing in knowledge processes of organizations. In this sense, a new ontology developed by Brătianu et al. (2022) was used to design an instrument for measuring risks and vulnerabilities related to knowledge processes in organizations. Organizational knowledge dynamics perspective (Brătianu et al., 2022) was used to group knowledge risks typologies into the following clusters: knowledge creation, knowledge acquisition, knowledge loss, knowledge sharing, knowledge use, emotional knowledge dynamics, spiritual knowledge dynamics. Examples of knowledge risks belonging to such clusters may include a knowledge risk of non-creation and a knowledge risk of bad timing (for knowledge creation cluster), knowledge spillover or knowledge forgetting (for knowledge loss), as well as knowledge hiding and knowledge hoarding (for knowledge use). Our study fills a gap in the literature by suggesting a scale for measuring knowledge risks and grouping them by factor, and also a scale for measuring vulnerabilities and grouping them by type of vulnerabilty by means of principal components analysis. Current state of knowledge on vulnerabilities and knowledge risks comprises mainly theoretical approaches. Also, most studies do not discuss the concepts of knowledge risks and vulnerabilities together. The main novelty of our study lies in its quantitative approach to analysing knowledge-related vulnerabilities and risks. For this purpose, a questionnaire was applied to a sample of employees comprising both managers and non-managers from Romanian organizations. The factors resulted after having applied the principal components analysis have provided a clearer picture of the constructs of vulnerabilities and knowledge risks, leading to a deeper understanding of knowledge processes and their risks.

Keywords: Knowledge risks, Vulnerabilities, Knowledge processes, Knowledge dynamics

1. Introduction

The concept of knowledge risk has been the topic of several studies over the last three decades (Becerra, Lunnan and Huemer, 2008; Cooper, 2003; Massingham, 2010; Niwa,1989; Scott and Walsham, 2005; Zieba, Durst and Hinteregger, 2022). Its importance is given by the dificulties of pinpointing the invisible mecanisms determining the manifestation of such risks and the practical conditions favouring their occurrence. As knowledge risks are abstract concepts, several taxonomies have been coined over the years. This research is based on the study of Bratianu, Neștian and Guță (2022) that developed a taxonomy of knowledge risks based on the correspondence of knowledge risks with the knowledge processes in which they occur.

2. Literature Review

The theoretical approach is based on the assumption which has been derived from the general theory of risk, stating that each knowledge process containts actions, where knowledge represents the objects of specific processings, such actions taking place in contexts or modes favouring the apperance of knowledge risks that generate specific vulnerabilities in each knowledge process. The study sees knowledge vulnerabilities as the states of organisational knowledge systems that are perceived as triggering or facilitating the appearance of negative consequences in the organization's activity.

This study aims to suggest measuring scales for the concepts of vulnerabilities and knowledge risks and identify the factors of these two constructs. We present an instrument for measuring knowledge risks and vulnerabilities related to knowledge processes using a new ontology of Bratianu, Neștian and Guță (2022) towards knowledge risks based on organizational knowledge dynamics.

This new classification takes into account the dynamics of knowledge value for the firm, namely, how the value of an organization's knowledge may be affected by the presence of knowledge risks grouped by nature of knowledge processes. There is an implicit relation between knowledge processes and knowledge risks, while the nature of processes determines the nature of knowledge risk (Bratianu, Neștian and Guță, 2022).

In this study, the concept of knowledge risk is seen as a particular use of a generic concept of risk in knowledge processes, reflecting situations of negative consequences occurring due to decisions made regarding

knowledge processes under the influence of internal and external factors (Cameron and Raman, 2005; Massingham, 2010; Massingham, 2020; Society for Risk Analysis, 2018).

These concepts were used to develop seven clusters of knowledge risks grouped using a criterion of a relation between knowledge risk and knowledge process: (KC) – knowledge creation risks, (KA) – knowledge acquisition risks, (KL) – knowledge loss risks, (KS) – knowledge sharing risks, (KU) – knowledge use risks, (EKD) – emotional knowledge dynamics risks, and (SKD) – spiritual knowledge dynamics risks (Bratianu, Neștian and Guță, 2022). Several prominent papers in the field of knowledge risks were used to extract the risk typology, each presenting a slightly different knowledge risk typology (Bratianu et al, 2020; Durst and Henschel, 2020; Durst and Wilhelm, 2013; Durst and Zieba, 2017; Durst and Zieba, 2019; Durst and Zieba, 2020; Durst, 2019; Durst, Hintereger and Zieba, 2019; Zieba and Durst, 2018; Zieba, 2017). Also, we have analysed an array of perspectives to knowledge processes (Andreeva and Kianto, 2011; Andrews and Delahaye, 2000; Kraaijenbrink, 2012; Staab et al, 2001) as to suggest a list of knowledge processes to be used in the taxonomy.

The study questionnaire was constructed by utilising the above-mentioned taxonomy, alongside with scale development for knowledge risks and knowledge vulnerabilities.

As for the second concept of knowledge vulnerabilities, we reviewed the literature in the field on risk management. An accepted perspective is that vulnerability is a measure of likelihood for an asset to be attacked successfully by a given threat (Avci and Ozbulut, 2018) that may cause losses or damages. In case of knowledge vulnerabilities, the idea of an attack is not the most suitable perspective. Instead, we may see a threat as an event or context causing loss of knowledge to an organisation.

Vulnerabilities differ from risks as they possess three specific underliyng caracteristics related to the manifestation of knowledge risks. The first characteristic is the *deterministic capacity*, being the root of likelihood of knowledge risks manifestation (Bratianu, Neștian and Guță, 2022). A risk is a potential for loss and damage when a threat occurs. Knowledge vulnerabilities are the weak points of the knowledge system and the knowledge management routines that trigger or facilitate the apperarance of risks, exposing the organisation to threats. These weak points are the determinants of knowledge risks as they initiate the knowledge risks under the pressure of external forces (Bratianu and Bejinaru, 2022; Fuchs, Birkmann and Glade, 2012; Sarawitz, Pielke and Keyhah, 2003). The second caracteristic of vulnerabilities is the *capacity to respond* with a countering action (Marandola and Hogan, 2006). If the system has a vulnerability, the system's capacity to respond, when a risk is manifested, may be hindered. Third, vulnerabilities reduce system's *absorptive capacity*. When a risk is manifested, the presence of a vulnerability is related to a lower capacity of loss prevention or decrease, or recover to a normal state (Marandola and Hogan, 2006).

Starting from the conceptual framework and theoretical meaning of the concept of vulnerabilities, we developed a list of vulnerabilities related to each of the knowledge risks in the taxonomy put forward by Bratianu, Neștian and Guță (2022).

3. Methodology

3.1 Nature of the Study

The nature of our study is exploratory. Current state of knowledge on the concepts of knowledge vulnerabilities and knowledge risks is theoretical, comprising mostly taxonomies of knowledge risks, the literature on this topic being scarce. Our approach is deductive and our research strategy is survey-based, with the use of quantitative methods of analysis (Saunders, Lewis and Thornhill, 2007). The novelty of the study lies in a quantitative approach to the analysis of knowledge-related vulnerabilities and risks.

3.2 The Research Instrument

The instrument is a questionnaire comprising a filter question, a scale for measuring the types of knowledge risks, a scale for measuring the types of knowledge vulnerabilities, three questions at the end of the questionnaire regarding the following: position within the organization (management or execution), length of service within the organization (under one year, between one and five years, over 5 years), the organization's field of activity (open question).

Both scales for the latent variable "type of knowledge risk" and "type of knowledge vulnerability" range from one to five, 1 – total disagreement (the situation is not found in the organization); 2 – disagreement (rarely found in the organization); 3 – neither disagreement, nor agreement (found sometimes); 4 – agreement (frequently found); 5 – total agreement (the situation is curently found in the organization).

The scale for types of knowledge vulnerabilities and knowledge risks contains 21 and 19 items, respectively. Both scales were developed based on vulnerabilities and risks that may be associated with the following seven clusters of knowledge processes: knowledge creation, knowledge acquisition, knowledge loss, knowledge sharing, knowledge use, emotional knowledge dynamics and spiritual knowledge dynamics.

The cluster „knowledge creation" contains the following risk typologies: knowledge risk of non-creation and knowledge risk of bad timing. The cluster „knowledge acquisition" comprises the knowledge risk of not acquiring the necessary knowledge at the required time and knowledge risk of wrong acquisition. „Knowledge loss" contains risks of knowledge loss with the retirement of people, risk of knowledge spillover and risk of knowledge forgetting. „Knowledge sharing" contains the risk of knowledge hiding and knowledge hoarding. The „knowledge use" cluster includes the risk of knowledge attrition when embedding it into products and services; the risk of knowledge waste. „Emotional knowledge dynamics" contains the emotional risk of organizational change and that of changing the managers. „Spiritual knowledge dynamics" comprises spiritual knowledge risk of changing the organzational values system and spiritual knowledge risks, when people work in different cultures in multinational companies (Bratianu, Neștian and Guță, 2022).

The filter question was applied as we were interested in analysing only private companies, and not public institutions or not-for-profit organizations. The survery was conducted online (between 20th and 26th of March 2023) using Google Forms. It helped us eliminate 13 out of 130 answers, which lead to a total of 117 valid questionnaires. To provide answers to all questions and items was mandatory for a questionnaire to be considered complete and then accepted to be sent.

3.3 The Sample

A link to the questionnaire was sent via different online channels (social media, software used in our teaching and research activities, etc.).

Out of a total of 420 people who received the questionnare, 130 respondents completed the questionnaire, 13 not working in private companies. There were 117 valid questionnaires and a valid rate of response of 27.8%.

We were interested in the perspectives of both managers and non-managers: 46.15% and 53.85% of the respondents, managers and non-managers, respectively.

Regarding the length of service in organisations (seniority), 35.04% of the respondents worked for over five years in the organization, 47.01% between one and five years, and only 17.95% under a year. Sample distribution by seniority of 117 respondents in companies strengthens the level of trust in the relevance of respondents' answers, considering that an employee with a longer length of service could know the company better.

As for organizations' field of activity, the sample comprising 117 respondents mentioned such areas as transportation, construction, retail, consultancy, online commerce, outsourcing, construction materials production, banking, drug promotion, automotive sector, real estate, metallurgy, legal sector, information technology, agriculture, medical equipment, marketing and services, finance consultancy, management consultancy, pharmaceutical industry, accounting, evaluation of movable and immovable properties, clinical research, commerce, audit and consultancy, hospitality industry, non-banking financial services – currency exchange, real estate and facilities, human resources, health, consultancy and training, public power supply and energy from renewable sources, sales and education.

3.4 Methods and Techniques Used for Data Analysis

For data processing and analysis, we used Microsoft Excel and Statistical Package for the Social Science (SPSS, version 20). Consistency (reliability) and factor analyses (principal components analysis - PCA) were conducted in SPSS. We have used reliability analysis for determining the internal consistency of the entire instrument (without the nominal scales), the scale for types of knowledge risks and knowledge vulnerabilities, respectively, the results obtained for the constructs' components "type of knowledge risks" and "type of knowledge vulnerability", respectively. PCA was used for extracting the components, also called factors, for each of the two latent variables: knowledge vulnerabilities and knowledge risks. The study also suggests the scales for both latent variables. Since similar quantitative studies have not been found in the literature on the topic, we applied exploratory factor analysis. There were no missing values as all items were mandatory for questionnaire completion and sending. Some items had to be reversed as they were positively or negatively formulated. Since we were measuring the vulnerabilities and risks, we chose to reverse the positively formulated items.

4. Results

4.1 Consistency Analysis

We tested the reliability of the entire questionnaire (only the ordinal scales, withouth nominal variables and open questions) and the reliability of the latent variables "type of knowledge vulnerability" and "type of knowledge risk".

The reliability analysis shows that the instrument and the scales for both latent variables have internal consistency, and therefore are reliable, since all Cronbach Alpha coefficients exceed the value of 0.7 (Hair et al, 2006). The values are shown in Table 1.

Table 1: Consistency Analysis of the Instrument and the Scales

Scale	Cronbach alpha coefficient
Entire instrument (both scaled: 40 items)	0.923
Scale for type of knowledge vulnerabilities (21 items)	0.883
Scale for type of knowledge risks (19 items)	0.856

4.2 Components Resulted for Knowledge Vulnerabilities and Knowledge Risks

The components resulted from principal component analysis for the latent variable "Types of knowledge vulnerabilities" are shown in Table 2 below. In the following table, K means "knowledge", C – "creation", A – "acquisition", L – "loss", S – "sharing" and U – "use". Also, EKD means "emotional knowledge dynamics" and SKD stands for "spiritual knowledge dynamics". The abbreviation "V" stands for the word "vulnerability". The number of each item (for example 2, from KA2_V) is its number in the cluster, as it was included into the theoretical cluster (knowledge acquisition, knowledge creation, etc.). For example, KA2_V is the second item included in the cluster of vulnerabilities related to knowledge acquisition.

Varimax rotation with Kaiser normalization was used. In Table 2, the items are displayed in descending order of their loadings, and only loadings higher than 0.5 are shown. According to Hair et al (2006), only loadings higher than 0.5 have practical relevance.

The solution contains 15 out of 21 items in the scale for knowledge vulnerabilities. Six items were eliminated due to such problems as individual measure of sample adequacy (MSA) lower than 0.5; very few significant correlations with other items; low communalities; loadings on two components (we guided after Hair et al, 2006). The total variance explained by four extracted components is 67.14%.

Table 2: Results for "Types of knowledge Vulnerabilities"

Rotated Component Matrix				
	Component			
	1	**2**	**3**	**4**
KA2_V: To obtain the necessary knowledge, we have ways that are aligned with organizational strategies.	0.818			
KA1_V: We have solutions through which, when necessary, we obtain the knowledge we need in time.	0.812			
KC2_V: We are connected in real time to the challenges / issues in the business environment.	0.658			
KC1_V: We have the capability to create new knowledge when it is needed.	0.649			
KU1_V: The organization has mechanisms through which it pursues access to new knowledge in the field.	0.619			
EKD2_V: Changing managers causes emotional problems for employees, affecting their performance.		0.876		
EKD1_V: Employees are put in situations where they feel strong negative emotions at work, affecting their performance.		0.822		
SKD1_V: The values shared by employees in the organization form a rigid system,		0.762		

Rotated Component Matrix				
	Component			
	1	2	3	4
which can be affected by the change of some of the managers or of the preferred ways of working.				
KL3_V: Sporadic use of some ways of working makes it difficult to remember the details that lead to the most efficient way of accomplishing tasks.			0.738	
SKD2_V: In the organization, there is a chance of occurrence of problems related to a different interpretation of some of the communicated information due to different cultural origin of those involved.			0.684	
KA4_V: Decision-makers are not prepared for some situations that require decision-making.			0.620	
KU3_V: Some employees have skills useful to the organization, which are being neglected.			0.609	
KA3_V: Decision-makers are ignorant of the new knowledge that we need.			0.579	
KS1_V: The organization requires employees to share with colleagues the knowledge they use in their work.				0.856
KS2_V: Employees' current work includes activities that involve sharing knowledge with each other.				0.776
Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization.				

The value of Kaiser-Meyer-Ohlin (KMO) test is 0.835, which indicates that the solution obtained by applying principal components analysis is very good; Sig value of Chi-square (Bartlett's Test of Sphericity) is 0.00, which guarantees us a likelihood of 95% that there are statistically significant correlations between the variables (Pintilescu, 2007).

According to the items loaded on each component and taking into consideration the majority of the items included in each component (Hair et al, 2006), we suggest the following names for the four knowledge vulnerabilities components: component 1 – *vulnerabilities related to knowledge creation and knowledge acquisition* (Cronbach alpha 0.822), component 2 – *vulnerabilities related to emotional and spiritual knowledge dynamics* (0.845), component 3 – *vulnerabilities related to knowledge loss and knowledge use* (0.770) and component 4 – *vulnerabilities related to knowledge sharing* (0.759).

Table 3 includes the results obtained by applying PCA, with Varimax rotation with Kaiser normalization for types of knowledge risks. "R" stands for "risk". Items are displayed in descending order of their loadings; only loadings higher than 0.5 are shown. The solution contains nine out of 19 items in the scale for knowledge risks. We have eliminated 10 items due to such problems as very few significant correlations with other items and / or individual measures of sample adequacy (MSA) lower than 0.5; low communalities. Total variance explained by the three extracted components is 70.95%.

Regarding some problems with corellations and with MSA values, we looked for explanations in the literature. According to Lorenzo-Seva and Ferrando (2021), MSA can highlight two types of problematic items: *noisy* items – items that behave almost randomly, and *redundant* items – the items sharing specific content with the other ones. Based on the exploratory factor analysis, we consider risks related to knowledge sharing to be related to other items in the scale for knowledge risks, and therefore reflecting other types of risks.

Table 3: Results for "Types of Knowledge Risks"

Rotated Component Matrix			
	Component		
	1	2	3
KU1_R: Some knowledge used in my organization is outdated / obsolete as new inventions have appeared.	0.842		
KU2_R: Some knowledge used in my organization is corrupt as we had waited too long	0.839		

Rotated Component Matrix			
	Component		
	1	2	3
before it was used.			
KC2_R: Employees' ideas are sometimes expressed too late compared to the time when they could have been used.	0.636		
KA1_R: We do not sometimes obtain new knowledge in the needed time-frame.	0.615		
EKD2_R: Changing managers led to negative employee emotions, causing further deterioration of the way employees use or make their knowledge available to the organization.		0.863	
EKD1_R: When employees experience strong negative emotions at work, it causes further deterioration of the way they use or make their knowledge available to the organization.		0.827	
SKD1_R: Making changes in the organization's system of values had negative consequences on the way employees used or made their knowledge available to the organization.		0.797	
KA3_R: We sometimes acquire knowledge that is not useful for the needs of our organization.			0.893
KA2_R: We sometimes acquire knowledge „unsuitable" to the needs of our organization.			0.878
Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization.			

The value of KMO test is 0.728, which indicates that the solution obtained by applying principal components analysis is good. Sig value of Chi-square (Bartlett's Test of Sphericity) is 0.00, which guarantees with a likelihood of 95% that there are statistically significant correlations between the variables (Pintilescu, 2007).

We propose the following names for the three components obtained for knowledge risks, in line with the items loaded on each component and taking into consideration the majority of the items included in each component (Hair et al, 2006): component 1 – *risks related to knowledge creation and knowledge use* (Cronbach alpha 0.775), component 2 – *risks related to emotional and spiritual knowledge dynamics* (0.809) and component 3 – *risks related to knowledge acquisition* (0.846).

Figures 1 and 2 below present the components obtained for knowledge vulnerabilities and knowledge risks.

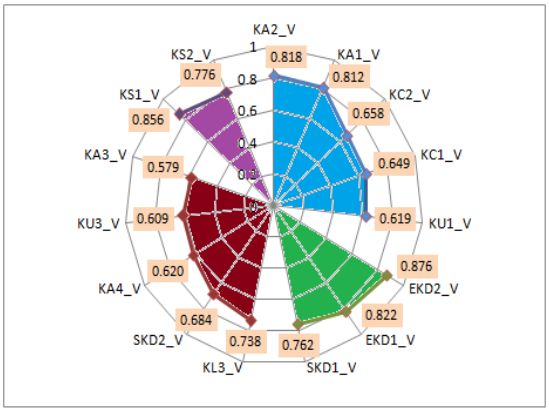


Figure 1: Components for Knowledge Vulnerabilities

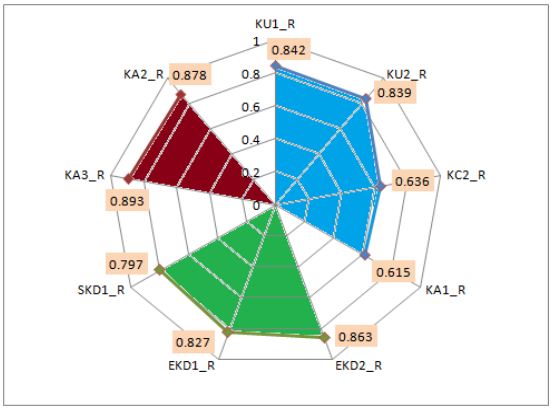


Figure 2: Components for Knowledge Risk

5. Conclusion

This study aimed to suggest measuring scales for knowledge vulnerabilities and knowledge risks and identify the factors composing the two constructs. Thus, a first conclusion is that we can see different associations, both for vulnerabilities and risks, in the grouping of different knowledge processes. For the vulnerabilities scale, knowledge creation grouped together with knowledge acquisition, knowledge loss with knowledge use, emotional and spiritual knowledge dynamics, knowledge sharing resulted by itself in a component. For risks, knowledge creation grouped with knowledge use, emotional and spiritual knowledge dynamics also grouped

together, knowledge acquisition resulted by itself in a component. There are some major differences between the components for each of the two constructs. These differences concerning knowledge-related processes comprise knowledge creation vulnerabilities combining in a single factor with knowledge acquisition vulnerabilities, and knowledge creation risks combining in a single factor with knowledge use risks; knowledge use vulnerabilities combining in a single factor with knowledge loss vulnerabilities, while knowledge use risks combining in the same factor with knowledge creation risks. Knowledge sharing as a knowledge process appears only in the factorial solution for vulnerabilities, being though eliminated from the solution for knowledge risks. Table 4 is a visual representation that compares the results by types of knowledge vulnerabilities and knowledge risks.

Table 4: Comparative Results for "Types of Knowledge Vulnerabilities" and "Types of Knowledge Risks"

Comp. 1	KA2_V
	KA1_V
	KC2_V
	KC1_V
	KU1_V
Comp. 2	EKD2_V
	EKD1_V
	SKD1_V
Comp. 3	KL3_V
	SKD2_V
	KA4_V
	KU3_V
	KA3_V
Comp. 4	KS1_V
	KS2_V

Comp. 1	KU1_R
	KU2_R
	KC2_R
	KA1_R
Comp. 2	EKD2_R
	EKD1_R
	SKD1_R
Comp. 3	KA3_R
	KA2_R

Note: We used different shades of gray to mark different knowledge processes

A potential explanation for the combining of knowledge *loss* and knowledge *use vulnerabilities* in the same factor, and knowledge *creation* with knowledge *use risks*, lies in the fact that when companies have vulnerabilities leading to loss of knowledge, it could also involve vulnerabilities related to knowledge use. Further, this complex vulnerability may correlate with risks related to knowledge use, which may also lead to knowledge creation risks, since it is harder to create new knowledge when organizations have problems related to knowledge use.

Another interesting result is related to the process of knowledge sharing. Regarding vulnerabilities, PCA led us to a factor referred to as vulnerabilities related to knowledge sharing. However, for the factorial solution for risks related to knowledge processes, we decided that it was correct to eliminate the items measuring knowledge sharing, thus the solution for this type of risks does not contain a factor for knowledge sharing. A possible explanation may be the fact that vulnerabilities related to knowledge sharing do not transpose in risks related to the process of knowledge sharing but in risks related to other knowledge processes. However, an alternative explanation may be related to the small size of the sample, which is a limitation of the present study.

Another potential explanation that needs to be cautiously treated (due to sample size and the exploratory nature of the study) is the fact that we may need to rethink some of the items, and reformulate or conceptually reframe them into other clusters than the initial ones (considering the current empirical results).

Althouth it needs further improvement and testing, the proposed scale is a first step in performing a quantitative assessment of risks and vulnerabilities related to knowledge processes in organizations. We believe that the components resulted by applying principal components analysis offer a clearer picture on the constructs of vulnerabilities and knowledge risks, leading to a deeper understanding of knowledge processes and their associated risks.

The results of this study need to be cautiously treated due to the small size of the sample (117 valid responses) and the applied convenience sampling technique. Therefore, future research can include sample extension and a systematic sampling; scale refinement and further testing – exploratory and confirmatory; longitudinal studies for companies interested in knowledge risks and vulnerabilities.

After refinement, the scale will be useful for organizations intending to assess their knowledge vulnerabilities and risks. Correlations between the components of knowledge risks and knowledge vulnerabilities, as well as the calculation of means for each component could offer valuable information for taking managerial decisions.

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Exploring the Intersection of Knowledge Management and Spirituality in Higher Education Institutions

Carla Neves, Raysa Rocha and Paulo Pinheiro
NECE Research Center in Business Sciences, University of Beira Interior, Covilhã, Portugal

carla.teixeira.neves@ubi.pt
geaquinto.rocha@ubi.pt
pgp@ubi.pt

Abstract: Higher Education Institutions (HEIs) have the fundamental role of teaching, research, and interaction with society, which are the three main vertices in the creation and dissemination of knowledge. HEIs can enhance their sustainability and competitiveness by effectively managing the knowledge of each collaborator and creating more value. In this way, HEIs lay the foundation for sustainable growth and extend their competitive advantages. However, it requires motivated and committed collaborators aligned with the mission, values, and objectives of the organization. Therefore, we suggest that the incorporation of spirituality can promote innovation, organizational sustainability, and increase knowledge management practices. To address the research gap on the integration of KM and spirituality in HEIs, we conducted a literature review using three databases, Web of Science, Scopus, and EBSCO. The review revealed that the integration of KM and organizational spirituality has not been studied in an integrated way. As such, we present suggestions for future research and practice, emphasizing the need for HEIs to focus on managing knowledge and incorporating spirituality into their practices to enhance their competitiveness and sustainability. Accordingly, this study contributes to the literature by awarding and discussing KM and spirituality as two key components of HEIs. Once, incorporating spirituality can promote innovation, organizational sustainability, and increase knowledge management practices. Moreover, this study provides valuable insights for HEIs to improve their management practices, promote sustainability, and enhance their competitive advantages.

Keywords: Knowledge management; Knowledge management practices, Spirituality, Organizational spirituality, Education, Higher education institutions

1. Introduction

Knowledge is seen as a key source of competitive advantage within an organization (Feiz et al., 2019; Dei and Van Der Walt, 2020) , as it provides new opportunities and enables problem solving (Feiz et al., 2019). In this way, and in this knowledge society all organizations operate in a global economy that is characterized by intense competition, economic interdependence and collaboration (Van Laar et al, 2017). Thus, organizations are increasingly humanized and dedicated to determining values at the individual and organizational levels. In this sense, Knowledge Management (KM) is an important topic for organizations and specifically for Higher Education Institutions (HEIs), whose continuous improvement strategy involves achieving international standards of quality and excellence, which is only achieved if they practice an effective KM (Moscoso-Zea and Lujan-Mora, 2017).

However, rational knowledge is not enough to ensure that appropriate decisions and actions are taken for organizations to achieve the competitiveness they desire (Rocha and Pinheiro, 2021). In this way, and so that HEIs fulfill their function of contributing to the economic and sustainable development of any country (Madboulya et al., 2021; Roopaa and Gopinath, 2021) it is important to integrate spirituality, since it inspires innovation, enhances productive work, emotional intelligence, employee involvement and loyalty (Alomar et al., 2022). That is, in HEIs, an environment marked by spirituality is favorable to the creation of knowledge, which on the one hand promotes efficient knowledge management and on the other hand enhances trust and promotes sharing (Shahzadi, 2017).

This paper aims to analyze the state of the art of research on KM and spirituality in HEIs. The objectives are to identify existing literature that addresses KM and spirituality in HEIs and to analyze the practices of KM and spirituality in HEIs present in the literature. By achieving these objectives, this work aims to contribute to the understanding of how HEIs can effectively manage knowledge and enhance their competitiveness by integrating spirituality.

2. Insights on Knowledge Management and Spirituality in HEIs

As IHEs represent the highest level of learning and education, as education has as its main focus the student as a whole, with all their facets and dimensions, from intellectual to professional, psychological, moral, and spiritual dimensions (Kassaye, 2018). They are the places where students develop in various areas and where research is

promoted. In other words, they are a community of people committed to studying, to research, in a place that is a universal source of knowledge (Kassaye, 2018). Similarly, they also seek to instill confidence in individuals, in order to increase their motivation, and thereby improve organizational capacity, opportunities to learn and acquire knowledge to obtain positive results (Dei and Van der Walt, 2020).

Moreover, IHEs are one of the few places where knowledge is used by all employees. They are responsible for the production and transfer of knowledge, so they must have a greater concern for knowledge management (Asiedui et al, 2022; Saleh et al, 2018). Rowley (2000) points out that the norms, values, and practices associated with the creation, sharing, and dissemination of knowledge in IHEs are complex, so in line with knowledge management, organizational spirituality also has strategic importance. These should encourage the spirituality of their employees, motivating them to deal with their own knowledge (Lakshmi and Das, 2021). Although IHEs have not yet explored these themes in depth, as other organizations have done (Ramachandran et al, 2009; Ojo, 2016; Marouf and Argarwal, 2016; Lakshmi and Das, 2021; Asiedui et al, 2022), we see from the analysis carried out that there is already a concern with knowledge sharing and with existing knowledge management practices in IHEs. However, with regard to spirituality, this is not so evident.

Organizational spirituality is often considered when discussing the organizational culture of IES. Also, spiritual intellectual capital is interpreted as encompassing the spiritual values of the organization, including adaptability, commitment, motivation, trust, responsibility, respect, justice, receptivity, integrity, mutualism, benevolence, humanism, and generativity (Jurkiewicz and Giacolone, 2004). These values, in order to be efficiently practiced, must be present in the organizational culture and serve as drivers of proactive, entrepreneurial, and creative behavior capable of leading to innovation and sustainability. Furthermore, IHEs with a more dynamic organizational culture advocate an atmosphere where all employees feel truly integrated, where everyone identifies with their fellow collaborators. If different employees have the capacity for acceptance, a spirit of collaboration, and a sense of responsibility, then we are faced with a voluntary environment for sharing knowledge.

Nevertheless, little attention has been given to the connection between organizational spirituality, that is, an organizational culture marked by higher order values focused on individual well-being, the well-being of others, and knowledge management (Khari and Sinha, 2018). To be effective, spirituality needs to be integrated into the organizational culture and reflected in everyday organizational practices. And this is only possible if the administration and the administrative council adopt it as part of their vision, so that its benefits grow for employees and the organization (Dandona, 2013). That is, organizational spirituality is influenced by the environment, organizational culture, mission, vision, and organizational values (Rocha and Pinheiro, 2020). Likewise, Shahzadi (2017) points out that IHEs that possess an environment marked by spirituality are conducive to the creation of knowledge, promote trust among team members, which increases knowledge sharing.

3. Research Design

We conducted a systematic literature review to address our research goals. A literature review article provides a comprehensive view of the literature related to a topic, identifies current knowledge as well as existing gaps at the research level (Paul and Criado, 2020). The procedure is shown in Figure 1.

4. Analysis of the Results

In this section, we report an in-depth analysis of the systematic review outcomes to provide a comprehensive view of the latest findings and insights regarding KM and spirituality in IES. Through our analysis, we identify the most valuable findings and trends in the literature and offer critical insights that can inform future research and practice. Overall, the research includes themes as spiritual knowledge and intellectual capital in HEIs. A compilation of the research, considering spirituality and KM in HEIs in provided below in Table 1.

Saad and Haron (2013) conducted a qualitative study with a sample of 15 academics to explore and describe the types of knowledge shared among academics in a public university in Malaysia. The authors adopted Van den Hooff and De Ridder's (2004) definition of knowledge sharing as "a process where individuals mutually exchange their knowledge and together create new knowledge" (p. 118). They concluded that categorizing/classifying knowledge is extremely important for Higher Education Institutions (HEIs), particularly as academic knowledge producers, as it facilitates the process of capturing, using, sharing, and retrieving the knowledge necessary for faculty.

They found that academics share three types of knowledge: corporate knowledge, social knowledge, and codified knowledge. (i) Corporate knowledge pertains to the organization's core activities and management

procedures, including disciplinary knowledge (knowledge of the discipline and research) and operational knowledge (knowledge of the institution's policies and practices). Social knowledge refers to knowledge related to shared beliefs, ethics, norms, culture, values, entertainment, national political affairs, and common interests, with prevailing knowledge of culture, spiritual knowledge, hobby knowledge, and common interest knowledge. Finally, (iii)codified knowledge is shared electronically (photos, videos, conference slides) and/or in writing (research articles, lecture notes, tutorials, books, among others) (Saad and Haron, 2013).

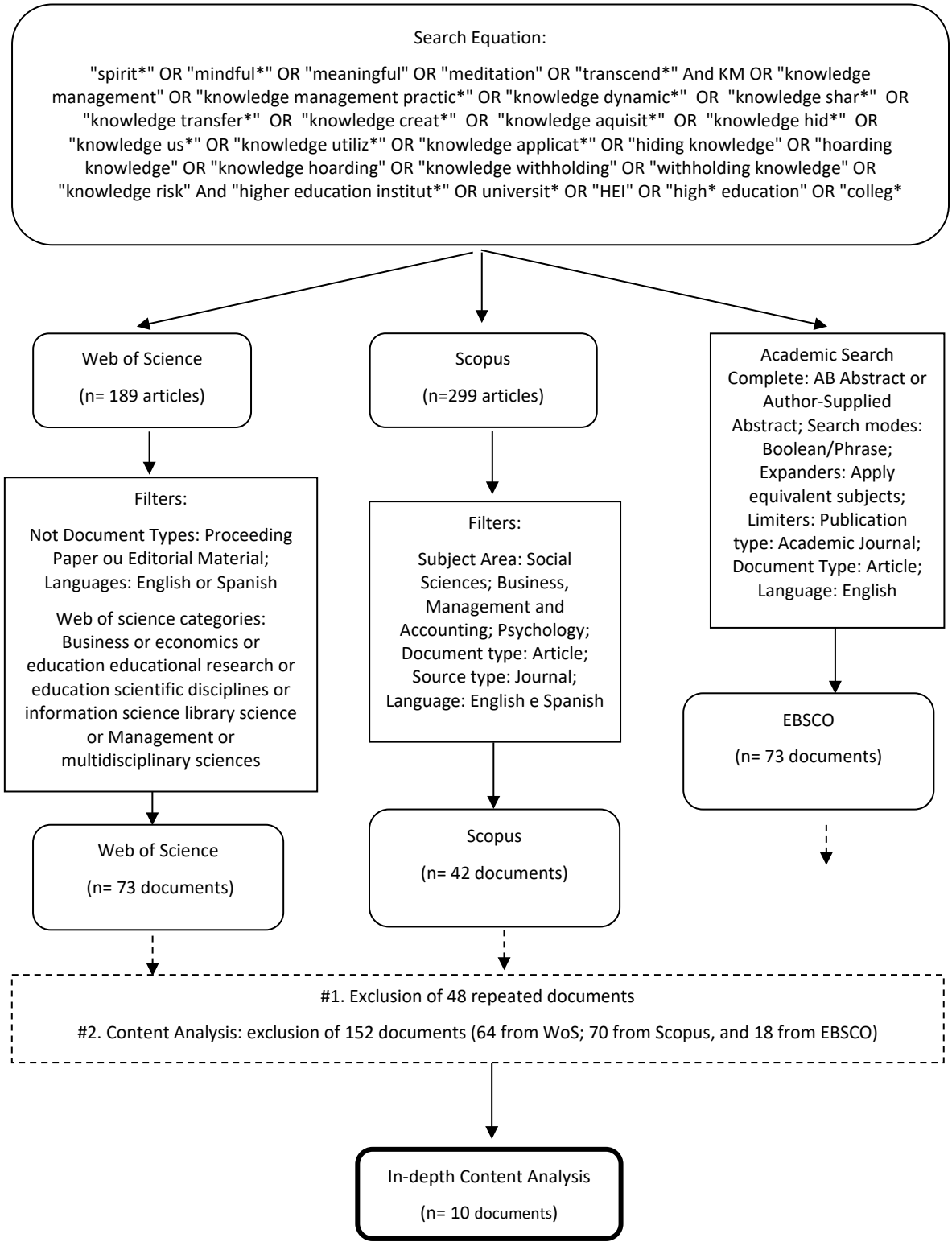


Figure 1: Structure of the Systematic Literature Review

Feiz et al. (2019) conducted a study on the effect of knowledge sharing on the psychological empowerment of faculty members at an Iranian university. They distributed three questionnaires to 350 faculty members and found that knowledge sharing positively affects psychological empowerment and organizational memory. The authors suggest that planning for knowledge sharing among faculty members can improve resource management and develop knowledge-based skills. They also encourage universities to incentivize knowledge sharing to increase confidence, effectiveness, and productivity among faculty members.

Nawaz et al. (2020) emphasize the importance of a systematic knowledge management approach in universities due to their role in creating and transferring knowledge and dependence on and vulnerability to knowledge erosion. Their study focuses on knowledge management practices in Europe, Asia, and the Gulf Cooperation Council countries, analyzing perception, gathering, creation, sharing, dissemination, and retention of knowledge. Using a quantitative methodology and a sample of professors, the authors conclude that there are similarities between most of the practices analyzed, except for knowledge gathering and retention, where considerable differences exist. Furthermore, the authors suggest the need for integrated knowledge management systems in universities.

Leon and Vătămănescu (2015) explores how storytelling is used as a knowledge strategy among faculty members in Romanian HEI. The qualitative study involved 29 professors who were selected through snowball sampling, based on their two-year professorship and professional experience in the private sector. They highlight the critical role of human and structural capital in knowledge creation, acquisition, and sharing, and recommend storytelling as an easy-to-implement and cost-effective knowledge strategy.

The authors propose storytelling as a knowledge strategy that is easy to implement and has lower costs compared to other strategies. Storytelling involves the sharing of various types of knowledge, such as cognitive, emotional, and spiritual. Cognitive knowledge encompasses an understanding of the work environment by transmitting tacit and explicit knowledge based on shared mental models. Emotional knowledge enables employees to know what others expect of them, promoting cultural adaptation, while spiritual knowledge transmits norms and values from generation to generation, allowing employees to internalize organizational culture and stimulate its adaptation. Storytelling allows faculty members to share their experiences inside and outside the classroom, demonstrating availability and openness to hearing their colleagues' experiences.

In sum, the study by Leon and Vătămănescu (2015) highlights the importance of leveraging storytelling as a knowledge strategy in HEIs. This strategy has the potential to bridge the gap between explicit and tacit knowledge by creating a platform for knowledge sharing, thus promoting innovation and strategic renewal. It is crucial for HEIs to recognize and prioritize storytelling as an effective knowledge strategy to unlock the full potential of their intellectual capital. By doing so, they can cultivate a culture of collaboration and learning that fosters the development of a knowledge-based society.

Bejinaru (2017) and Bratianu and Bejinaru (2017) propose a new construct of intellectual capital structure using the multi-field theory of knowledge and the concept of non-linear integrators. They identify knowledge strategies that can increase intellectual capital in HEIs. The authors introduce three new categories of intellectual capital: rational, emotional, and spiritual. They suggest that HEIs should focus on analyzing emotional and spiritual intellectual capital.

The authors propose four knowledge strategies that can increase intellectual capital. These strategies include creating knowledge through a rewards system to encourage research, sharing knowledge to increase operational intellectual capital, acquiring new knowledge from external sources, and exchanging knowledge within a university network through the exchange of students and faculty. The goal is to identify and overcome barriers to knowledge sharing in order to improve university strategies and increase intellectual capital. However, they also suggest that further research is needed to understand the impact of these strategies on intellectual capital and to develop ways to implement them in HEIs according to their mission and vision (Bejinaru, 2017; Bratianu and Bejinaru, 2017).

Bratianu and Vătămănescu (2018) provided a new approach of the entropic knowledge dynamics and investigate the impact of the decision-making process. Through a quantitative methodology using a survey of 700 management and business administration students, they present the multifield theory of the knowledge based on the energy metaphor of knowledge. They attribute to the three forms of energy: mechanical, thermal, and electric, the three forms of knowledge: rational, emotional, and spiritual. The entropic dynamics of knowledge assumes that these three forms of knowledge are in continuous interaction, and any one of them can transform into any form of knowledge. In this context, for Bratianu and Vătămănescu (2018), the decision-making process

is not purely rational but results from the contributions of rational, emotional, and spiritual knowledge, as well as the entropic dynamics of each of these. The authors' findings suggest that the decision-making process should consider the entropic nature of knowledge, as it could lead to more effective decisions.

Pavlidou et al. (2021) address concerns about business education, which often focuses on instructional design and individual disciplines rather than developing students' holistic knowledge and long-term employability skills. The authors draw on the domain of knowledge management and dynamic knowledge theory to approach business education as a dynamic field of knowledge composed of three forms of interaction: rational, emotional, and spiritual knowledge, following the work of Bratianu and Bejinaru (2019a) and Bratianu and Bejinaru (2019b). Moreover, Pavlidou et al. (2021) emphasize that hybrid learning environments stimulate different aspects of rational, emotional, and spiritual knowledge due to the diversity of learning modes and sources, which guides teachers to use knowledge structure as a guide to assess student experiences. Therefore, it is crucial to understand the dynamics of knowledge and to consider its role as an essential force in business education, which challenges traditional teaching methodologies.

Power and Handley (2019) developed an interdisciplinary model of best practices in UK HEIs with a focus on teaching, learning, and the student experience. This model brings together six enablers that promote interdisciplinarity: (i) Positioning: Interdisciplinarity should be positioned outside the curriculum, which allows for the reduction of disciplinary barriers and removes some knowledge niches; (ii) People: Authentic leadership and selection of support group members; (iii) Environment: Spaces, resources, and infrastructures; (iv) Rewards: Target measures, talent management, incentives, and clarity of impact; (v) Conduct factors: Mutual respect, intellectual fusion; and (vi) Communication: Articulation in terms of benefits, values, impact, challenges, barriers, and facilitators of interdisciplinarity. However, the authors consider that more research is needed to validate this model, including integrated research that allows for an understanding of the implications of this model within British HEIs involving all stakeholders and also the commercial sector so that interdisciplinarity progresses.

Alwaheeb et al. (2020) provide a comprehensive review of studies that explore the relationship between organizational commitment and knowledge sharing in order to develop a conceptual framework that links these two concepts in HEIs. The analyzed literature reveals a lack of evidence on how organizational commitment influences knowledge sharing in the context of HEIs in Malaysia. In other words, there is still a gap in knowledge sharing in HEIs that could be filled if institutions motivate knowledge-sharing behavior and promote it (Alwaheeb et al., 2020). Likewise, the authors suggest that academics need to focus on increasing the level of organizational commitment to improve knowledge-sharing behavior, as well as workplace spirituality, which will ultimately enhance the effectiveness and performance of HEIs. However, according to the authors, there may be other organizational factors that can influence knowledge sharing, and these should be examined in future studies (Alwaheeb et al., 2020).

Table 1: Knowledge Management Practices and Spirituality Dimensions.

Studies	Knowledge Management	Spirituality
Alwaheeb et al. (2020)	Knowledge Sharing	Workplace
Bejinaru (2017)	Knowledge Creation, Sharing, Acquisition	Individual and Workplace
Bratianu and Bejinaru (2017)	Knowledge Creation, Knowledge Sharing, Knowledge Acquisition	Individual and Workplace
Bratianu and Vătămănescu (2018)	Knowledge Creation, Sharing, Acquisition	Individual and Workplace
Feiz et al. (2019)	Knowledge Sharing	Individual
Leon and Vătămănescu (2015)	Knowledge Creation, Sharing, Acquisition	Individual and Workplace
Nawaz et al. (2020)	Knowledge Creation, Sharing, Perception, Collection; Dissemination, Gathering	Workplace
Pavlidou et al. (2021)	Knowledge Creation, Sharing	Individual and Workplace
Power and Handley (2019)	Knowledge Sharing	Individual
Saad and Haron (2013)	Knowledge Sharing	Individual and Workplace

5. Discussion

The presented analysis of the results explored the relationship between KM and spirituality in HEIs providing valuable insights. It highlights the need for systematic knowledge management approaches to manage and transfer knowledge effectively, thereby improving resource management and developing knowledge-based skills. The study also emphasizes the critical role of human and structural capital in knowledge creation, acquisition, and sharing, and recommends storytelling as an easy-to-implement and cost-effective knowledge strategy that promotes innovation and strategic renewal. The proposed knowledge strategies, including creating knowledge through a rewards system, sharing knowledge to increase operational intellectual capital, acquiring new knowledge from external sources, and exchanging knowledge within a university network, can increase intellectual capital in HEIs, but further research is needed to understand their impact and to develop ways to implement them according to mission and vision.

The outcomes indicate that most authors do not examine organizational spirituality and KM together in HEIs. However, Leon and Vătămănescu (2015) present storytelling as a knowledge-sharing strategy, indicating that through it, educators share rational, emotional, and spiritual knowledge. In contrast, Bejinaru (2017), Bratianu and Bejinaru (2017), and Bratianu and Vătămănescu (2018) integrate these two constructs into their work. When presenting the main knowledge strategies to increase the potential of HEIs and operational intellectual capital, they refer to KM practices that interconnect with spiritual intellectual capital.

Furthermore, it is observed that Bejinaru (2017) and Bratianu and Bejinaru (2017) address the main knowledge strategies for increasing the potential of IES and operational intellectual capital, which are related to knowledge management practices. Therefore, it can be inferred that they are among the few authors who, in the same work, articulate the two constructs: knowledge management and organizational spirituality. Bejinaru (2017) and Bratianu and Bejinaru (2017) emphasize the importance of emotional and spiritual knowledge in knowledge creation, as they contribute to a culture that encourages research efforts and stimulates new ideas in science, technology, and business. This perspective aligns with the idea that knowledge management and organizational spirituality should be viewed in an integrated manner. Organizational spirituality may serve as the primary motivator for employees to act on their individual capacity to increase organizational effectiveness and reinforce knowledge management tools and techniques (Lakshmi and Das, 2021). Thus, spirituality serves as the foundation for ethical and committed behavior within and outside of HEIs.

The theoretical and practical contributions of this literature review are significant. The review highlights the importance of knowledge management and spirituality in HEIs and provides evidence that HEIs must adopt a culture that supports knowledge dynamics. The findings of this review have important implications for policymakers, educators, and researchers who are interested in the effective functioning of HEIs. Policymakers should pay more attention to the organizational culture and leadership style in HEIs to ensure that these institutions can promote knowledge dynamics effectively. Additionally, educators should be encouraged to share their knowledge and experiences, and researchers should be supported in their efforts to explore the complexities of knowledge management and spirituality in HEIs. Furthermore, the results of this analysis have significant implications for the effective functioning of HEIs and can be used to inform future research in this area.

6. Conclusions

HEIs face intense competition and rapidly changing behaviors. To thrive, HEIs must decide between a more creative, dynamic, and collaborative approach that enhances their longevity and competitiveness or a more passive and stagnant one. Implementing coherent and interconnected knowledge management and spirituality practices is a path they must undertake to choose the former option. Thus, to assess the state of research on KM and spirituality in HEIs, we conducted a study using three databases. We aimed to determine whether the literature integrates these two themes and to identify the most focused KM and spirituality practices in the literature.

Effective KM in HEIs is crucial, as it allows us to gauge how knowledge can be created, shared, transferred, stored, and reused to achieve organizational goals. Thus, it is essential to analyze the KM practices used in HEIs. However, research on such practices in isolation are insufficient. Thus, it is important to incorporate the concept of organizational spirituality, which can lead to a better organizational climate and greater sustainability. Both constructs should work together rather than in separation. Unfortunately, most authors do not integrate these concepts in their analysis. Therefore, KM and organizational spirituality should be studied together, as they feed into each other, resulting in a more beneficial outcome for HEIs. Leaders should promote effective KM and

develop practices that contribute to a work environment guided by spiritual values. Our analysis also revealed that this area remains relatively unexplored, despite its potential importance in the future of HEIs.

Notwithstanding of the research contribution, it has limitations, namely, the small number of documents analyzed. Thus, it is necessary for example, to search in other databases and try other search terms.

In conclusion, our study emphasizes the importance of integrating KM and organizational spirituality in HEIs. Doing so can lead to a more competitive and sustainable institution. However, further research is necessary to better understand how to effectively integrate these concepts into HEIs.

7. Future Research Avenues

The current literature on the integration of KM and spirituality in HEIs has several research gaps. Future research suggestions can enhance understanding of the integration of KM and spirituality in HEIs and its influences. Hence, this research offers valuable contributions to the literature, and offering below insights and recommendations for future research and practice.

Firstly, future studies should focus on the identification and analysis of the relationship between spiritual knowledge and intellectual capital in HEIs. For example, to provide a deeper understanding of the relationship between spiritual knowledge and intellectual capital would be beneficial in facilitating the creation, utilization, sharing, and transfer of knowledge in HEIs.

Secondly, future studies should examine the role of leadership in promoting the integration of KM and spirituality in HEIs. Leaders can play a crucial role in fostering a culture of spirituality and knowledge sharing in organizations. Therefore, research should investigate the characteristics of effective leaders in HEIs who facilitate the integration of KM and spirituality, as well as the potential barriers to this integration.

Thirdly, future research could explore the impact of cultural differences on the integration of KM and spirituality in HEIs. HEIs operate in a globalized world, and each country has its cultural and social specificities, which may impact the integration of spirituality and KM. Hence, comparative studies between different countries could provide insights into the cultural and institutional factors that affect the integration of KM and spirituality in HEIs.

Finally, future studies should investigate the impact of KM and spirituality on the well-being and job satisfaction of employees in HEIs. Given the importance of well-being and job satisfaction in organizational performance, it would be valuable to explore how the integration of KM and spirituality could contribute to these outcomes.

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