Proceedings of the
23rd European Conference on Knowledge Management

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



VOLUME ONE

Edited by

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

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Proceedings of the

23rd European Conference on Knowledge Management ECKM 2022

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University of Naples Parthenope and
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ECKM Preface

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

ECKM is now a well-established event on the academic research calendar and now in its 23rd year the key aim remains the opportunity for participants to share ideas and meet the people who hold them. The scope of papers will ensure an interesting two days. The subjects covered illustrate the wide range of topics that fall into this important and ever-growing area of research.

The opening keynote presentation is given jointly by Prof. Manlio Del Giudice, Linked Campus University in Rome, Italy and Prof Armando Papa, the University of Teramo, Italy. The second day of the conference will open with an address by Dr Omid Haass, RMIT University, Australia, who will talk about *Exploring the application of digital twin as an enabler in knowledge management*.

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

We hope you enjoy the conference.

Prof Piera Centobelli
University of Naples Federico II

Prof. Roberto Cerchione
University of Naples Parthenope
Italy
September 2022

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Salem, Faculty of Computer and Information Sciences, Ain Shams University, Cairo, Egypt; Dr Kalsom Salleh, Faculty of Accountancy, University

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

Biographies

Conference and Programme Chairs



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



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

Keynote Speakers



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



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

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



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

Mini Track Chairs



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



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



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



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

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



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



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



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



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



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



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

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



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



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



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



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



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

Biographies of Contributing Authors

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Techniques and technologies for managing COVID-19 related Knowledge: A Systematic Review

Wala Abdalla[1], Suresh Renukappa[1], Subashini Suresh[1] and Khaled Algahtani[2]
[1]Faculty of Science and Engineering, University of Wolverhampton, UK
[2]Ministry of Justice, Riyadh, Kingdom of Saudi Arabia
W.abdalla@wlv.ac.uk
Suresh.Renukappa@wlv.ac.uk
S.Subashini@wlv.ac.uk
khmghtani@moj.gov.sa

Abstract: Managing COVID-19 pandemic outbreak requires rapid responses, adapting to change, and developing a set of ongoing, systematic, and interrelated processes to improve the planning, treatment and controlling the pandemic. Knowledge management (KM) is considered one of the instruments that helps organizations and supports managers in making effective use of key resources and in identifying actionable problem-solving knowledge and practice. Thus, it is vital to conduct appropriate KM activities to facilitate effective decision-making efforts., Advanced technologies have made significant contribution to improving the KM processes and provided several tools and mechanisms to enable and facilitate knowledge capturing, sharing, and transfer. With this in mind, the aim of this paper is to explore the techniques and technologies used for managing COVID-19 related knowledge. The findings are in the main, based a systematic review of literature. The findings report on the importance of KM techniques and technologies for managing COVID-19 related knowledge. The study concluded that KM techniques and technologies played vital role during COVID-19 in facilitating distance working/ learning, combating "infodemic", promoting knowledge share and transfer, facilitating collective /innovation, and in facilitating remote mentoring and training. Social media platforms (e.g., Twitter, Facebook, WhatsApp, etc.), Zoom, MS Teams, Virtual Meeting, Video Conferencing, as well as Email and knowledge maps are among the most used knowledge management techniques and technologies used to manage COVID-19 related knowledge. The paper concludes that to gain competitive advantage, it is necessary for organisations to recognise and use a blend of information and communication technology (ICT) and non-ICT-based KM techniques and technologies. KM techniques and technologies roles are not mutually exclusive, and organisations may adopt any combination of them to tackle their particular issues or support particular motives. Therefore, it is recommended to deploy and combine the simple, low cost, and easy to use with minimum training needs KM techniques and technologies.

Keywords: COVID-19, Knowledge management, knowledge creation, knowledge sharing, techniques, technologies, tools

1. Introduction

The COVID-19 pandemic is the biggest challenge humanity has faced since the Second World War (Al-Omoush et al., 2020; Ahmad Qadri et al., 2021). COVID-19 pandemic has affected all the human activities and has evoked an era of agility (Anwar et al., 2022). Managing a pandemic is a complex task. However, pandemics' devastating effects can be actively shaped and mitigated by managers, through right and timely decisions (Ammirato et al., 2021). Ahmad Qadri et al., (2021) noted that as the Coronavirus has necessitated organizations to learn rapidly and to develop new ways of functioning. According to Tovstiga and Tovstiga (2021), COVID-19 has produced a perfect knowledge storm. Ammirato et al., (2021) noted that decisions are critical to manage the spread of the pandemic, and the effectiveness of these decisions depends upon the capacity to create, share, collect, transfer, and elaborate knowledge, that is by an effective and efficient process of knowledge management (KM) in pandemics. Therefore, the pandemic poses a unique challenge to knowledge research and practice (Tovstiga and Tovstiga, 2021). Al-Omoush et al., (2020) noted that the Resource-Based View (RBV) theory affirms that firms need to use their physical, human, and organizational assets, both tangible and intangible, to maintain their competitiveness. Within the view of the RBV, knowledge, as an intangible asset is one of the most important sources of proactiveness. Almatrooshi et al., (2021) highlighted the importance of knowledge as a critical factor of succeeding with the process of minimizing the damages caused by diseases such as COVID-19, EBOLA or SARS. The authors noted that this is where knowledge-based organizations benefit from KM techniques and technologies. The authors noted that an organization with a good KM infrastructure will have the advantages as it was noticeable that they were more flexible and faced less issues with the sudden changes that happened with the pandemic of COVID-19 (Almatrooshi et al., 2021). According to Casalegno et al., (2021),

researchers in the management and communication literature have argued that inefficiencies in communication and knowledge sharing, especially in emergency and crisis situations, can cause and intensify the knowledge gap among audiences, which can then lead to misbehaviours. Moreover, Al-Omoush et al., (2020) noted that great efforts are being made to research COVID-19 and the effect of the pandemic on business from different perspectives (e.g., human resources perspective, innovation, entrepreneurship, and consumer behaviour change). Although the evident importance of KM to face pandemics, the KM of pandemics is not a unitary and coherent topic within the scientific landscape of KM (Ammirato et al., 2021). Moreover, the current literature shows limited evidence of the role of KM techniques and technologies used to achieve effective KM procedures during the COVID-19 pandemic. There is no work which explores the synergy of the three aspects i.e., COVID-19 pandemic, KM, and techniques and technologies. Therefore, the aim of this paper is to explore the usage of KM techniques and technologies in managing COVID-19 related knowledge.

2. Theoretical background

2.1 Knowledge management

According to Canzano and Grimaldi (2012), in the last years, KM has become one of the most considerable topics both in literature and in practice. Similarly, Sytnik and Kravchenko (2021) noted that during the last decades, the global economy has been facing a transformation from the era based on natural resources to the era of knowledge, in which knowledge has become a strategic asset and a dominant enabler of organizational development, performance, and competitiveness. According to the knowledge-based view (KBV) of the firm, knowledge is seen as the most strategically important intangible asset of organizations and a critical source of competitive advantage (Davenport and Prusak, 1998; Nonaka and Takeuchi, 1995; Sytnik and Kravchenko 2021). In a globalizing and competitive industry, companies need to manage knowledge efficiently in order to succeed. They need to develop precise plans and to provide managerial guidelines, in order to make the available knowledge proper of the organization. KM practices have been shown to improve organizational performance, organizational innovation, and open innovation (Bhatt, 2001; Acharya et al., 2022). According to Sytnik and Kravchenko (2021), nowadays, KM is generally recognized as a profound factor of economic development, innovations, competitiveness, long-term organizational survival, and sustainability. Črešnar et al., (2019) noted that KM as a concept has a wide range of definitions across the range of different functions where it is applied. Acharya et al., (2022) noted that KM, a concept referring to the creation, sharing, and storage of knowledge, focuses on individuals acquiring new knowledge, a team collaborating for innovation, and organizations learning for better performance. Črešnar et al., (2019) argued that KM activities, which include generating, gathering, disseminating, applying, and storing knowledge, are critical for organization's success in innovation. Sytnik and Kravchenko (2021) noted that the vital necessity to manage organizational knowledge in a more effective manner has been giving an impetus for rapid development of KM concepts, models, and tools. Moreover, Črešnar et al., (2019) noted that nowadays, dynamic business environment is increasingly dependent and based more on high technology, which brings with it a high demand for knowledge and innovation. With rapid digitalization and constant globalization, companies and even entire economies are becoming increasingly knowledge based (OmotayoČrešnar et al., 2019). Furthermore, Bhatt (2001) noted that researchers and academics have taken different perspectives on KM, ranging from technological solutions to the communities of practices, and the use of the best practices. For example, information technology (IT) is believed to provide an edge in harvesting knowledge from piles of data repositories, consisting of point of sales, customer credit cards, promotional sales, and seasonal discount data (Bhatt, 2001). However, Bhatt (2001) contend that knowledge resides in human minds and, therefore, employee training and motivation are the key factors to KM. Therefore, technologies and social systems are equally important in KM.

2.2 Techniques and technologies for effective KM implementation

Renukappa et al., (2017) noted that tools are usually required to facilitate KM. The authors argued that, just as it can prove difficult to arrive at a single definition of KM, firm definitions of KM tools can also prove elusive owing to the lack of consensus regarding what constitutes a KM tool. Canzano and Grimaldi (2012) stated that technology plays a fundamental role at every step of the KM system and it is one of the main features characterizing KM. However, KM is not simply a matter of Information and communication technology (ICT) tools. Technology constitutes only a single aspect of the whole set of KM initiatives (Canzano and Grimaldi, 2012). Črešnar et al., (2019) noted the generally accepted differentiation between two main strategic focuses in KM. First strategies (ICT strategies) are explicit oriented and can also be referred as codified strategy or system strategy. Second strategies (personalization/ human strategies) are tacit oriented and focused on interpersonal relationships. With these strategies, knowledge is managed with techniques focusing on people and their

interaction rather than on ICT (Črešnar et al., 2019). Renukappa et al., (2017) noted that not all tools are IT based but much emphasis is placed on the electronic tools due to their dynamic capabilities, quick evolution, and organisational impacts. Egbu, et al., (2005) noted that non-IT tools are termed as KM techniques and the IT tools termed as KM technologies. Massingham (2014) noted that the term 'KM technologies' refers to information technology-based tools and 'KM techniques' refers to non-information technology-based tools. Moreover, Davenport and Prusak (1998) assert that KM tools are more than information technology it is about the people who add value by transforming static data into meaningful information and knowledge by mixing it with their own experience and interpretations. Massingham (2014) suggests that the terms 'KM tools' and 'KM techniques' are interchangeable and believe that KM techniques are simply the means through which knowledge is managed using tools. Table1 summarises the key differences between KM techniques and technologies.

Table 1: Key differences between KM technologies and techniques

KM Technologies	KM Techniques
• Based on explicit knowledge	• Grounded on tacit knowledge
• Involves IT infrastructure and know-how	• People-based
• Can be difficult to set up and maintain	• Easy to set up and maintain
• Expensive to set up and maintain	• Relatively cheap to set up and maintain

Source: (Massingham, 2014).

3. Methodology

The aim of this study is to explore the usage of key KM techniques, and technologies for managing COVID-19 related knowledge. The study follows a systematic literature review (SLR) to achieve this aim, which can be defined as a tool to identify, evaluate, and interpret available and relevant studies regarding a particular research question (Kitchenham, 2004). A research literature review is a: "systematic, explicit, and reproducible method for identifying, evaluating, and synthesizing the existing body of completed and recorded work produced by researchers, scholars and practitioners" (Castaneda et al., 2018). Systematic reviews differ from ordinary literature surveys in being formally planned and methodically executed. They are intended to be independently replicable, and so have a different type of scientific value than ordinary literature surveys.

The critical, or integrative, review approach aims to assess, critique, and synthesise the literature on a research topic in a way that enables new theoretical frameworks and perspectives to emerge. The method used in this study followed that proposed by Tranfield et al., (2003) with three stages: planning the review, conducting the review, reporting, and disseminating the results. Thus, the first stage is planning the review, which involves the core aspects of the systematic review protocol, developing a list of keywords, and criteria for the inclusion of articles, as well as defining the search string to be given in input to the data source. A university's library search engine, which gives access to various databases including Science Direct, Scopus, TRID, Web of Science, and Wiley Online Library, was used to complete an online search. To this aim, we identified and then, combined a number of keywords, namely 'COVID-19', or 'coronavirus' or 'pandemic' and 'knowledge management' or 'KM', and 'tools', 'techniques', and 'technologies.' Thus, the resulting search string is ['COVID-19' OR 'coronavirus' or 'pandemic' AND 'knowledge management' OR 'KM' AND 'tools' OR 'techniques' AND/ OR 'technologies'], to search the titles, abstracts and keywords of available articles. In reference to the inclusion criteria, a strict selection criterion for the inclusion of studies was developed in order to provide the best quality evidence. Articles were reviewed according to their relevant subject. In particular, the articles must be published in peer-reviewed journals, which were available online within the time frame between December 2019 and April 2022 (to ensure relevance to COVID-19), written in English and had relevance with respect to the research aim (see Table 2 for the selected articles). These choices are justified by the fact that those inclusion criteria may assure the identification of the most relevant articles related to the topic under investigation (Natalicchio et al., 2017).

The second stage involved carrying out the review of relevant articles and selection procedure. The initial search resulted in a total of 829 records. These records were then screened and reduced to 342 by applying the inclusion criteria - i.e., subject area, English language and available online. The articles were then 'eye-balled' to ensure they were consistent with the keyword search, the abstracts assessed against the research aim, and duplicates removed. The total number of articles was reduced to 57. The full text of the selected articles was read to determine the relevance with respect to the aim of the study and the results were reduced down to 24 articles. Finally, these 24 articles were reviewed, categorised and analysed (see Table 2). Finally, reporting and dissemination are considered in the third phase. This stage involved critically documenting and presenting the results from the selected articles analysis.

Table 2: techniques and technologies for managing COVID-19 related knowledge LR findings

Reference	Title	Source title	Focus	Methodology	Country	Discussion
Al-Omoush et al., (2020)	Impact of social capital and collaborative knowledge creation on e-business proactiveness and organizational agility in responding to the COVID-19 crisis.	Journal of Innovation & Knowledge	Collaborative knowledge	Online survey	Jordan	Explores the role of social capital in response to COVID-19 crisis.
Buheji and Buhaid (2020)	Capturing accumulated knowledge and learning of COVID-19 pandemic from Front-Line nurse.	HR Management Research	Accumulated knowledge	LR	Bahrain	Investigates nurses accumulated COVID-19 knowledge and how to deal with it.
Dal Mas et al., (2020)	Knowledge translation in oncology. A case study.	Electronic Journal of KM	Knowledge translation (KT)	Case study	UK	Claims that an effective KT enhances knowledge transfer, share, creation and innovation.
Xie et al., (2020)	The information impact of network media, the psychological reaction to the COVID-19 pandemic, and online knowledge acquisition: Evidence from Chinese college students.	Journal of Innovation & Knowledge	Network media information	Survey	China	Investigates impact of COVID-19 network media information on online knowledge acquisition of college students.
Ahmad Qadri et al., (2021)	How to improve organizational performance during Coronavirus: A serial mediation analysis of organizational learning culture with knowledge creation.	KPM	Organisational learning	Questionnaire	Malaysia	Explores how knowledge creation and organizational culture can facilitate organizational performance during COVID-19.
Ayoub et al., (2021)	Combat COVID-19 infodemic using explainable natural language processing models.	Information Processing & Management	Infodemic	Natural language processing model	USA	Detecting and combating infodemic/ misinformation
Bharadwaj et al., (2021)	A review on the role of machine learning in enabling IoT based healthcare applications.	IEEE Access	ML	LR	India	Reviews various state of the art applications of ML algorithms currently being integrated with H-IoT.
Bratianu & Bejinaru (2021)	COVID-19 induced emergent knowledge strategies.	KPM	Emergent KS	LR	Romania	Compares characteristics of emergent knowledge strategies (KS) and deliberate KS.
Casalegno et al., (2021)	COVID-19 in Italy and issues in the communication of politics: bridging the knowledge-behaviour gap.	KM Research & Practice	Communication/ KBGs	Longitudinal methodological approach	Italy	Discusses the role of the institutional communication of politics during emergencies.
Ammirato et al., (2021)	Knowledge management in pandemics. A critical literature review.	KM Research & Practice	KM in pandemics	LR	Italy	Aims to point out the state-of-the-art of management literature on KM of pandemics.
Edghiem et al., (2021)	Covid-19 transition, could Twitter support UK Universities?	KM Research & Practice	Social media platforms	Conceptual FW	UK	Explores the use Twitter to share Covid-19 related knowledge.
Saide and Sheng (2021)	Knowledge exploration–exploitation and information technology: crisis management of teaching–learning scenario in the COVID-19 outbreak.	Technology Analysis & Strategic Management	Knowledge exploration & exploitation	SLR	Taiwan	Provides a holistic view of knowledge transfer and ICT scenario in education during COVID-19.
Singh et al., (2021)	Knowledge sharing in times of a pandemic: An intergenerational learning approach.	KPM	Knowledge sharing	LR/ PRISMA	India	Argues that intergenerational learning is a useful intervention to address the challenge of

Reference	Title	Source title	Focus	Methodology	Country	Discussion
						knowledge sharing in the NWoW.
Tovstiga and Tovstiga (2021)	COVID-19: a knowledge and learning perspective.	KM Research & Practice	'Conscious–competence'	'Conscious–competence' FW	UK	Attempts to make sense of the pandemic from a knowledge perspective.
Tran et al., (2021)	Social media insights during the COVID-19 pandemic: Infodemiology study using big data	JMIR Medical Informatics	Social media	LR	Vietnam	Aims to understand public attention toward the pandemic through social media platforms.
Wang and Wu (2021)	Knowledge management based on information technology in response to COVID-19 crisis	KM Research & Practice	KM in CM	LR	Taiwan	Presents a set of operational guidelines for healthcare organisations by means of effective KM practices
Abdalla et al., (2022a)	An evaluation of critical knowledge areas for managing the COVID-19 pandemic.	JKM	Knowledge mapping	SLR	UK	Knowledge mapping represents a great opportunity to create value, facilitate collaboration, knowledge share and transfer.
Abdalla et al., (2022b)	Managing COVID-19-related knowledge: A smart cities perspective.	KPM	Smart cities & KM	SLR	UK	Suggests that the increased adoption of smart cities strategies supports knowledge capture, acquisition, sharing, and transfer.
Acharya et al., (2022)	Managing information for innovation using knowledge integration capability: The role of boundary spanning objects.	IJ of Information Management	Knowledge Integration	Questionnaire	USA	suggests that relational obstacles could be resolved through a common knowledge.
Al-Omoush et al., (2022)	Networking and knowledge creation: Social capital and collaborative innovation in responding to the COVID-19 crisis.	Journal of Innovation & Knowledge	Social capital	Questionnaire	Jordan	Social capital has played a significant role in responses to the COVID-19 crisis
Anwar et al., (2022)	A Tacit-Knowledge based Requirements Elicitation Model Supporting COVID-19 Context.	IEEE Access	COVID-19 Elicitation model	SLR	Pakistan	Aims at identifying the requirements elicitation techniques and challenges supporting COVID-19 Context.
Dias et al., (2022)	Revisiting Small-and Medium-Sized Enterprises' Innovation and Resilience during COVID-19: The Tourism Sector.	J Open Innovation: Technology, Market, & Complexity	SMEs innovation & resilience	Questionnaires/ interviews	Portugal	Emphasizes innovation and resilience as the starting points to understand how SMEs are influenced by external factors.
Naqshbandi & Jasimuddin (2022)	The linkage between open innovation, absorptive capacity and managerial ties: A cross-country perspective.	Journal of Innovation & Knowledge	Open innovation	Questionnaire	Brunei	Show mediating effect of perceived absorptive capacity in relationship of external managerial ties and open innovation.
Tomé et al., (2022)	Knowledge management and COVID-19: Technology, people and processes.	KPM	Technology, people & processes	LR	Portugal	Analyse impact of Covid-19 in organizations from KM perspective

4. Findings and discussion

4.1 General observations

The first step in the analysis of the selected articles was to classify them by date of publication. Half of the articles are published in 2021 (n=12, 50%), one third of the articles included in this review are published in 2022 (n=8, 33%), and around one sixth of the articles are published in 2020 (n=4, 17%). Leading authors are affiliated with institutions in Europe (n=5), UK (n=5), USA (n=2), and Asia (n=12). Regarding the academic journals, the articles

included in this review are published in various academic journals including: Knowledge and Process Management (n=5), Knowledge Management Research & Practice (n=5), Journal of Innovation & Knowledge (n=4), IEEE Access (n=2), Journal of Knowledge Management (n=1), Journal of Open Innovation: Technology, Market, and Complexity (n=1), International Journal of Information Management (n=1), JMIR Medical Informatics (n=1), Human Resource Management Research (1), Electronic Journal of knowledge management (n=1), Information Processing & Management (n=1), and Technology Analysis & Strategic Management (n=1).

4.2 Importance of knowledge management during COVID-19 pandemic

Wang and Wu (2021) noted that in times of crisis such as in the time of the COVID-19 pandemic, where rapid responses are required, it is vital to conduct appropriate KM activities to facilitate effective managerial efforts. Sytnik and Kravchenko (2021) noted that KM provides integration of some organizational processes like planning, organizing, motivating, and controlling of employees, designed, and used systematically to ensure effective employment of an organization's knowledge-related assets. Tomé et al., (2022) noted that the distinctive feature of the current crisis is that the COVID-19 crisis is about knowledge and information and can only be understood in the scope of the knowledge economy and the society of information. Ammirato et al., (2021) noted that decisions are critical to manage the spread of the pandemic, and the effectiveness of these decisions depends upon the capacity to create, share, collect, transfer, and elaborate knowledge, that is by an effective and efficient process of KM in pandemics. Additionally, the absence of reliable information on the novel coronavirus has shown the extent to which "we don't know what we don't know" (Tovstiga and Tovstiga, 2021; Bratianu and Bejinaru 2021). Thus, Bratianu and Bejinaru (2021) noted that the COVID-19 crisis proved that we are managing in an uncertain world. KM may contribute significantly to reduce the overall uncertainty by focusing knowledge dynamics on knowledge sharing, organizational learning, increasing network knowledge flow, and an influx of consumers' knowledge (Bratianu and Bejinaru, 2021). Moreover, building specific COVID-19 pandemic inter-regional knowledge could facilitate more effective response strategies in the future, especially when dealing with such aggressive infections (Buheji and Buhaid, 2020; Ammirato et al., 2021).

Additionally, the current literature has extensively investigated how collaborative knowledge creation provides businesses with a basis for proactive actions in a complex and uncertain environment (Al-Omoush et al., 2020; Ammirato et al., 2021; Ahmad Qadri et al., 2021; Sytnik and Kravchenko, 2021; Buheji and Buhaid, 2020). Sytnik and Kravchenko (2021) noted that since collective knowledge exists throughout the employees' interaction process, rather than in their minds or databases, social factors such as communication and collaboration play a vital role in the utilization and coordination of knowledge resources. However, communication is badly affected due to the restrictions in COVID-19 scenario. During COVID-19 pandemic, the interference in concentration of employees has caused serious challenges and brought problems in sharing tacit knowledge (Anwar et al., 2022). Moreover, limited shared knowledge and understanding arise because of the differences in individuals' functional specialization, hindering their efforts to collaborate (Acharya et al., 2022; Naqshbandi and Jasimuddin, 2022). Therefore, Anwar et al., (2022) noted that many organisations deployed a variety of communication channels and collaborative tools to overcome communication challenges. However, lack of proper training on how to efficiently use such tools created significant communication gaps between the analyst and stakeholder. Thus, Singh et al., (2021) noted that to solve the emerging challenges facing effective KM in the current COVID-19 crisis, organizations find creative ways to promote knowledge sharing among their workforces.

4.3 The role of KM techniques, and technologies for managing COVID-19 related knowledge

The findings emphasises the role of digital technology in the COVID-19 pandemic response management (Drew et al., 2020; Abdalla et al., 2022b). Moreover, ICTs provided various tools that facilitate KM procedures during COVID-19 pandemic (Alomari et al., 2021; Abdalla et al., 2022a). ICT based tools and social media platforms (e.g., WhatsApp, Twitter), MS Teams, Video Conferencing, virtual communities, Virtual Meeting, instant messaging, and mobile applications are considered key sources for knowledge capturing and knowledge sharing during COVID-19 pandemic (Alomari et al., 2021). Similarly, Drew et al., (2020) noted that mobile phone applications and web-based tools facilitate self-guided collection of population-level data which can be rapidly redeployed to inform participants of urgent health information. In addition, during and post-COVID-19 pandemic the use of online video conferencing tools, webinars, Zoom, Skype and Microsoft Teams enabled distance-working, facilitated knowledge sharing between employees (Acharya et al., 2022; Tomé et al., 2022).

On the other hand, the World Health Organization announced a massive "infodemic" that made it difficult to find trustworthy and reliable sources of information (WHO, 2020; Ayoub et al., 2021). Ayoub et al., (2021) noted

the widespread and dissemination of false and misleading information about COVID-19 and that it is even promoted by famous public figures, including celebrities and politicians. "Infodemic" can intensify or lengthen outbreaks when people are unsure about what they need to do to protect their health and the health of people around them (WHO, 2020). However, KM techniques and technologies - especially with the growing digitization and the expansion of social media - provided various opportunities in detecting and combating COVID-19 related misinformation. For example, according to Ayoub et al., (2021), it was reported that by April 2020 Facebook removed more than fifty million posts related to COVID-19 since they were classified as misinformation. Other big social media companies, including Google and Twitter, also removed scammers of ads related to face masks, hand sanitizers, and manipulative posts related to COVID-19 (Ayoub et al., 2021). Moreover, Ammirato et al., (2021) highlighted the role of media in the management of pandemic and how it contributes to effective knowledge transfer. Dal Mas et al., (2020) noted the emergence of several knowledge translation and KM tools and techniques. The authors highlighted those technological tools allow to translate and share data and knowledge in a more accessible and standardised way. Moreover, electronic medical records are used to store data and share information both internally and also with external professionals. Xie et al., (2020) highlighted the role of social media in promoting knowledge sharing and acquisition during COVID-19. During the early months of the pandemic, social media platforms (e.g., Facebook) were the main source for public information and engagement instead of official COVID-19 government sites (Xie et al., 2020; Tran et al., 2021).

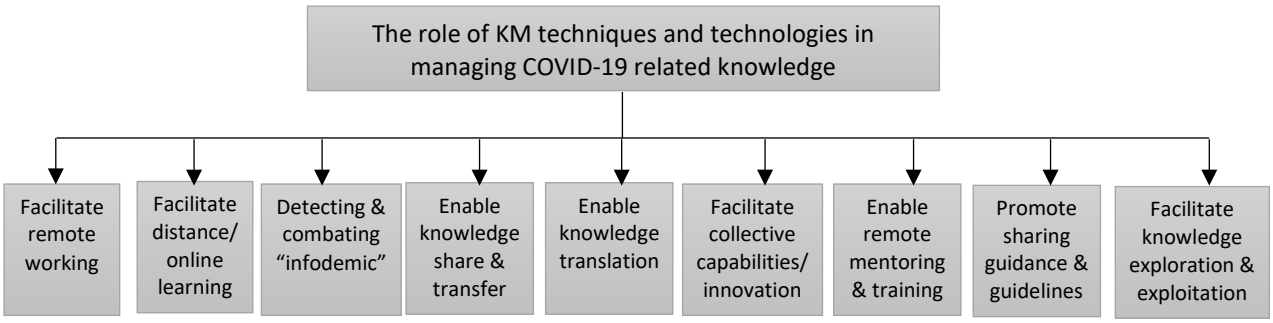


Figure 1: Summary of the findings on the role of KM techniques and technologies in managing knowledge related to COVID-19 pandemic

Nevertheless, the finings revealed the role of KM tools in promoting knowledge exploration and exploitation to and, thus, facilitating online learning during COVID-19 pandemic. For example, social media platforms (e.g., Facebook, Twitter, etc.), Zoom, Google meet, MS Teams, YouTube, video conferencing, and email are among the most important KM tools that support knowledge exploration process in the times of crisis such a COVID-19. Whilst electronic document management systems, e-journals, e-books, Moodle, and knowledge portal are amongst the KM tools adopted to support knowledge exploitation (Saide and Sheng, 2021; Ahmad Qadri et al., 2021; Acharya et al., 2022). Furthermore, Al-Omoush et al., (2022) noted that social capital has played a significant role in responses to the COVID-19 crisis. The developments in collaboration environments enabled by the advance of digital technologies have created KM tools fundamental to the development and enhancing social capital, collective intelligence and collaborative capabilities (Al-Omoush et al., 2022; Buheji and Buhaid, 2020). Edghiem et al., (2021) noted that social media platforms such as Twitter facilitate communication in institutions and bridge the space between their boundaries and online communities. Additionally, Singh et al., (2021) noted that excessive formal training interventions may not be effective within the COVID-19 situation when a large segment of the workforce is working remotely. The authors highlighted the role of intergenerational learning programs (IGL) in facilitating training and mentoring especially in a time of uncertainty such as that of the current COVID-19 pandemic. Thus, KM techniques and technologies may be deployed to facilitate IGL programs during COVID-19. Moreover, Abdalla et al., (2022a) highlighted the role of Knowledge maps in promoting KM procedures sharing during COVID-19. Knowledge mapping represents a great opportunity to create value by bringing stakeholders together, facilitating comprehensive collaboration and facilitating broader in-depth knowledge sharing and transfer.

5. Conclusion

Knowledge is a fundamental resource for an organisation. KM is perceived as the deliberate and systematic coordination of employees, technology, processes, and organizational structure so as to add value through knowledge use, reuse and innovation (Tomé et al., 2022). Therefore, organizations need to develop and deploy robust strategies, of strategically oriented tools, techniques, and technologies to successfully manage

knowledge (Tomé et al., 2022). Technology becomes the main knowledge transmission vehicle within the firm, enabling the right integration between KM and the organization. ICT has provided organizations with fast, high quality, and reliable information systems, which enable the re-usage of codified knowledge (Črešnar et al., 2019). ICT helps support knowledge sharing, quality decisions, and internal organizational links (Canzano and Grimaldi, 2012). ICT enabled KM tools are rapidly changing and there are a lot of IT or KM system features to facilitate and maximise knowledge acquisition, share, and transfer in times of crisis such a COVID-19 (Saide and Sheng, 2021). During the times of COVID-19, IT enabled KM tools (e.g., network, technology platform, repositories, and firewall) represented a critical asset that facilitates KM activities and prevents healthcare professionals from being infected by the virus (Wang and Wu, 2021). The findings revealed various KM techniques and technologies deployed during COVID-19 pandemic. Social media platforms (Facebook, Twitter, WhatsApp, etc.), Zoom, Google meet/ classroom, MS Teams, YouTube, video conferencing, Edmodo, Moodle, knowledge maps, and email are among the most important KM tools that support KM process in the times of crisis such a COVID-19. Mentorship programmes, communities of practice, advisory groups, systematised learning, and comprehensive repositories of tools and resources have also been identified as putting knowledge into practice techniques to facilitate the management of COVID-19 pandemic (Ammirato et al., 2021). The findings indicate that during COVID-19 pandemic, KM techniques and technologies played significant role in facilitating remote working, facilitating distance/ online learning, detecting and combating "infodemic" , promoting knowledge share, transfer, and translation, facilitating collective capabilities/ innovation, facilitating remote mentoring and training, promoting sharing guidance and guidelines, and in facilitating and promoting knowledge exploration and exploitation. Organizations should consequently adopt knowledge-oriented ICT infrastructure. However, it is recommended that ICT based tools are adopted and combined with processes and structures. Both conventional and modern KM techniques and technologies could enable effective KM during COVID-19 pandemic. Therefore, to gain competitive advantage, organisations should recognise and use a blend of ICT and non-ICT based KM techniques and technologies. This literature review set out to provide an understanding of the use of KM techniques and technologies to manage knowledge related to COVID-19 pandemic. This research provides a basis for future empirical research on the role and importance of KM techniques and technologies in managing COVID-19 pandemic.

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Knowledge Transfer in Doctoral Education During the Pandemic Time: An Exploratory Study of the PhD Students' Experiences

Rocco Agrifoglio[1], Paola Briganti[1], Maria Ferrara[1], Maria Luisa Iavarone[1], Rocco Reina[2], Luisa Varriale[1] and Anna Maria Melina[2]
[1] University of Naples Parthenope, Naples, Italy
[2] Magna Graecia University of Catanzaro, Catanzaro, Italy
rocco.agrifoglio@uniparthenope.it

Abstract. The research aims to explore how PhD students interacted with professors and peers and transferred knowledge during pandemic time. We firstly aim to provide an overview of communication media used by students, as well as to classify them for different kinds, social presence, and media richness. Furthermore, our research also aims to explore how doctoral students took their courses by interacting with professors and with peers, in terms of learning (KT) and social exchange relations (LMX, TMX, POS), through online learning platforms and communication media. We conducted exploratory research on 25 PhD students from 5 Italian PhD Programs in 'economic and statistical sciences' area. Data was collected through (a) the focus group interview with PhD students for collecting their opinions and experiences on the usage of media for communicating with professors and peers and (b) an online questionnaire aimed to measure their experiences or perceptions on technology usage and social relations. Results shown that PhD students used e-learning platform for communicating with peers and professors, so developing good social relations -even at a distance- which have encouraged knowledge transfer among them.

Keywords: Knowledge transfer; doctoral education; LMT; TMX; POS; media richness; social presence

1. Introduction

The Covid-19 pandemic has created numerous problems in doctoral education, and above all for face-to-face PhD courses, encouraging the adoption of online learning platforms to enable students to take course remotely. It has also profoundly limited the social interactions between students and professors and between students (peers), pushing them to experience new ways of communication and sharing of knowledge through using communication media.

Although previous research based on social perspective to investigate KT in education, still little attention was paid to the links between social relations, communication media, and KT when the pandemic occurred.

The research aims to explore how PhD students interacted with professors and peers and transferred knowledge during pandemic time. We firstly aim to provide an overview of communication media used by students, as well as to classify them for different kinds, social presence, and media richness. Furthermore, our research also aims to explore how doctoral students took their courses by interacting with professors and with peers, in terms of learning (KT) and social exchange relations (LMX, TMX, POS), through online learning platforms and communication media.

We used a mixed method to explore the PhD students' experiences. We conducted exploratory research on 25 PhD students from 5 Italian PhD Programs in 'economic and statistical sciences' area. In particular, data was collected through (a) the focus group interview with PhD students for collecting their opinions and experiences on the usage of media for communicating with professors and peers and (b) an online questionnaire aimed to measure their experiences or perceptions on technology usage and social relations.

Results provided useful insights for research on KT in doctoral education and for PhD programs' coordinators involved in definition of teaching methods and training programs that are more suitable for sharing knowledge through social relations' improvement and technology usage.

2. Literature review

We reviewed the literature on media richness, social presence, and social exchange dimensions, such as Perceived Organizational Support (POS), Leader-Member Exchange Theory (MX) and Team-Member Exchange Theory (TMX).

Media richness theory describes how various communication media carry the intended information and the symbolic information with respect to the intended message and the sender: features of a communication media, such as the capacity to allow quick feedback, provide multiple cues, use language variety, and the perception of personal focus, determine the richness of the media (Shepherd & Martz, 2006; Daft et al., 1987).

Face-to-face is the richest form of communication media, reducing equivocality more efficiently than telephone, instant messaging, written, addressed documents (email, memo, letter), unaddressed documents (fliers, bulletins, and reports), progressively lower in social presence and media richness scales (Daft et al., 1987).

Face-to-face communication can transmit facial expressions, body language, gestures, proximity, and non-verbal cues and is therefore the highest in social presence and media richness: all other communication media are compared to face-to-face, and in many ways are adapted or designed to be more like face-to-face communication to find ways to make up for the medium's lack of richness.

Specifically, media richness theory was developed in the 1980s by organizational scholars with the use of electronic communication media, such as email (Daft, Lengel, & Trevino, 1987; Daft & Lengel, 1986, 1984). The theory identifies the matching between the richness of a medium and the equivocality of task as the main source of successful use of a communication channel or medium: the effective information processing in organizations is significantly related to uncertainty and equivocality reduction, respectively thanks to adequate quantity or amount of information to reduce uncertainty, and appropriate quality or richness of information to reduce the confusion or the lack of understanding (equivocality). For instance, using a media communication technology tool such as email, the technological medium can transfer a large amount of information to reduce uncertainty, but equivocality reduction could be a problem, because of the lack of nonverbal cues featuring mediated communications.

Media richness theory describes the "richness" of a communication channel based on the presence of four criteria: immediate feedback, multiple cues, language variety, and personal focus. Basing on this theory, face-to-face represents the richest medium, followed by phone, written addressed document (e.g., letter, email, and text chat), and unaddressed document (e.g., flyer). Effective manager selects medium with higher richness features, such as face-to-face, in presence of higher levels of equivocality of the task, and lower rich medium, such as lean unaddressed documents, for unskilled tasks.

Media richness theory has been applied in interpersonal, educational, and organizational contexts (Ishii et al., 2019).

In the interpersonal context, mobile devices have changed communication in the development of friendship relationships. The increase of channel options (webcam, instant messaging, texting and social media, face-to-face communication tools) is giving pressure to users on what way to transmit a message to another individual is morally or socially appropriate (Pettegrew & Day, 2015). Duration of the interaction causes positive effect of happiness just using face-to-face; testing, phoning, emailing people reported no relationship between duration of interaction and happiness (Vlahovic, Roberts, & Dunbar, 2012). However, referring to voice chat, Kwak (2012) highlights the role of communicator media use: theoretically voice chat is a richer channel than text-based chat, because let communicator to actively reduce equivocal communication of information, but if the answers don't give immediate feedback, the richness of the medium decrease and uncertainty and equivocality risk to damage the relationship.

Liu and Yang (2016) stated that mobile phones use, that would expect immediate responses, facilitate immediate communication in close friendships, more than social networking sites, and also instant messaging services on these sites, used for less intimate relationships. On the other hand, specifically the adolescents perceive instant messaging relatively rich, despite media richness theory, and they like more asynchronous channels to apply advanced tool of "presentation control", which should transfer the portray of a desirable image, by filtering or regulating information in messages, pictures, and videos: the use of a theoretically lower rich medium could better control the quality of communication, and, consequently, the quality of friendship relation (Sheer, 2010).

Furthermore, mobile learning is an important, growing topic of interest in the educational context: the main findings showed that each channel had advantages in different areas (Lan & Sie, 2010). To analyze the successful transfer of information in mobile educational programs, the authors compared three media in terms of accuracy

and adaptability criteria of the media richness theory: Really Simple Syndication (RSS), email, and short message service (SMS). email resulted as the content richest medium, letting significant quantities of detailed information; on the other hand, SMS or text messaging presented more advantages in terms of timelines; finally, RSS, which could instantly inform the subscribers the information updates, was superior in terms of accuracy and adaptability, and the most appropriate for mobile-learning device.

Lan, Hung, and Hsu (2011) provided images, multiuser function, and life-like quality simulations (rich online condition writing tasks), text-based with the option for the participants to perform suggested word searches (lean online condition), verbally led by an instructor with pen and paper directions (theoretically richest face-to-face condition), to compare motivation, anxiety, and enjoyment of writing tasks among elementary students in two levels of a computer mediated classroom (rich and lean), and in a traditional classroom: instructions transferred through rich and lean mediated channels enhanced higher levels of motivation and enjoyment, and lower levels of anxiety in the participants. The rich online classroom was the best choice for students to become happy successful writers.

Balaji and Chakrabarti (2010) analyzed the role of online discussion forums in a traditional face-to-face course. Despite the leaner characteristics of online discussion, it resulted a more successful approach, in terms of effective interactivity and better student performance, than the traditional lecture-only style of face-to-face discussion, by taking technological advantages of each channel. in Furthermore, research showed that communication with theoretically rich media, such as face-to-face, as highlighted by the study of many online courses, may not always produce positive outcomes in terms of students' motivation, satisfaction, and performance (Cole, 2016).

Finally, in the organizational context, successful collaboration among team members resulted significant to achieve organizational goals today often through online collaboration. Some authors (Aritz et al., 2018) studied teams which collaborated using multiple-media communication channels (email, Google Docs, Facebook, texting, phone calls), and insider preference for certain channels and communicative tools. File sharing, web conferencing, messaging, phone was grouped into four categories, basing on their features: for instance, Google Docs and email were grouped into the channel that let to have file sharing capabilities; texting and instant messaging were categorized as messaging class. Well-coordinated teams were able to use richer channels, that allowed immediate feedback (web conferencing and phone), than poorly coordinated teams.

Constantly evolving technology has been enriching "lean" media in multiple ways and transforming communication, highlighting the need to revise media richness theory as showed by inconsistent above results from empirical studies, concerning today seeking gratification technology-driven advanced communication contexts (Ishii et al., 2017).

Moreover, social presence is defined as "the extent to which one feels the presence of a person with whom one is interacting" (Latchman & Latchman, 2000; p. 559), and "the feeling one has that the other persons are involved in a communication exchange" (Carnevale, 2000; p. 188). The degree of social presence is caused by the communication medium and more channels or cues are available in the medium, more attention is paid to the other participants in the communication (Chen & Wein, 2020; Kuyath & Winter, 2006; Walther, 1995).

Organizations are constituted by an interconnected system of social exchange relationships between leaders, subordinates, and coworkers (Sparrowe & Liden, 1997; Sparrowe & Liden, 2005). In particular, in organizations there are two focal social exchange relationships, the individual with leaders (LMX), and individual with team (TMX) (Liao et al., 2010).

LMX was derived from social exchange theory and role theory, and refers to the relationship between an individual and his or her leader (Herman et al., 2018; Bernerth et al., 2016; Wayne et al., 1997): when leaders and subordinates are able to develop mature leadership relationships, mutual trust, respect, congruent values, and affection (in-group perception), the quality of this dyadic relationship positively affects leader and individual attitudes and behaviors, especially the levels of performance (Chen et al., 2018; DeConinck, 2009; Graen & Uhl-Bien, 1995). Employees of the in-group tend to contribute more than the literal job description, while "out-group" workers only perform the routine tasks required by the leaders, because of a lower perceived quality of LMX characterized by policies, formal rules and authority (Tsay et al., 2014; Graen & Scandura, 1987).

TMX represent a theoretical extension of LMX, and, in particular, while LMX focuses on the vertical relationships between leaders and subordinates (Banks et al., 2014), TMX refers to the quality of horizontal relationships among the members of the team, in terms of satisfaction with coworkers and perceptions of cohesiveness, individual's willingness to share ideas, feedback and help other members in a team, in turn, receiving recognition, assistance and information from other members (Farh et al., 2017; Banks et al., 2014; Tsay et al., 2014; Seers et al., 1995; Seers, 1989).

According to organizational support theory (OST) workers develop a general perception concerning the extent to which the organization values their contributions wiht equity and cares about their well-being (perceived organizational support, POS) (Kurtessis et al., 2017; Eisenberger & Stinglhamber, 2011; Shore & Shore, 1995; Eisenberger et al., 1986). The main antecedents of POS, identified by literature, are fairness, human resource practices, and supervisor support; the major consequences are affective organizational commitment, job satisfaction, and job performance (Riggle et al., 2009).

3. Methodology

This study adopts a multi-method approach by combining qualitative approaches, such as focus group and interviews, and quantitative approach, such as the sample survey.

Indeed, according to the most relevant contributions in the literature, combining both qualitative and quantitative methods can really contribute to investigate phenomena still underrepresented. On one side, qualitative research, largely based on inductive reasoning, works as an effective strategy able to analyze participants' meanings and the relationship between them by using several data collection techniques and analytical procedures (Saunders, Lewis, &Thornhill, 2015; Corbin & Strauss, 2014); on the other side, quantitative research, mostly based on deductive reasoning, is recognized crucial for testing objective theories by investigating the relationship among variables.

Indeed, using a mixed method we explore the PhD students' experiences adopting the following approaches with specific techniques:

1. we interview and survey 10 students and 2 coordinators from 2 Italian PhD Programs in 'economic and statistical sciences' area. A focus group interview will be used to gain exploratory data from the PhD students, while interviews will be conducted with PhD coordinators. We'll constitute two groups (one for each PhD program) composed of 5 PhD students for collecting their opinions and experiences on the usage of media for communicating with professors and peers. The interviews and focus group interview were conducted using a well-defined structure, where questions specifically focused on the aim of the study were asked, specifically these questions concern the content of experience for students (if and how their motivation changed before/during/after pandemic; if the students changed their lifestyle; questions inspired to the Study Approach Questionnaire regarding the motivation for studying, individual job organization, flexibility, anxiety management, PhD orientation versus the academic world (Cornoldi et al., 2005);
2. We conduct a follow-up survey by administering a questionnaire to such students to measure their experiences or perceptions on technology usage and social relations. Our short survey consists of five constructs and for each of them multiple item scales were developed, measured on different point Likert scales. Specifically, Perceived Organizational Support (POS) was measured using Eisenberger, Cummings, Armeli, and Lynch's (1997) eight-item scale. Answers were given on 7-point Likert-type scales ranging from 1 = ''strongly disagree" to 7 = ''strongly agree". Leader-Member Exchange (LMX) was measured using Graen and Uhl-Bien's (1995) seven-item scale. Answers were given on 5-point Likert-type scales ranging from 1 = ''strongly disagree'' to 5 = ''strongly agree''. Social Presence Scale (SPS) was measured using Kim (2011) 5-point Likert scale. Finally, Perceived Media Richness (PMR) and Overall Functionally were measured using Sheer (2011) 7-point scale, ranging from 0= "strongly disagree" to 6 = "strongly agree".

4. Results and discussion

This section reports the results of the focus groups and questionnaires obtained from our analysis on the topic of knowledge sharing in doctoral programs during the Covid-19 pandemic. We first proceeded to the mapping of the doctorates present in Italy belonging to the XXXVI cycle and pertaining to area 13 (economic sciences and statistics). Of the 98 Italian universities analyzed, of which 11 non-state telematic, 20 non-state and 67 state, it

emerged that the doctorates under examination were a total of 234; of these 74 are international doctorates and 38 are industrial doctorates. The analysis shows that almost all Italian universities have an e-learning platform, specifically only 9 out of 98 are not yet equipped with such platforms. Through e-learning it was possible to carry out lectures / seminars during the academic year 2020/2021 (XXXVI), years heavily affected by the pandemic emergency. During this period, many universities have adopted mixed teaching methods, i.e., both face-to-face, when obviously allowed by national provisions, and online through platforms such as Teams, Moodle, Zoom etc. After mapping the Italian universities and related research doctorates, to achieve the goal of better understanding the process of transferring knowledge between doctoral students through the study of the qualities of social relations and the use of online learning platforms, a 'qualitative-quantitative survey which envisaged a dual method of data collection. Specifically, 2 universities participated in the survey sample with which to analyze the issue of knowledge sharing in doctoral programs during the Covid-19 pandemic. Were conducted n. 2 remote focus groups via Ms-Teams in which PhD students also not present in Italy participated; following the focus groups, participants were then asked to answer a short online questionnaire. The survey was attended by n. 8 PhDs of the XXXVI cycle, of which 7 replied to the online questionnaire. From the focus group it emerged that the answers to the various questions posed to the doctoral students were mostly homogeneous. As highlighted by the following graph (Figure 1) in most cases the use of digital solutions proposed by their universities in their doctoral programs did not lead to a significant change on the part of the respondents on interest in studying, performance in study, the management of one's time and the yield in the study "before" and "after" the pandemic.

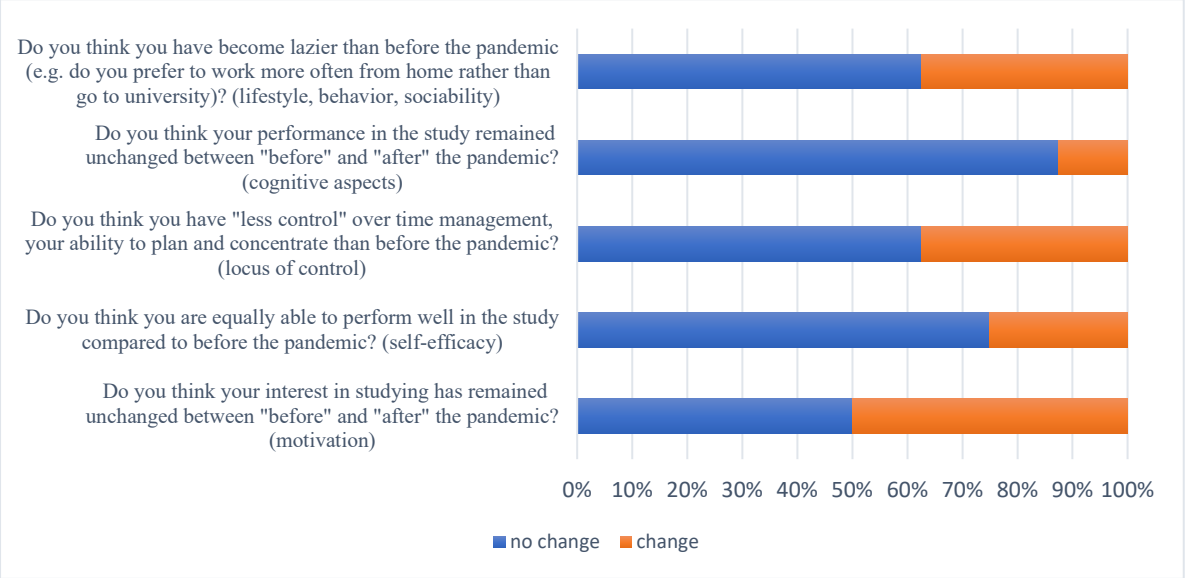


Figure 1: Does the use of digital solutions proposed by universities in doctoral programs lead a change or not? Answers given by the PhD students in the 2 focus groups

Furthermore, during the focus groups, PhD students had the opportunity to answer a series of open questions that gave them the opportunity to better motivate their answers and express their opinions on the topic of knowledge sharing using digital platforms to learn during the emergency period. Specifically, to the question "*If and how your relationship with your supervisor changed during the pandemic emergency?"* all the PhD students stated that through the platforms it is now possible to meet your supervisor / tutor at any time of the day, at any time. All this represents a positive aspect for them. Another positive aspect is undoubtedly a saving in terms of costs in printing documents, relating to one's research, to be given to the supervisor; through the online platforms it is possible to easily share the screen and thus you can have immediate feedback. The negative aspect is, however, that there may be connection problems, internet network problems that do not allow or make connection difficult. For respondents there is therefore a change due to the introduction, during their doctoral program, of digital learning solutions, not so much from a technological point of view but from a psychological point of view, as there is no personal relationship, face to face with your supervisor. When we asked *"Adopting a research perspective, did the digital solutions have the improvements in your research experience? Did you have a better knowledge transfer thanks to the digitalization or not* "Everyone replied that for the transfer, the sharing of knowledge, it is undoubtedly preferable to be present at the university, to attend lectures and seminars in person rather than through online platforms. Only one graduate student stated that *"in terms of*

productivity, in terms of gaining knowledge, I think you can gain the same knowledge and you can share the same knowledge in the same way also if it is done, whether online or offline". Also asking them "*Did you have a specific advantages and disadvantages in during the pandemic emergency using digital solutions?*" Also, in this case the answers were homogeneous. The disadvantage is that there is no possibility to socialize with colleagues and therefore a greater ability to open to new knowledge is lacking, there is no interaction and therefore knowledge sharing. The perspective of the human, social relationship is missing. The advantage is that it is possible to shorten the distances and therefore you have the greatest possibility of interacting more frequently with your tutor and then there is the possibility of participating in international conferences from home. There is the effective use of time through these digital tools, through this new technology. Digitization was mainly fruitful to manage everything and carry out the activities within the PhD.

The above is also confirmed by the answers provided by the PhD students in the questionnaire. Specifically, as shown in the following graph (Figure 2), respondents agreed that having used the online platforms allowed them to use more signals (e.g., text, audio, visual) and it gave a feeling of face-to-face communication. In addition, greater value has been given to the fact that digital solutions are still easy, fun, flexible to use and undoubtedly alleviate one's apprehension about communication.

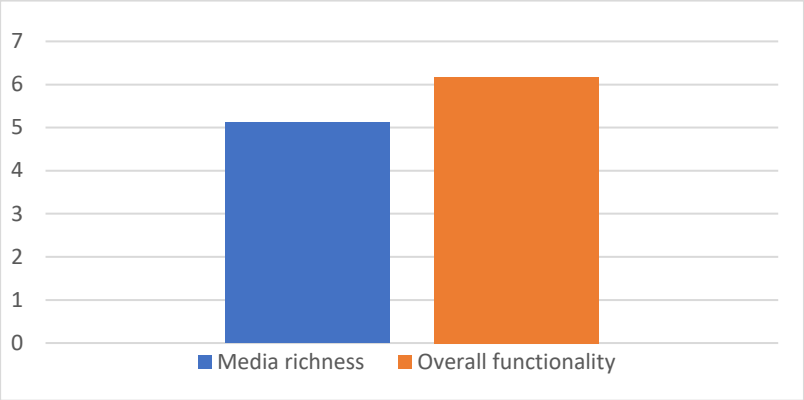


Figure 2: Media Usage.

Also going to investigate social exchange, specifically, how the system of social exchange relations between leaders, subordinates, and collaborators changes, using digital solutions, the answers stand at high values. In detail, as shown in the following graph (Figure 3), the quality of relations with the leader (LMX) and the team-member exchange (TMX) report more than positive values. Leader is close to the needs of the respondents and understands any work problems. The respondents themselves have good social exchange relationships with their colleagues. It therefore emerges that the perceived organizational support (POS) of the respondents is quite high. All respondents quite agree on the fact that the organization considers their own opinions, well-being, goals, and values of each.

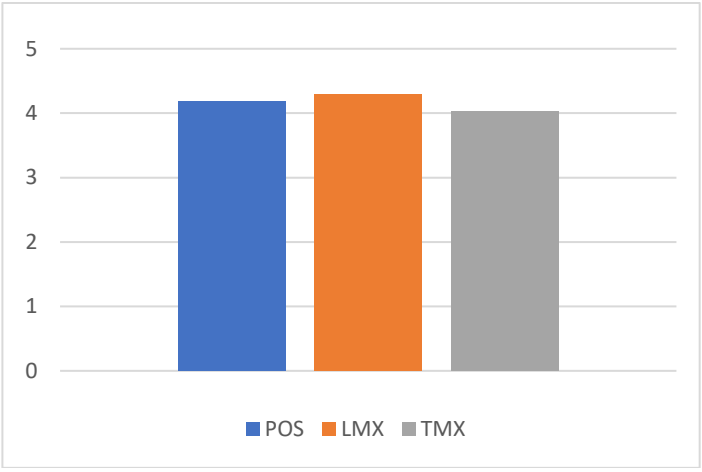


Figure 3: Social Exchange.

Analyzing the further answers of the questionnaire administered, it emerges that the social presence, defined as “the extent to which one feels the presence of a person with whom one is interacting” (Latchman & Latchman, 2000, p. 559), and “the feeling one has that the other persons are involved in a communication exchange” (Carnevale, 2000, p. 188) achieved high scores.

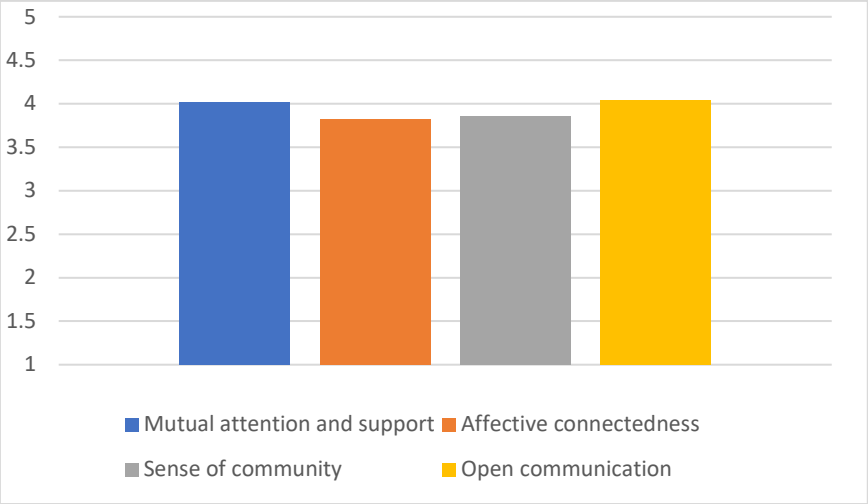


Figure 4: Social Presence.

Figure 4, indeed, shows how social presence allows for the cultivation of emotions and relationships and plays an influential role in promoting and sustaining meaningful and successful learning experiences, as highlighted by (Whiteside, 2017, p. 133).

5. Conclusions

The Covid-19 pandemic has created numerous problems in doctoral training and especially for face-to-face doctoral courses, encouraging the adoption of online learning platforms to allow students to take courses at a distance. It had a negative impact and profoundly limited the social interactions between students and professors and among students, leading them to experiment with new ways of communications and above all sharing knowledge using different communication’s tools.

The results of the analysis carried out show that the PhD students used the e-learning platform to communicate with colleagues and professors, thus developing good social relationships, even at a distance, and encouraging knowledge transfer among them.

From the results of the interviews, it emerged that the use of digital solutions proposed by universities in their doctoral courses did not lead to a significant change on interest in studying, study performance, time management and study performance "before" and "after" the pandemic.

For some respondents the disadvantage of distance learning is that there is no possibility of socializing with colleagues and therefore no interaction and knowledge sharing. The perspective of the human and social relationship is missing.

The results provide useful insights for research on KT in doctoral training and for the coordinators of doctoral courses involved in defining the teaching methods and training programs best suited to sharing knowledge through the improvement of social relationships and the use of technology.

The main limitation of this study is certainly the small number of conducted interviews and questionnaires with doctoral students; so the next step for future research it will be to improve the survey with the participation of a larger number of PhD students belonging to different Italian universities in order to better understand the phenomenon.

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Remote work and Knowledge Exchange Strategies in the Opinions of Generation Z

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 situation of the Covid-19 pandemic has forced many companies to switch to a remote work system. This phenomenon took a massive form in the first stage of the pandemic mainly due to the lockdown. However, in the following months, many employees found this professional arrangement convenient and conducive to the organisation of work and personal life. Remote work seems to be particularly attractive for employees of the young generation. At the same time, employers have noticed that this form of work definitely has benefits, but also brings disadvantages. Today, management practitioners are increasingly pointing to the hybrid work model as the preferred one. In order to learn about the preferences of the Generation Z employees in terms of the forms of work and their impact on various aspects of work, a survey was designed. The research was conducted in December 2021 on a sample of the Generation Z representatives with the aim to identify their attitudes and opinions about the remote type of work based on their experiences and expectations. 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 strength of the correlation between the variables was assessed using the Spearman's rank correlation coefficient. The results of the research reveal interesting dependencies between the reasons for knowledge exchange in the remote work.

Keywords: knowledge exchange, pandemic COVID-19, remote work, generation Z

1. Introduction

Many years have passed since Drucker's (1999) publications , where he pointed out that besides labour, capital and land, knowledge is the fourth and most important factor of the production, and although the importance of labor, capital and land for economic processes has significantly decreased, and the global economies shifted their focus from production to services, the future still belongs to people and organisations possessing knowledge (Hamel and Prahalad 2006, p.46). In a knowledge-based society, the knowledge manager is the most perfect asset for a company. Currently, creation of a competitive edge involves predictions of the directions of transformations in the world and taking advantage of the opportunities entailed by said transformations. Therefore, in a modern world, neither land, capital, nor even the possession of a workforce is a guarantee of success. Knowledge (both individual and organisational) is a factor allowing one to search for new solutions, recognise emerging opportunities and threats, and create opportunities for development (Słocińska 2013).

In literature, we find references that knowledge is (Probst et al, 2004, p.29): structured, complex, context-dependent, dependent on the person using it, and reflected in models of behaviour. It is the result of a complex process of knowledge creation and assimilation during the stages of socialisation, externalisation, combination and internalisation (Makselon 2007). These processes are influenced by the environment, levels of social and content-related competences, but also by the availability and usage of various technological solutions. Taking the above into account, it should be assumed that the perception of knowledge, and also of its acquisition and exchange will also be influenced by e.g. belonging to specific age group. Current workforce includes representatives of several generations of workers, starting from still professionally active employees of the Baby Boomers generation, through the dominant Generation X and Generation Y, to the youngest professionally active people representing Generation Z. Literature on the subject shows differences in the terminology related to the nomenclature of individual generations, and the delineation of the divisions between the latter. The aim of the study is to present the results of studies on the opinions of Generation Z representatives in relation to knowledge exchange in the context of attitudes to remote work.

2. Attitudes of Generation Z in relation to the knowledge exchange in remote work conditions

In the literature on the subject, the legitimacy and correctness of grouping employees by age category, as well as the definition of the term 'generation' itself is still a hotly debated topic. Therefore, various authors writing on issues the issues analysed here cite various classifications of generational divisions (Rodriguez et al, 2019; Bencsik et al, 2016; Bencsik and Machova 2016; Goh and Lee 2018; Kirchmayer and Fratricova 2018, Lazanyi and Bilan 2017; Bejtkovsky 2016; Hejnova 2015). The most popular division assumes that Generation Z includes people born after 1995, although some research also includes people born in 1990, while others include only those born in 2000 and later; Generation Y are people born in the years 1980-1994, Generation X are people born in the years 1965-1979 and the Baby Boomers are the generation of the post-war population spike, being born between 1946 and 1964.

Analysis of reports and studies (Dolot 2018; Duffy 2018; Hijzen and Menyhert, 2016; Lazanyi and Bilan 2017; Lyons et al, 2017; O'Boyle et al, 2017; OECD, 2014; Robak 2017; Singh and Dangmei 2016; Tulgan 2013; Zwart and Baker 2018) that focus on the organisational behavior (including sharing of knowledge) among the youngest employees representing Generations Y and Z, allows us to summarize the observations made by the authors. What connects both generations is a great commitment to or even dependence on modern information technologies and tools used to support them. It should be noted, however, that the iconic device of Generation Y is a laptop, while the representatives of Generation Z definitely prefer smartphones. These are the basic communication tools used by the representatives of both generations and their usage overshadows direct communication. Through them, young workers acquire and share knowledge. However, for both generations, knowledge is almost synonymous with the category of information. It also seems that the representatives of Generation Z have much greater difficulties with verifying the quality of knowledge and information available on the Internet. What distinguishes these generations from the previous ones is the perception of knowledge and information themselves - they are not competing goods for the above-mentioned groups. Young people share this resource freely, not considering it unique and necessary for shaping their own career.

The results of the research highlight the fact that there may be problems related to the exchange of knowledge, or to the recognition and expression of tacit knowledge that employees themselves are not always aware of. Gaps in the social and communication skills of the youngest generations may hinder the processes of encoding and decoding of such messages. Social transformations described above were put to the test during the COVID-19 pandemic. In the face of strict sanitary measures and the lockdown introduced in many countries, many enterprises decided to switch to remote work, and the young students were forced to accept the conditions of remote learning.

Before the pandemic, remote work for employees of many companies was known as the 'premium class benefit'. It could have only been used occasionally or in exceptional circumstances. The massive shift in thinking and perception of remote work seemed like an impossible process. Spring 2020 brought a real revolution in this regard. A large and very fast technological transformation took place. Remote work quickly became a standard from the first months of the pandemic.

Literature studies in the field of remote work indicate that there is a wide variety of terminology in relation to this issue. The introduction of terms such as teleworking and telecommuting to the literature stems from the works of Nilles (2003, p. 21) who defines teleworking as transferring work to employees, instead of employees to work, i.e. a form of substitution of ordinary work with information technology. On the other hand, telecommuting seems to be a narrower term, referring to the periodic work performed outside the main, stationary office (for example, in customer's facilities, in a telework center, or at home), with the main emphasis being placed on eliminating the daily travel to and from the workplace. However, there are also studies (Pyöriä 2011) in which the distinction between the two terms is limited only to the geographical area of operation, what means that 'telecommuting' is just an American equivalent of 'teleworking'. In case of Polish publications, these terms are also used interchangeably, and their Polish standardised substitute is 'remote work'.

For the purposes of this study, the understanding of the concept of the remote work has been narrowed down, identifying it with the work performed outside the workplace, usually at home, using the internet connectivity with company servers. It should be noted however that in Poland, due to an applicable legal basis, the terms 'teleworking' and 'remote work' are not interchangeable (Krzyżanowska 2020). Thus, a remote worker does not

have a permanent workstation in the office, and their visits to the workplace are occasional and associated with exceptional situations.

The main advantages of this form of work include, first and foremost, an increase in organisational flexibility, reduction in operating costs. decrease of absenteeism, better catering to the people with disabilities, ability to live in rural areas or places distant from industrial centers, as well as the ability to take better care of children or other dependents. On the other hand, the most mentioned disadvantages of remote work include problems resulting from the need to provide the employee with specific IT instruments and the operationalisation of this form of work organisation (Czarnecka and Słocińska 2016).

Assuming that the knowledge sharing is always a people-to-people process (Liyanage et al, 2009, p. 122), makes understanding of the mechanisms controlling the exchange of knowledge more meaningful. According to T. H. Davenport and L. Prusak (2000, p. 30), knowledge has its sellers and buyers, as well as the intermediaries in the transactions of exchange and acquisition of knowledge. In the opinion of the aforementioned authors, people share their knowledge because it satisfies their basic needs and expectations. Therefore, employees can share their views based on the following reciprocity rules (Davenport and Prusak 2000, pp 30-38):

- reciprocity - an employee 'selling' their knowledge expects the possibility of 'acquiring' knowledge attractive to themselves, either immediately or in the future;
- reputation - having the reputation of a person 'selling' knowledge (being an expert) can be a form of satisfying the need for the recognition or power, but also helps to attract new knowledge by multiplying the number of exchange transactions based on the principle of reciprocity.
- altruism - results from the internal need to share and help (although, as Kukowska (2016, pp 165-174; 2019, pp 152-163) notes, altruism in the light of evolutionary psychology is most often characterized by the rule of reciprocity - mutual altruism), from the organisational point of view and process of knowledge exchange, a group of employees selling knowledge without vested interest is particularly valuable.
- trust - a condition for bypassing the barriers blocking the exchange, such as monopoly on knowledge or its artificial shortage, with such barriers resulting from a fear that 'selling' knowledge might lead to a loss of the traits that make the employee attractive and valuable for the organisation, with personal relationship in the workplace playing an important role in this mechanism.

A specific challenge for the effective completion of the knowledge exchange process is the transformation of explicit knowledge into the tacit knowledge that involves usage of the knowledge by the new 'holder'. It is a cognitive and emotional experience mandating the adoption of a personalisation strategy as a basic strategy for the organisational activities related to the stimulation of the knowledge exchange processes. It appears that due of the egoism typical of Generation Z, this stage of knowledge exchange is particularly difficult to implement and requires supporting young employees in experimenting with what is a form of implementation of the newly acquired knowledge.

3. Methodology

The research results presented in the study constitute part of a quantitative survey conducted among young people (Generation Z and Generation Y) at the turn of 2021/2022. The research focused on the impact of the remote learning experiences on the preferences concerning the remote work among young people in the terms of employee relations, knowledge, development and learning, motivation, communication, teamwork, creativity, work organisation and work-life balance.

The study presents a fragment of the research results related to knowledge exchange. The following research assumptions were adopted in the area of analysis of the influence of preferences concerning the remote work on the perception of knowledge exchange processes within the organisation:

- the COVID-19 pandemic situation resulted in a mass transition of young people to the remote learning and work, what contributed to the popularisation of remote work.
- the advantages and disadvantages of remote work, also in reference to knowledge exchange, are described in literature on the subject.
- the motives of the knowledge exchange transactions were described in accordance with the typology of Davenport and Prusak and include trust, reciprocity, reputation and altruism.

In the course of research, the following problem was presented: has the experience of remote learning contributed to the creation of an erroneous (relative to the features of remote work described in literature) perception of remote work and its impact on the exchange of knowledge?

The survey was conducted using quantitative research methods and the survey technique. The latter has been chosen because it allows a direct contact with the respondents. The study involved young people (representatives of Generations Z and Y) studying various fields of knowledge and living in the Silesian Voivodeship. These particular groups were selected, because their age and professional competences make it very likely that will perform remote work in the future.

The main research tool used was a standardised questionnaire consisting of 75 closed questions and statements. A Likert scale (the so-called Likert scaling technique) was used to assess the responses, allowing to determine a relative intensity of the different responses (Babbie 2004, p. 192). Stable conditions that were presented beforehand allow for a reliable and quick analysis of the collected material, its uniformity and ease of preparation (Churchill 2002, p. 309) . The research tool (the questionnaire) is original and was created by the members of the research team consisting of the employees of the Department of Applied Sociology and Human Resource Management, at the Faculty of Management of Częstochowa University of Technology. 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 =0.9338).

STATISTICA software was used in the process of compiling the research results. To assess the significance of differences in the analysed variables, the following non-parametric tests were used: Mann-Whitney U test (UMW), Kruskal-Wallis ANOVA (AKW) test, and the chi-square test. The obtained statistics were analysed using the publication by Stanisz (2006, pp 369-391). Spearman's rank correlation coefficient was used to assess the strength of correlations occurring between variables.

For the purposes of analysing the results of the study, we adopted several statistical hypotheses concerning the occurrence of significant differences in the respondents' statements because of their characteristics and experience of employment, remote learning and remote work. H0 is a hypothesis stating that there are no differences due to the grouping variable, while H1 is an alternative hypothesis that there are such differences. These hypotheses were verified by the aforementioned statistical tests that allowed for the rejection of the H0 hypothesis about the lack of statistically significant differences and the adoption of an alternative hypothesis about the existence of such differences. The study presents dependencies verified with statistical tests that allow to infer about the regularities in the studied group.

Results of the research

The survey involved 226 students. In the literature, the representatives of the Generation Z are most often described as people born after 1995, although some researchers include those born in 1990 while others include only those born in 2000 or later. Using the above criteria, the distribution of respondents in the investigated group is presented in Table 1.

Table 1: The distribution of the studied group according to the definitional categories of Generation Z

	Born in 1990 and later %	Born in 1995 and later %	Born in 2000 and later %
Generation Z	89.82	83.19	29.20
Others	10.18	16.81	70.80
Total	100.00	100.00	100.00

Source: own elaboration based on the research result

Since the most common division into generations in the literature indicates the year 1995 or 1990 as the liminal year for Generation Z, it was assumed that the dominant population in the study group was composed of the representatives of that generation. As the statistical tests did not reveal statistically significant differences in the opinions of Generation Z representatives and other respondents regarding the analysed issues, the description

and analysis of the research results will present the overall results without distinguishing between Generation Z and the older respondents that can be considered representatives of Generation Y.

The study groups consisted in 50.44% of women and in 48.23% of men with 3 respondents (1.33%) not declaring their gender identity. Among the respondents, 86.72% declared at least some experience with remote learning, with 12.83% declaring lack of such experience (one person did not express their opinion in this area). In regard to work experience, vast majority of the respondents (86.28%) confirmed such experience, and 13.27% denied having it (1 person did not provide definite response). In addition, 48.67% of respondents had experience with remote work, with 50.88% declaring lack of such experience (1 person did not provide response). When asked about their preferences regarding the form of work in the future, the most common response was a hybrid form of work (50.00%), followed by stationary work (35.40%) and remote work (12.39%), with 2.21% of respondents not providing a response.

In regard to the issue analysed in the study, authors of the study selected five indicators representing the respondents' opinions on the motives of knowledge exchange transactions in the case of remote work:

1. remote work fosters knowledge exchange.
2. remote work allows you to share knowledge without vested interest.
3. remote work allows to share knowledge only with selected employees who can give me something in return.
4. remote work enables to create the image of a competent employee.
5. remote work helps to build trust in relations with employees.
6. remote work enables a quick exchange of information

The indicators above were analysed in terms of the differentiation of the respondents' statements with regard to independent variables such as:

1. age
2. gender
3. remote learning experience
4. work experience
5. experience in working remotely
6. form of work preferred in the future (stationary, remote or hybrid)

Regarding the issue of knowledge exchange, the majority of respondents (41.15%) stated that remote work is conducive to the exchange of knowledge, 27.88% did not have a decisive opinion in than matter, and 27.43% had the negative opinion (Table 2). Regarding the statement that remote work enables quick exchange of information, 57.08% of the respondents expressed their positive opinion, and 19.47% had opposite opinion, with 19.91% of the respondents were not able to define their firm stance on this issue.

Table 2: Percentages of answers in the field of knowledge exchange

Responses	%					
	A	B	C	D	E	F
N/A	3.54	3.10	5.31	5.31	5.31	3.54
1	7.52	7.96	11.95	7.52	19.47	6.64
2	19.91	14.16	12.83	8.85	22.58	12.83
3	27.88	35.40	34.96	38.49	36.28	19.91
4	25.22	28.32	22.56	27.88	11.50	26.55
5	15.93	11.06	12,39	11.95	4.86	30.53
total	100.00	100.00	100.00	100.00	100.00	100.00

1 - completely disagree; 2 - rather disagree; 3 - neither agree nor disagree; 4 - rather agree; 5 - completely agree.
Source: own elaboration based on the research result

In regard to the exchange of knowledge without vested interest, the distribution of respondents' answers was a bit less optimistic, with 39.38% of the respondents supporting such advantage of the remote work, 22.12% having the opposite opinion and 35.40% not being able to express their opinion on this issue. When asked whether remote work allows sharing knowledge only with selected employees who can give them something in return, 34.95% of respondents agreed that remote work allows for such verification of recipients of knowledge, the same number of them was undecided on this issue, and 24.78% believed that remote work is not conducive

to such a knowledge exchange strategy. In terms of the exchange of knowledge forming the image of a competent employee in remote work conditions, 39.83% of the respondents agreed with this statement, 38.49% was undecided and 16.27% had a negative opinion (what is the lowest indication across all five determinants). As the exchange of knowledge takes place mainly under conditions of trust, the respondents were also asked whether remote work allows building trust in employee relations. Here, the distribution of answers significantly differed from the previous answers. Only 16.36% of the respondents confirmed the positive impact of remote work on building trust, 36.28% were undecided and 41.95% stated that remote work is not conducive to trust building.

To assess the significance of the differences in the analysed variables, the non-parametric ANOVA Kruskal-Wallis (AKW) test was used. The distribution of the results is presented in Table 3. The data presented therein show only statistically significant differences that allow for the rejection of the H0.

Table 3: The ANOVA Kruskal-Wallis test for independent variables and selected indicators

Independent variables	Analysed indicators					
AKW test at the accepted level of significance (α = 0.05)	A	B	C	D	E	F
I.	-	-	-	-	-	-
II.	-	-	-	-	-	-
III.	-	-	-	-	p = 0.0385	-
IV.	-	-	-	-	-	-
V.	-	-	-	-	p = 0.006	-
VI.	p = 0.0045	p = 0.0205	-	-	p = 0.0106	-

Source: own elaboration based on the research result

The variable that differentiated the respondents' answers to the greatest extent was the form of work preferred in the future. There was no indication that preferred form of work was influenced by respondent's age.

The form of work as a variable differentiating the analysed indicators (AKW test) indicates the connection of the evaluation of remote work as conducive to the exchange of knowledge, allowing selfless knowledge sharing and helping to build trust in relations with employees. Whereas:

- the largest percentage of respondents confirming that remote work is conducive to knowledge exchange indicated preference for a hybrid or stationary form of work;
- among the respondents who indicated that remote work allows selfless sharing of knowledge, the largest percentage preferred hybrid work first, and stationary work second;
- respondents denying that remote work allows to build relationships with coworkers have chosen mostly stationary or hybrid work; it should be noted however, that among people expressing negative or ambiguous opinions about the positive impact of remote work on employee relations, the largest group was formed of the respondents with no remote work experience (AKW) and with remote learning experience (AKW); people with experience in remote work more often expressed positive opinions about the possibility of building employee relationships in remote work conditions.

In the analysed area, attempts were also made to observe regularities related to the recognition of differences between information and knowledge by the respondents (Table 4).

Table 4: Spearman's rank order correlation for selected variables at p <0.001

Remote work	It favours the exchange of knowledge	It enables the quick exchange of information
It helps you building trust among employees	0.27523	-
It allows you to share knowledge disinterestedly	0.58396	0.35502
It allows you to share knowledge with selected employees only	-	-
It allows you to shape the image of a competent employee	0.23157	0.27041

Source: own elaboration based on the research result

During the examination the results of the correlation of the Spearman's rank order between the indicators, it was noted that the respondents who indicated that remote work is conducive to the exchange of knowledge were also convinced that it is a form of work that allows to build trust between employees. No such relationship

was found in regard to the provision of information. Of note are the correlations indicating that the respondents admitting that remote work allows for selfless sharing of knowledge also indicated their positive opinions on the impact of remote work on the exchange of knowledge and on the ability to exchange the information quickly. It was also observed that the respondents recognizing the benefits of remote work in terms of knowledge and information exchange also state that remote work allows building the image of a competent person.

4. Discussion

During the analysis of the research findings, certain limitations have to be taken into account. First, the study is a pilot study, and therefore does not present the opinion of a representative sample of the surveyed population in Poland, narrowing it down only to those inhabiting the Silesian Voivodeship. Second, much like in other studies relating to Generation Z, the use of year-of-birth criteria is still disputed, especially given that Generation Z coming from developed countries may differ from the representatives of Generation Z in Poland, a country that advanced from the group of developing countries to the prestigious group of developed markets only in 2018. Despite these limitations, the presented research results nevertheless provide an insight into the analysed problem and indicate some interesting dependencies.

The discussed topic does not have publicly available literature presenting the results of research on the preferences of work forms and knowledge exchange strategies in the context of the remote learning experience of Generation Z. This is undoubtedly related to the fact that due to the COVID-19 pandemic, young people around the world have experienced a massive shift towards remote education and work, therefore the consequences of such shift are still being investigated. The effects of this phenomenon were first felt by the employers, who more and more frequently find that the remote work is a preferred form and that it can be beneficial to them.

At the same time, the conducted research revealed some interesting regularities that may be of significant importance for the shaping of the work environment by employers and for the management of the knowledge exchange processes.

One of the conclusions that can be drawn from the research results is optimistic because it indirectly indicates that the Generation Z respondents see the difference in the concepts of 'knowledge' and 'information' (the respondents were not asked during the study how they understand these terms). The respondents relatively more often agreed with the statements that remote work allows the exchange of information in comparison with statements about exchange of knowledge. It is especially visible in relation to employee relations building. It seems that the relationship between these indicators may be mutual, that is, the knowledge exchange processes may shape relations between employees and good relations may support the knowledge exchange processes.

In the context of the study, it should be emphasized that many publications indicate that the relationships in the workplace are a key aspect determining the work selected by the representatives of Generation Z who also usually notice that remote work does not facilitate such relationships. Such opinions are expressed mainly by people with no remote work experience (AKW) and the respondents with the remote learning experience. Such a regularity is probably a consequence of the negative experiences related to e-learning that was introduced in an unplanned, chaotic manner and was formed spontaneously as a rapid response to the realities of the pandemic. There was no proper substantive preparation on the part of both teachers and students. In this situation, young people often reacted negatively as they were abruptly denied direct contact with their peers and teachers. However, it is worth investigating whether the belief about the negative impact of the remote work on relationships is caused only by the experience of remote learning, or does it result from the combination of the compulsory distance learning with the lockdown experience that in the perception of Generation Z representatives is combined into one. The optimistic premise of the discussed results are the opinions of people with actual remote work experience who agreed that such form of work allows building the desired relations between the employees.

Taking the above into account, the opinions indicating that the majority of respondents agree that remote work is conducive to knowledge exchange may be somewhat surprising. It should be considered here whether the Generation Z representatives understood 'knowledge' solely as formal and explicit knowledge. As young employees or people with no work experience, they may have not yet seen the power of the tacit, informal

knowledge that stems primarily from the employment, internship, or other professional experience, and from general maturity.

The indications and regularities regarding selfless knowledge sharing as a strategy for knowledge exchange may also be interesting. A question arises here whether the disinterested exchange of knowledge is not equated by generations Z with the unilateral transfer of knowledge they deal with in social media or have been in relation to distance learning.

5. Conclusions

The period of forced transition to remote work, however, made employers aware that remote work translates not only to the benefits of saving time and reducing the cost of the workplace maintenance, but frequently causes a loss of employee motivation and problems with work organisation, building trust, and employee involvement. Also, the employees who previously have often perceived remote work as an arrangement allowing them to maintain their work-life balance better, have verified their expectations since, noting that remote work can be as absorbing as the stationary one, and its effectiveness is based primarily on self-discipline, self-motivation and self-organization.

The result of this mass social experience of the COVID-19 pandemic is the introduction of the hybrid work opportunities in many organisations on a large scale. Therefore, it should be observed how the social processes occurring among employees who have so far been performing stationary work will shape in the future after switching to hybrid or remote work. One of such processes is the knowledge exchange between the employees.

The analysis of the research material in the area covered by the subject of the study brings up the crucial question: to what extent are the categories of the knowledge exchange motives developed by Davenport and Prusak still valid? The market approach to the exchange of knowledge based on the perception of knowledge as a commodity traded on the market of buyers and sellers assumed that in these processes both parties strive for satisfaction and profit maximisation (even regarding the altruism rule). This theory, however, was developed under the conditions specific to the 1980s and 1990s, when Generation X was the dominant age cohort in the general workforce and it struggled with serious economic crises and high unemployment rates. For the representatives of this generation, knowledge has become a desirable merchandise, increasing the employee's advantage on the labour market. Currently, the situation we observe in the area of knowledge exchange seems to be related to the mass dissemination of knowledge rather than the knowledge exchange. Undoubtedly, the motives and expectations of the Generation Z representatives concerning knowledge exchange should be the subject of research in the near future. And the results of such research will certainly have a significant impact on the employment policy in organisations, and on the processes of building attractive work environments.

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Managing Knowledge About Future of Work: A Model for Higher Education Institutions

Matheus Argôlo[1], Mauricio Miranda[1], Rodrigo Pagliusi[1], Yuri Oliveira de Lima[1], Herbert dos Santos[1], Carlos Eduardo Barbosa[1,2], Alan Lyra[1] and Jano de Souza[1]
[1]PESC Coppe, Universidade Federal do Rio de Janeiro, Rio de Janeiro, Brazil
[2]CASNAV, Brazilian Navy, Rio de Janeiro, Brazil
matheusargolo@cos.ufrj.br
mmiranda@cos.ufrj.br
rodrigopagliusi@cos.ufrj.br
yuriodelima@cos.ufrj.br
herbertsds@cos.ufrj.br
eduardo@cos.ufrj.br
alanlyra@cos.ufrj.br
jano@cos.ufrj.br

Abstract: The Fourth Industrial Revolution is causing considerable changes to the world of work. The interaction between technology and work, which takes many forms such as digitalization, automation, and augmentation, is happening quickly and broadly, impacting economic sectors left almost untouched by previous industrial revolutions. In this scenario, Higher Education Institutions (HEIs) must be able to foresee changes to prepare future professionals to match the needs of this new digital age. The professionals that are being prepared today need to learn a new set of skills related to emerging and disruptive technologies, such as Artificial Intelligence, the Internet of Things, and Big Data. In this paper, we propose a Knowledge Management model to help manage the HEIs' teaching staff knowledge about the future of work, specifically, the expected skills and competencies to be highly demanded from professionals in the future. Therefore, we performed a brief review of related work about Knowledge Management in the context of HEIs, Management of Future-oriented Knowledge, and the application of the Delphi method to studies concerning the Future of Work. Considering this previous work, we propose a Knowledge Management model that combines the European Foundation for Quality Management (EFQM) Excellence Model framework with a Delphi process that is used during the Knowledge Generation step of the Knowledge Management process. The proposed model considers that professors are experts in their areas of concentration and, as such, are capable of helping their HEIs with their knowledge that can be used to improve the courses' curricula. The model also considers that HEIs can help professors make this knowledge explicit, then store, transfer, and apply it. We provide detailed information about how to apply the model, how to deal with potential application problems and the model limitations. The proposed Knowledge Management model can help HEIs to keep up with the trends of demands of the labor market.

Keywords: Knowledge Management, Future-oriented Knowledge, Higher Education Institutions, Delphi Method, EFQM Excellence Model

1. Introduction

The fourth Industrial Revolution involves the combined use of several technologies such as artificial intelligence, robotics, bio, and nanotechnology, in the most diverse areas of human production, from Medicine to Law, including Education, and Industry (Schwab, 2017).

As the automation of tasks that hitherto required humans, including non-repetitive cognitive tasks such as those that constitute many white-collar jobs, a severe, broad, and fast-paced change in the skills that are demanded from workers is taking place. Several studies, following Frey & Osborne's (2017) seminal work, estimate that, depending on the country, 35-85% of existing jobs have a high risk of being automated in the next decades (Lima *et al.*, 2021).

In this context, it is paramount that society trains new professionals according to the current and expected demands of the labor market. Here, Higher Education Institutions (HEIs) play a central role and need the tools to update their courses' curricula properly with the teaching staff being able to support this change with their knowledge. As such, the goal of this paper is to propose a Knowledge Management (KM) model to help manage the HEIs' teaching staff knowledge about the future of work, more specifically, about the skills and competencies that are expected to be highly demanded from professionals in the future.

2. Related work

This section aims to provide examples of how KM is applied within HEIs, how KM can benefit from Future-Oriented Technology Analysis (FTA) techniques, and how the Delphi method can provide insight into the future of work. We do not intend on making a comprehensive literature review and primarily expect to extract from the literature some supporting evidence of the effectiveness of these tools.

2.1 Knowledge Management in HEIs

A Knowledge Management System (KMS) is a category of Information System used in organizations to manage knowledge with the help of IT-based systems and provide support to processes involving the creation, storage, retrieval, transfer, conversion, protection, and application of knowledge (Oumran *et al.*, 2021).

KMSs can help HEIs in decision-making processes, and oversee and evaluate educational activities (Oumran *et al.*, 2021). Organizational, technological, or environmental factors contribute to hinder their adoption despite the perceived advantages for KMSs. The perception of the usefulness of KMS, the existence of IT infrastructure, financial support, and proper training in using the system are some of the most important factors to facilitate its adoption among potential users (Oumran *et al.*, 2021).

Moscoso-Zea *et al.* (2019) apply KMSs in HEIs, presenting what they described as "a hybrid information infrastructure for business intelligence and analytics". Their goal was to implement a KMS based on educational data warehouses for analytics and data visualization. The authors supported the idea of knowledge management associated with Big Data techniques and argued that the two main challenging factors related to data analysis are both the immense volume of information generated every day and the fact that various existing information systems are distributed, isolated from another and heterogeneous, a problem known as *islands of information*. As a result, the authors advocate for a centralized, hybrid infrastructure of enterprise architecture and business intelligence analytics for KM in education.

A good example of how the application of KM can be useful to HEIs can be found in the article by Hoffmann *et al.* (2019). Using a data model based on the Brazilian Higher Education Census, the author proposed the implementation of organizational knowledge management about school dropouts, helping managers to control evasion. The authors not only show how KM can be useful to support decision-making processes but also highlight how KMSs may perform a relevant role in the context of HEIs.

Pinto (2014) discusses the role of KM in HEIs, presenting a framework to improve knowledge sharing and collaboration in a HEI. This framework integrated KM practices – such as Communities of Practice, Best Practices, and Learned Lessons – with what the author called a Knowledge System (KS). The KS consisted of a corporative portal with a set of KM tools – as Knowledge Repositories, Knowledge Maps, and Learning Systems – which gave support to the aforementioned KM practices. The author's proposal shows how technological tools may aid KM practices and processes.

Although many examples of how KM is applied within HEIs were found, the usefulness of KM as a means to improve higher education courses' curricula appears to have not been fully explored. We support the idea that KM can be a powerful tool to achieve this end, but, as a more robust framework to guide the HEI's staff and improve the curricula towards the satisfaction of the labor market's ever-changing needs is required, we shall propose a KM model which serves best this particular end.

2.2 Managing future-oriented knowledge

HEIs should provide useful courses to their students and make them resilient to labor market changes. Combining KM with Future-Oriented Technology Analysis (FTA) can empower the management of HEIs' Intellectual Capital (IC). IC can be simply defined as the sum of all knowledge in an organization that creates a competitive advantage (Alvino *et al.*, 2021; Ferenhof *et al.*, 2015; Junior *et al.*, 2019; Nahapiet & Ghoshal, 1998). FTA techniques are used to discover the forces driving the future and their processes, resulting in better-informed decision-making (Junior *et al.*, 2019).

FTA Techniques such as Alternative Scenarios, for example, provide insights into HEIs decision-making. They show situations in which the current management would be inefficient, presenting possible mitigation paths.

FTA may be used for identification, creation, acquisition, storing, transfer and use of organizational knowledge, generating feedback for KM processes, and IC improvement (Nascimento *et al.*, 2021).

Junior *et al.* (2019) proposed a framework to combine a strategy for KM with three main dimensions: KM Processes, IC, and FTA Strategies. The first one is focused on the identification, acquisition, creation, storage, sharing, and use of organizational knowledge (Map Value Propositions). The second focuses on the structuring of tangible and intangible knowledge of the organization, or the Intellectual Capital (Support KM Processes Structuring). Finally, the third focuses on methods that may contribute to the structuring of the KM processes, as well as the formation of a body of knowledge necessary for decision-making (Generate Support Information to the Decision-making). According to Junior *et al.* (2019), a benefit of using KM and FTA together is to make organizations more resilient.

In other work, Castro *et al.* (2019) propose a model that combines concepts of FTA, Participatory KM (PKM), and Technological KM (TKM) to assist the decision-making process and also improve the organizational IC. The proposed model uses FTA techniques to collect *data*, which is processed as *information*, then analyzed as *knowledge*. This knowledge is managed using TKM or PKM depending on whether it refers to new technologies or other subjects. The learning from such KM processes is used to identify opportunities and support the decision-making process.

The application of FTA in HEIs can provide forecasts about the future of work and assess the impact of future labor market scenarios on higher education. Institutions must be equipped with a set of appropriate tools – including management models and KM frameworks – to foresee and adapt to future change. Our proposed KM model deals with the need for a KM tool to manage future-oriented knowledge.

2.3 Delphi and the future of work

Delphi is a method designed to make forecasts of a subject through the consensus between experts from the required disciplines in an anonymous controlled debate, as their opinions are most likely to be correct (Gordon, 1994). To do so, the experts are identified and invited to answer a questionnaire anonymously, to collect their perceptions about the future of that subject. Then, the answers are analyzed and synthesized by researchers, starting what is called phase two of Delphi. They present the results as feedback for the participants. Experts with extreme opinions considering the average answers are asked to provide the reasons for their position. The results are synthesized again and feedbacked in the third phase of Delphi, presenting to all participants the reasons for the extreme positions. The participants, then, are asked to reassess their position considering the reasons presented, refuting them if necessary. The second and third phases can be repeated many times until a consensus is reached.

To assess the future of work, previous research invited experienced teachers and managers in a field. Chiu *et al.* (2015), for example, invited 13 teachers with more than 10 years of experience in design education or personnel from design-related industries. The main goal of their study was to build a set of indicators to assess students' competitiveness in design courses by forecasting the core competencies needed for professionals in that field. To build the Delphi, they analyzed other research papers and investigation reports to collect a set of possible competencies to construct the questionnaires. Then, they summarized the findings and classified the competencies into two distinct categories: general competency (individual generic competencies that anyone could achieve, like communication or leadership) and professional competency (specific competencies needed by professionals of a field to do their jobs, like knowledge and experience in some technique related to that field of work). Finally, they built a questionnaire with those two categories of competencies and sent it to experts, that did one round of phases two and three of the Delphi protocol to achieve consensus. As a result, they have identified a set of 65 competencies listed by experts as core competencies for the design worker.

The same methodology was used by Pérez-Pérez *et al.* (2018), which forecast changes in Additive Manufacturing by 2030 using a Delphi with more than 100 Spanish experts. The questionnaire was constituted with some future scenarios, and the experts needed to answer with their concordance level about the probability of that future scenario coming true. The scenarios were formulated by the authors with their perception of possible future scenarios. Then, they simplified the scenarios listed previously and sent them to experts, who did one round of phases two and three of the Delphi protocol to achieve consensus. The results were able to show the aspects, technologies, and areas with the greatest growth potential.

Fadhil *et al.* (2021) built an employability model using the fuzzy Delphi method. First, they found the soft skills defined in Literature to prepare for the Delphi survey. Then, they invited 345 experienced managers, team leaders, and workers from the Technology Industry Sector in Malaysia to participate in the Delphi to assess the skills that will impact the capability of future job-seekers to get and retain their jobs. The Delphi questionnaire was built with a set of hypotheses that could be supported or not by the experts, and the respondents could answer and revisit their answers at any time during the Delphi process. Using the Delphi results, the authors developed a framework with an instrument to measure the critical soft skills that influence employability and collect data from Industry to provide an employability model based on soft skills.

Our work taps into the HEIs' teaching staff knowledge about the future of work by using Delphi's method. The HEI's staff holds all the knowledge necessary for the courses to adapt and be "future-proof", outlining the expected skills and competencies to be highly demanded from professionals in the future, and based upon the described methodologies of previous works about Delphi and the future of work we may derive detailed explanation on how professors should carry out the task of generating this knowledge. Therefore, we provide in this work a step-by-step guide on how to apply the Delphi method within a KM process mainly after the suggestions made by Gordon (1994).

3. The Knowledge Management Model

In this section, we present our proposal of a model to manage the knowledge of HEIs' teaching staff about the future of work. The proposed KM model should (i) aid the HEI's teaching staff to improve higher education courses' curricula in terms of adherence to the future demands of the labor market through KM, (ii) help manage future-oriented knowledge for the HEI to be able to foresee and adapt to labor market future changes, and (iii) generate knowledge making use of the teaching staff's knowledge about the future of work. Our proposed model combines the European Foundation for Quality Management (EFQM) Excellence Model with a Delphi process.

The presentation of this model is divided into two parts: in the first part, we present the Knowledge Management Process (KMP) explaining each one of its four steps, and in the second part we give a more detailed description of how Delphi can be used during the Knowledge Generation step of the KMP.

3.1 The Knowledge Management Process

The EFQM Excellence Model is described by Calvo-Mora *et al.* (2015) as a framework to implement the principles and practices of Total Quality Management (TQM). The authors show that the EFQM Excellence Model can be used to design and implement knowledge management processes, and explain how to integrate the EFQM Excellence Model framework, process methodology, and the so-called "supplier/partner management" in the KMP.

As the EFQM Excellence Model is reportedly the best-known reference in Europe when introducing and improving TQM systems (Calvo-Mora *et al.*, 2015), we decided to base our KMP on it. In addition, this new approach may take advantage of the integration between the KMP and the EFQM Excellence Model and help provide HEIs with a means of implementing TQM. Figure 1 synthesizes the whole process.

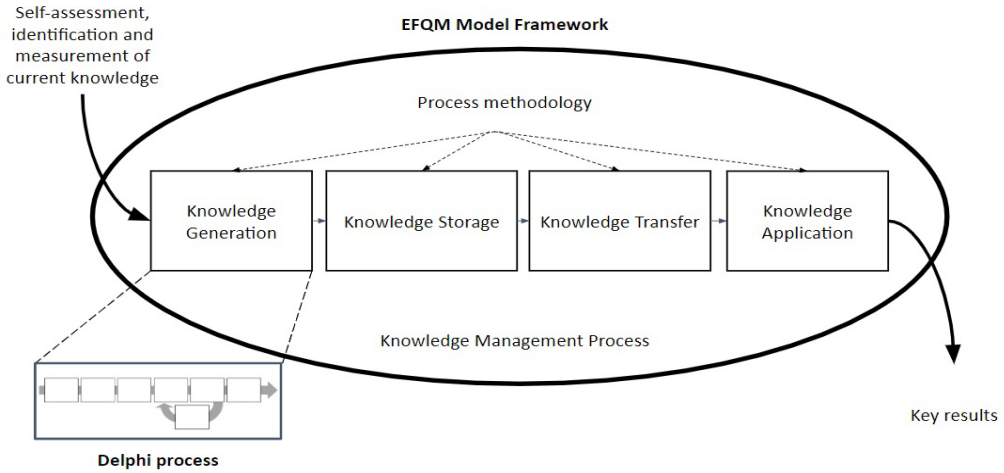


Figure 1: EFQM Model Framework KMP, after Calvo-Mora *et al.* (2015).

The original KM process is preceded by a self-assessment using the methodology present in the EFQM Excellence Model (Calvo-Mora *et al.*, 2015). The organization, or the HEI in our case, should first set out its objectives in terms of what knowledge it needs before the process starts. Our KMP adapts the original proposition, consisting only of the following four-step described below: generation, storage, transfer, and application. While Calvo-Mora *et al.* (2015) were concerned about generalizing the process to be applied, we already know that our work aims to help the management of the HEI staff knowledge about the skills and competencies expected to be highly demanded from professionals in the future. With this in mind, the self-assessment analysis prescribed by the EFQM Excellence Model may be performed as a way to provide those involved in the process with a complete background about the institution itself, i.e. what is done, who does it, and where it is done (Calvo-Mora *et al.*, 2015).

3.1.1 Knowledge Generation

This step is intended to fill the knowledge gap about the skills and competencies of future workers. Our process will specifically resort to internal knowledge creation as a means to generate it. We hypothesize the HEI teaching staff to give more accurate predictions of what these skills and competencies are likely to be. Nevertheless, a method to expound the teaching staff's tacit knowledge and transform it into explicit knowledge is needed. The Delphi method is the method of choice to create the knowledge needed for the KMP to continue. As the application of the Delphi method is rather complex, being somewhat of a process within a process, a more detailed explanation of how we propose it to be applied in this step is given below in subsection 3.2.

3.1.2 Knowledge Storage

Once the Knowledge Generation is done, it is time to store its results. This step is about building what is called "organizational memory" by Calvo-Mora *et al.* (2015). The self-assessment analysis conducted before the Knowledge Generation step and the results of the Delphi process must be stored in a way that they can be easily accessed and maintained. Here, we suggest the people involved to discuss which way works the best, but a very simple solution that may prove adequate would be to create a cloud storage folder with Dropbox or Google Drive and share it with the desired members of the teaching staff. The storage of the results produced should serve as a guide to future executions of the KMP while allowing a comparison between current and previous executions.

3.1.3 Knowledge Transfer

This step is where the transfer of the stored knowledge occurs, i.e. knowledge should reach the HEI teaching staff through information or experience if it is non-formalized, tacit knowledge. The original KMP makes use of the EFQM Excellence Model to facilitate the transfer of knowledge and do it in a more efficient manner (Calvo-Mora *et al.*, 2015). However, this might or might not work depending on whether or not the institution has already implemented the EFQM Excellence Model, especially. The institution may inform the teaching staff by organizing meetings or workgroups. Assembling a workgroup is a particularly interesting idea as the group can

be informed and discuss how to apply the new knowledge generated, leading the way to the last step of the KMP, the Knowledge Application step.

3.1.4 Knowledge Application

The Knowledge Application is the last step of the process, where the knowledge must be applied and used efficiently. The execution of the KMP can be time-consuming, but its results pay off as the new knowledge generated, if correctly stored and effectively transferred, can have great value for the institution, making it more efficient, more competitive, or improving the quality of the services it provides. However, if nothing is done to apply this knowledge, all the progress done will be lost and the benefits will be equal to zero.

The main objective of our KMP is to manage the HEI teaching staff's knowledge about the future of work. To apply this knowledge in our case is to compile what changes are necessary for the HEI courses' curricula to improve adherence to the future demands of the labor market, and implement these changes. The teaching staff may find out that the courses are already adherent to the labor market reality, and provide the student with the necessary skills and competencies needed or suggest changes in the curricula, such as updating technology or methodology taught, or even the addition or extinction of an entire course.

3.2 The Delphi process

The Delphi method is the method of choice to generate knowledge with the help of the HEI's teaching staff. As previously mentioned, the method can be simply described as a controlled debate among specialists to build consensus, and it is commonly used as a forecasting method. Anonymity and feedback are two irreducible elements of the Delphi method (Gordon, 1994), but the exact way the method is conducted may vary for a plethora of reasons. For our KMP, we suggest following the steps presented in Figure 2. The course's coordinator or a similar professional of the HEI's management staff can supervise the process. A professor can also be selected to have this role. Finally, an external expert in KM or Future Studies could act as a consultant to facilitate this process.

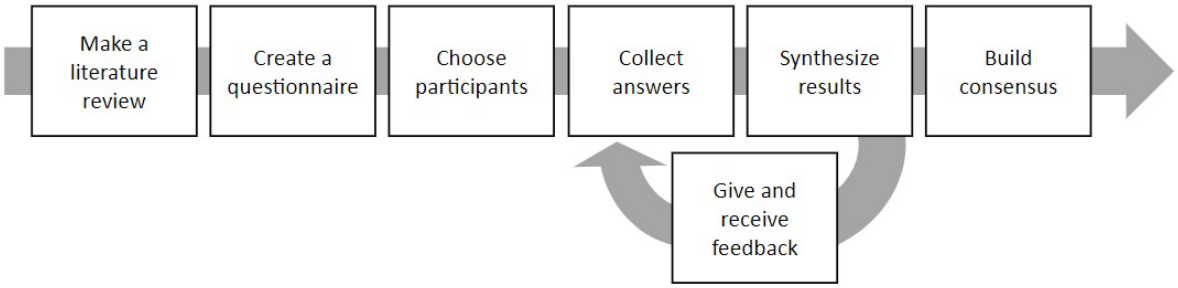


Figure 2: Delphi Process Steps.

3.2.1 Make a literature review

The purpose of the literature review is to survey (i) skills, (ii) competencies and (iii) future scenarios related to employability and higher education to serve as a basis to elaborate a questionnaire. As a means to provide the necessary evidence to solve a practical problem, we recommend the Rapid Review protocol to be followed as described by Cartaxo *et al.* (2018). A research question can be formulated as "What competencies are most relevant to pursuing a career in education?". Reading the literature can be a distributed process through which knowledge can be produced by the teaching staff. Also, the literature can be compiled by a single individual that presents its main results to the professors.

3.2.2 Create a questionnaire

Once the literature review is ready, it is necessary to prepare a questionnaire that will be answered by the participants. This questionnaire can be about both hard skills (course-specific technical skills) and soft skills (more generic and perhaps common skills to the higher education institution as a whole) necessary to future professionals, make a competency assessment or deal with future scenarios for employability and the future of work in the context of higher education.

The questionnaire can be made up of multiple-choice questions, Likert scales, short answers, or essay-like answers. The making of the questionnaire must be oriented by the literature review results. As for its implementation, we suggest that digital tools be used both in recording the answers and in their subsequent analysis. Google Forms is a great example of a tool that will help both in the elaboration of questionnaires and in the visualization and feedback of the results.

3.2.3 Choose participants

The key to a successful Delphi study lies in the selection of participants (Gordon, 1994). Participants must have prominent knowledge to answer the formulated questions and contribute with valuable ideas. It is desirable to include experts with different backgrounds to increase the potential for new ideas to arise and to instigate discussion. The experts must also be committed to the debate, and submit their answers until all rounds come to an end. If it is difficult to list potential participants, the ones selected can be used to recommend others. The number of participants may vary, but most studies use panels of 15 to 35 people (Gordon, 1994). Nevertheless, fewer people can be selected due to restrictions on the number of faculty members available or willing to take part in the research. We suggest the panel consist of, at least, five participants which can include the teaching staff as well as external professionals with considerable knowledge about the labor market of the course being analyzed. Despite Delphi being a statistically non-representative study, its results may be unhelpful if the panel is composed of few and unqualified people. As some of the participants are expected to abandon the debate, it is recommended to deliberately select more participants than what is considered enough.

3.2.4 Send the questionnaire and collect answers

The collection of answers is done after each round of the Delphi method. We suggest that responses be submitted digitally, participants are given an adequate amount of time to complete the questionnaire, and the means of communication remain the same. Another suggestion is to agree with the participants on the deadlines for sending responses, or to disclose a schedule that is accepted and followed by everyone. Forms can be sent by email, but those involved should be blind copied so that the anonymity of the participants is not compromised. The questionnaire may be tested before with a small group of participants that will not take part in the real debate to make questions less prone to misinterpretation or test possible answers.

3.2.5 Synthesize results

The synthesis of the results follows the stage of collecting answers. The way these answers will be synthesized and consecutively presented varies according to the questionnaire format, but it is recommended that aggregations be used (arithmetic means, medians, most frequent answers or lists of most frequent answers, etc.) together with strategies for data visualization (graphs, tables, lists, etc).

3.2.6 Give and receive feedback

In this step, participants are presented with the answers given in the previous round and, based on these answers, can change their answers or justify them. A professor who has offered a suggestion that is different from those of his peers may try to convince them otherwise. No participant should feel discouraged to disagree or pressured to agree with others, as anonymity ensures that an unpopular but well-founded opinion is not omitted, and it also guarantees the issuer the possibility to change his or her opinion without any judgment being made. Therefore, maximum attention should be paid to how feedback is given and received to avoid bias in responses and discomfort among participants. We suggest at least three iterations (i.e., rounds of discussion and synthesis of results followed by feedback) to take place before moving on to the next and final step.

3.2.7 Build consensus

The last step is consensus building. After all of the rounds have finished, it is necessary to take a step similar to what was being done when synthesizing results from previous rounds. The final product can have different formats (a report, a dashboard, etc), but it is recommended to include a log of the literature review execution, a copy of the questionnaire used, and the resultant consensus. A more detailed view of the evolution of the discussions may be included in the final text. It is also recommended to present results in a summarized and visual fashion, making use of graphs, tables, lists, figures, and diagrams instead of textual explanations whenever possible.

4. Discussion

The objective of this work was to help HEIs' courses to meet both present and future demands of the labor market. We supported the idea that this objective could be achieved through the application of a KM process,

making use of knowledge from the HEI's teaching staff. The proposed model combines FTA with KM and a TQM framework, the EFQM Excellence Model, providing HEIs with an artifact to achieving the goal of improving their courses' curricula.

KMPs do not make sense if they are not developed systematically. It is critical for HEIs to continuously generate and assimilate knowledge and new capabilities to remain competitive. Therefore, Total Quality Management as a management philosophy put into practice through the reference framework offered by the EFQM Excellence Model can serve as a context and support for the start-up and later development of a KMP (Calvo-Mora *et al.*, 2015).

A series of obstacles can occur that complicate the implementation of a KMP in the context of HEI, such as the integration of KM in daily activities, the cost of the information technologies, or the difficulty of some employees to adapt to or accept new orientations. Therefore, the KMP design must be supported by organizational structure, processes, and cultural values.

The Delphi method has some disadvantages that must be discussed. Firstly, the method depends on experts' availability and engagement to participate in all the rounds proposed. Some work is necessary for institutions to engage their participants, showing the importance of the contribution of Delphi to build some collective knowledge about the future of their courses, making it possible to assess and adjust courses that are not going in the right direction according to results found.

Sometimes, though, it's not possible to assure the participation of experts on all rounds of classical Delphi. In that case, a Real-Time Delphi could be applied. In Real-Time Delphi, experts receive the Delphi questionnaire and can see all other answers at any given moment. The participants can also revisit their answers at any time during the Delphi, changing opinions or justifying them. The Real-Time Delphi allows a reduction in the need for the synthesis of results as it only needs to be done at the end of the process. Thus, the duration of the "*Send the questionnaire and collect answers*" step, and the budget and time costs related to the synthesis process tend to be shortened, while participation rates tend to increase.

5. Final remarks

The impacts of the fourth Industrial Revolution will continue to be felt in the different areas of our lives, including Work. The Future of Work is closely related to the Future of Education, with formal education being a central element of development for the professionals of the future. Still, the importance of higher education courses is strongly dependent on the capacity of HEIs to update their curricula. This work proposed a KM model that helps the teaching staff of HEIs to evaluate what will be the essential skills and competencies for the employability of their students in the future.

This work was made to provide HEIs with the necessary tools to achieve the objective of improving their courses' curricula in terms of adherence to the labor market's present and future demands. For us it is clear that a match between the skills and competencies developed inside HEIs and the ones the market needs is of utter importance for both institutions and students alike, producing transcending developments that may benefit a whole country's economy. To support HEIs achieve this perfect match between education and the labor market is what we have done.

Since our model is yet to be tested, the next step is to apply the proposed model within an HEI and evaluate its effectiveness in helping HEIs to make improvements to their courses. We are looking forward to compiling what hard skills will be needed to make competent IT professionals in the next 5 years and apply our methodology to improve Computer Engineering courses.

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A Model for an Effective Learning Process in Higher Education: An Example from Three use Cases

Aurilla Aurelie Bechina Arntzen[1], Tone Vold[2] and Pedro J. Lara-Bercial[3]
[1]Institute of College of South East Norway
[2]Department of Organisation, Leadership and Management, Inland Norway University of Applied Sciences ·
[3]Universidad Europea de Madrid, UEM
aurillaa@usn.no
pedro.lara@universidadeuropea.es

Abstract: Knowledge is the most important asset in education. Knowledge Management has been the focus for many years in higher education. Recently, universities have embraced innovative processes that could foster a better learning process. Digital learning platforms such as Canvas or Blackboard has been deployed at the higher education to facilitate the learning process. However, it is still recognized that knowledge might not be fully acquired by students. Adoption of technological artifacts has proven to be a good step forward; however, it seems not sufficient. Lately there has been a focus on how to implement student centric methodologies to foster learning effectiveness. For instance, Project-based learning (Trullàs, Blay, Sarri, & Pujol) approach intends to provide to students the possibility to be engaged in project reflecting similar issues such in real life in order to further develop skills and competences. This paper outlines two approaches based on the leitmotiv "learning by doing" and on the implication of students in defining jointly a use case for their home exams. The paper presents 3 experiences from 3 universities based in Norway and Spain. A model for an effective learning in Higher Education is delineated.

Keywords: relevance of higher education, experiential learning, case-based learning, project-based learning, student active learning

1. Introduction

Academia is no longer an "ivory tower" (Etzkowitz & Leydesdorff, 2000), but instead, an organic part of a system to support the development of innovation, entrepreneurship and sustainability in an ever-developing knowledge-based society and work-life. It is well recognized that education and life-long learning are essential for the well-being of the society and goes beyond schools and universities. Academia should adapt their traditional way of teaching since education is considered to be a pillar of a knowledge economy. In addition, Academia should not only address the requirements of students represented as the Y or even the Z generation but as well should consider the lifelong learning trends. Companies or Individuals recognise the importance of developing new skills or competence during the work-life that could be relevant to their profession or their daily work activities.

Therefore, traditional education systems need to cope with the above listed challenges and new ways of knowledge creation or acquisition are fostering new approaches so that the learning processes are taking place in an effective manner. Several universities are promoting the leitmotiv "learning by doing" leading to two paradigms Project-Based Learning (PBL) and Problem Based Learning (PrBL). Larmer have identified some similarities and differences (Larmer, 2014). For example, PBL uses often uses cases or fictitious scenario while PrBL uses real world authentic cases.

Project-Based Learning (PBL), as a teaching methodology, is widely adopted by several secondary and higher education institutions (N. Krajcik, 2014). Aalborg University (Bertel, 2021) is pioneers in being totally oriented to PBL, based on the claim that project-based education is multidisciplinary by nature, and thus allows better results due to the active involvement of the student. Since Kolb presented his model of experiential learning (DA Kolb, 1984), a growing interest in implementing PBL as a new approach for teaching and learning has emerged (Baker, Robinson, & Kolb, 2012; Guo, Saab, Post, & Admiraal, 2020; Nurhidayah, Wibowo, & Astra, 2021). PBL approach has been recognised as an effective learning method since it requires an active participation of the students within the learning process (Terrón-López et al., 2017). In addition, students might share their acquired knowledge with other students while enhancing their learning experience by fulfilling their learning objectives.

Problem based learning (PrBL) methodologies have been successfully used in different domains. An active, collaborative and project-based learning methodology in the domain of software engineering is described in (Exposito, 2014), while PBL has been demonstrated an effective and satisfactory methodology for medical education (Trullàs et al., 2022).

Several methods to develop a PrBL models have been outlined. For instance (Phungsuk, Viriyavejakul, & Ratanaolarn, 2017) have developed of a Problem-Based Learning model using a virtual learning environment (VLE) for undergraduate students in the Photography for Communication Arts course. A web-based PBL application integrating PrBL authoring tool, a PrBL script instantiation tool, and a PrBL-specific run-time environment is developed by (Wang, Samaka, Miao, Ali, & Hoppe, 2016). PrBL also appears as a learning method for agile models of Software Engineering (Monett, 2013), robotics subjects (López-Nicolás, Romeo, & Guerrero, 2009), as well as for non-technical subjects such as marketing (Dušek, 2021).

However, although there are clear benefits, PrBL is not exempt from difficulties when it comes to bringing it to reality in the class-room (Park Rogers, Cross Francis, Gresalfi, Trauth, & Buck, 2011).

The main question is how to ensure students engagement in their learning process?

The Inland Norway University of Applied Sciences is investigating if involving student in the definition of homework exam based on use case of their own organisation would improve their grade. This approach is dealing mostly with students that are working in company and are undergoing into professional education. Utilizing the students' own initiative and background to develop these use cases may support the experience of relevance when working on the exams. The sense of relevance motivates for the learning to stick for then to become knowledge the students can use in a work situation.

This paper aims to look into the future of education by considering these different approaches in facilitating an effective learning process. Project based learning approach have been used at University of South-eastern Norway (USN) and at Universidad Europea de Madrid, Spain (UEM) while engaging students in defining their own homework exam based on their working environment has been implemented at USN and the Inland Norway University of Applied Sciences (INN). Our research is based on analysis of the teaching and learning approaches as described above to delineate a general framework encompassing some factors that will contribute to foster a learning process effectiveness.

The data are collected from three different courses; one course in "systems engineering" that is held at USN and one course in "learning organizations" that is deliver at INN. In addition, data collected at UEM are within the degree in computer Engineering as the PBL is a cross disciplinary and involved several courses.

The second section describes the cases of the three universities and outline some output of the evaluation of the implementation of project-based Learning and the student's engagement in homework specification.

The section three presents a preliminary framework of the ongoing research study.

2. Project based Learning and students' engagements in homework specification

For the purpose of our research, we adopted a case study approach as it is a suitable method for verifying and comparing outcomes across similar cases (Widdowson, 2011). This approach is generating an in-depth, multi-faceted understanding of a complex issue in its real-life context (Crowe et al., 2011). Stake defines "A case study is both the process of learning about the case and the product of our learning" (Stake, 1995). A case study is qualitative research and will contribute to gather data for providing a model encompassing factors that identified in using Project-Based learning and active students' engagements for an effective learning process.

The paper describes a multiple case study of the three universities' cases. To optimize predictive efficacy of the data collected, we used a mixed-mode approach for obtaining insights from the surveyed organizations. Literature reviews were exploited to add additional dimensions to our study.

2.1 A Project-Based Learning at the University of South Eastern Norway

2.1.1 Background of the case 1

From 2014 until 2020, a course systems engineering was conducted for master students for two different programs. One program was for student working part time and taking a master's degree within the field of systems engineering and the second program was for full time students in Master of embedded systems. The course was run over five full days. The course of "foundation of systems engineering" intends to provide a systematic approach to build a system starting from business needs or opportunity to system phase out. The part time students are all working in a company that is part of the joint educational program with USN. The two batch of students have to deliver homework 6 weeks after the lecture. The full-time student, in addition to the homework, must deliver a physical prototype or artefact based on the method of systems engineering.
The next sub-section describes the project-based learning projects and the HomeWorks.

2.1.2 Project Based Learning (PBL)

The project underlying background of the PBL was to learn how to apply with a concrete project the foundations of systems engineering. The project duration was set for five months. The group of 4 or 5 students should suggest a topic addressing a need, design and develop a prototype of the solution.

Over 7 years, there was several types of projects such as Snowplow robot, robot to remove plastic in water, automatic food pet delivery, automatic garbage sorting, etc... All the projects were built by the student under the supervision of a teacher, experts in some cases. They usually meet once a week for reporting the project progress. The students had to elaborate a budget covering the physical parts of the solution and USN provided the funds to buy the necessary device or equipment in case it was not available. The budget was small and thus students should come with a solution that was cheap but addressing the needs that was formulated at the beginning of the project. During the 5 months of the projects, that was divided in different steps such as stakeholder and their requirements identification, translation of these requirements into systems design, prototype building and verification of the solution. At each phase, students should make a presentation front of their other students so that everyone was aware of the progress of each group.

2.1.3 Use case from student's own organization

The homework encompasses one general part that was mandatory and two use cases to choose from. One general use case was specified by the teacher with several questions to answers, while the second one student could use rather their own organization as use case and answer the same questions.

Also, throughout the semester, the students have co-developed cases with the teacher and solved them in a plenary session. The mandatory assignments were to be solved in groups. By "forcing" the students to relate the curriculum to either their own or fellow student's workplaces, they were able to understand the different theoretical issues, also from a practical implications' perspective. The feedback was provided by either the teacher in the course, or a professor with similar competence from another institution. Exams were executed in the same manner; with two options and similar questions. The evaluations show that the students appreciate this approach and that they find the courses relevant for their work-situation.

2.1.4 Process evaluation description

The start of the initiative the use the PBL as a mean to expose the students to real life problem by developing prototype was not a smooth process as instructors did not have experience in this approach. Several challenges and issues for both instructors and students were identified and were addressed the following year. In order to assess this teaching/learning approach a mixed approach was conducted. A short survey sent to the students and informal meetings or interviews with both instructors and students were conducted over 6 years. Data collected and the analysis of the final solutions developed, showed that there is clearly an improvement, not only in the process itself, but as well in the result of the prototype and the report quality. This approach showed clear benefits for students in acquiring and applying knowledge of the systems engineering concepts and in others skill such as ability to work in team, to communicate, to cope with conflict resolutions, to manage project, to solve problem in creative manner and so forth. However, advantages for the instructors were not obvious as it required more time and willingness to investigate new domain of applications as the students were the one providing topics for the projects. We have identified few positive feedbacks from instructors related to the enjoyability of developing a concrete project, continuous challenges in getting new ideas or contributions in some cases in their research activities. For the organization, promoting such BPL is a means to attract more

students and to be defined as university of the future, though challenges for universities and instructors needed to be overcome. For instance, adaptation of the curriculum, schedule, lack of experience, resource demands, lack of consistent support, lack of incentive, costs for education, lack of instructors willing to embrace the PBL, lack of industrial experience of the teacher, a number of aspects that lead to more theoretical project.

Student's engagement in homework were assessed through analysis of whether students would choose the use their company as use case results and the evaluation of the homework results. Comparisons of the results showed a better quality of the homework when students would decide to write their own case study. The experience showed that students had better engagement with their coworkers, developed a better understanding and had to adopt a better reflective practice. Informal interviews with the students indicate that although they spend more time in describing their own case, they found it more relevant and thus more interesting to work on the homework.

2.2 A project Based learning at Universidad Europea de Madrid (UEM)

2.2.1 Background of the case 2

In 2012, Universidad Europea de Madrid opted for Project-Based Learning (PBL) as a keystone of the way their students should learn. The idea was to adopt a common approach across subjects in order to develop students' knowledge and skills, allowing them to become competent professionals who are capable of meeting educational and social needs. The leitmotiv was "students learn best when they apply knowledge as a part of real-life projects", just like they will do in the professional world.

As a part of this learning model, students begin working on projects in their first year. As a result, they develop communication, collaboration, problem-solving, and critical-analysis skills. Moreover, this learning methodology even occasionally includes collaboration with different companies and/or institutions, letting them to go closer to industry.

The study plan of the Computer Engineering Degree encompasses a specific teaching module dedicated to PBL including student's knowledge acquired in the basic training module.

The PBL approach was designed as well to include other modules taught in the same semester. The projects undertaken by the students were ranging from robot development to Data Analysis or Artificial Intelligence artifacts.

After three years of wide-spread implementation of this model in all engineering degrees and after carrying out an initial analysis of the results, in September 2015 the study plan of the Degree in Computer Engineering was modified, among others, to include specific courses on development of projects in all the years of the degree. Experience gained through PBL implementation highlighted recognized benefits not only for students, but as well for instructors and the University as indicated in the case 1.

2.2.2 Process evaluation description

A decade after the implementation of the PBL methodology, a self-assessment was conducted to investigate further the success criterions and to provide support for teachers that were engaged.

Measurement of impact was done through quantitative method. Data related to thirteen subjects of the Degree in Computer Engineering using either PBL or more traditional methodology have been analyzed to see the influence of PBL. These data include, over time, the evolution in the percentage of marks the success rates and the satisfaction of these subjects after the two runs for each course. The analysis has covered from the academic year 10-11, in which there were still no specific project subjects, up to the academic year 20-21.

Assessment shows that average percentage of students passing in traditional subjects has been gradually rising from 65% 2012 to 80% in 2018 as a collateral effect of the new project-based courses. The percentage dropped slightly the last couple year 2020 and 2021 probably due to the COVID-19 pandemic. Although there is a growing number of students passing their courses since year 2012 till 2018, analyzed of the data from year to year, showed that the grow is not linear. It shows that the type of project could influence the learning outcomes and the acquired knowledge.

Due to the success of PBL, the university have decided to expand this approach and thus have adopted a more systematic way to PBL implementation. A Project Based School (PBS) Office was created to support professors and provide resource to implement PBL in their classrooms at three levels: single course, integrative projects (IPs) covering more than one course and an extracurricular level with projects developed within students' clubs, external contests or other similar activities.

2.3 Engagement of student at homework process in the Inland Norway University of Applied Sciences

2.3.1 Background of the case 3

The courses that are a part of the research area are "Learning Organizations" and "Knowledge Management", both courses of 7.5 ECTS. The curriculum has previously been presented as lectures during seminars (1 day 3 times per semester). These were long days for both students and lecturer and thus it was decided to test out the Flipped Classroom (REF). Videos were then made available in the Learning Management System (LMS) and then only short lectures were provided during the seminars, introducing cases. A separate case book was developed for this purpose, which worked very well. In 2017 one of the students were the responsible for developing onboarding and training for newcomers in his organization and he asked to use his organization as a case for his assignment. The following semester, this opportunity was presented to all the students, but with an option of an "ordinary" case. Co-development and co-design became very popular in other courses as a part of the curriculum (for example within service design) and the idea of invite the students to co-design the assignments emerged. This development has become a very welcomed way of working together with the students and according to the student evaluations, this has contributed to the relevance of the courses back in their organization.

2.3.2 Process evaluation description

There have been several rounds of evaluation processes, both as a part of the quality system at the University, but also as a part of the research on relevance of higher education back in work-life. Through net-based surveys, interviews with individuals and groups, a careful evaluation of all the singular steps in the development from lecture-based education to Flipped Classroom combined with co-creation of assignments, has been carried out. The recruitment to the study program is rather stable and there is a waiting list to enter amongst the approximately 100 admitted each year.

3. Findings and discussion

Based on analysis of the three cases, we have identified few elements or factors that could play a significant role in ensuring an effective learning process for PBL and self involvement.

They are summarized in the following picture:

There are several factors that could be all explained. However, we can list some of them such as:

Intrinsic and extrinsic motive was important for both students and teachers as discussed in (Chiang & Lee, 2016).

Usefulness/Engagement is as much important for the teachers and students. The Gallup's Student Poll analysis clearly stated that students achievement is directly linked to its engagement (Reckmeyer, 2019).

Fairness/recognition by the organisation is essential for teacher as this new way of teaching require times, stronger and frequent interaction with others academic staff or students. Therefore, their effort to launch this type of initiative should be recognised by the university by providing technical and financial support. Instructors getting recognition for their academic work are motivated to pursue high-level instruction (Andrews, 2011).

Leadership has proven to be a very important factor. The work of (Carmeli et al., 2011) highlights the importance of leadership for promoting relational and organizational identification, thereby facilitating a positive environment for fostering innovative approaches for teaching.

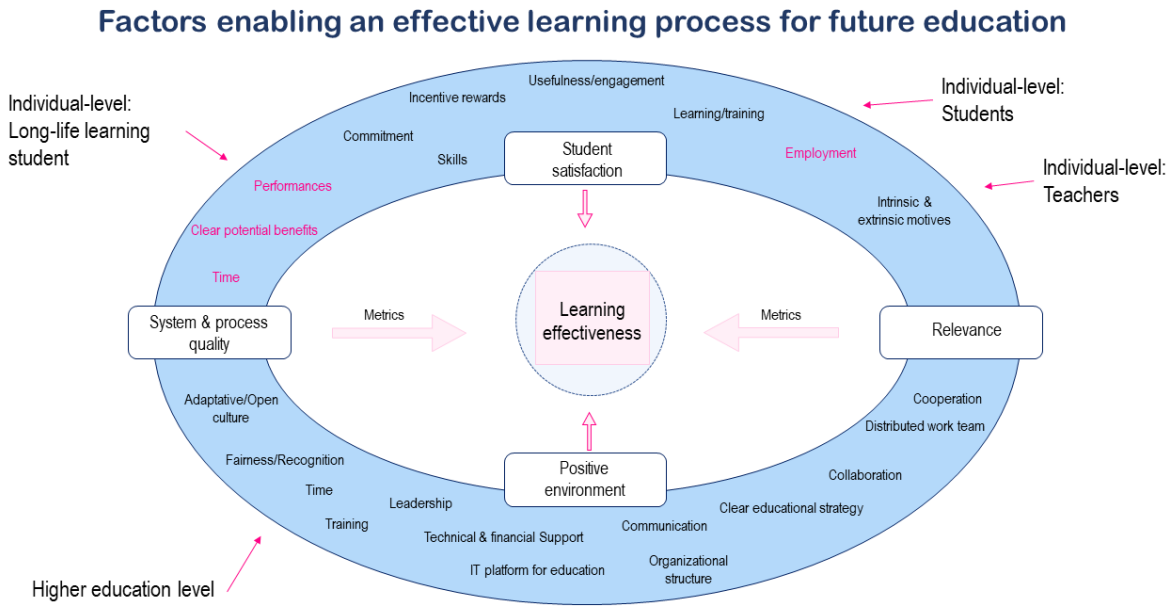


Figure 1: Factors for enabling an effective learning process based on PBL and student's engagement

4. Conclusion

This paper investigated the factors that could plays an important role in fostering learning process while using project-based learning as an educational methods and engaging students that are working in specifying their own homework based on their companies. The paper report experiments conducted in three different universities over several years and the aggregated results of assessment lead to a specification of a model encompassing several factors to be considered for good learning process. The work is still ongoing and cross comparison between the approaches needed to be further evaluated. However, the results of the assessments outline that although there are clear benefits that are more numerous for the students than for the instructors or higher education organizations; there is still a need to cope with challenges such as dedication, time, costs, curriculum adaptation, incentive, technical and financial support, etc. This is more relevant for Project based learning process. Engagement of the students in the specification of their own exam proved to be a good approach in fostering better quality. Academic and teachers have a strong role in fostering the knowledge sticking for the students and therefore adequate infrastructure supporting in an effective way the process should be well designed by the higher education organizations.

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Managing Knowledge Towards firm Performance: The Moderation role of the Business Environment

Emmanuel Ebo Arthur and Jan Stejskal
University of Pardubice, Pardubice, Czech Republic
emmanuel.arthur@upce.cz
jan.stejskal@upce.cz

Abstract: The prominence of the knowledge economy technological innovation and economic development globally cannot be questioned. However, not all firms especially from Central and Eastern European to tap into the benefits coupled with new knowledge for improvement in firm innovation performance. Mostly, this is due to environmental factors confronting the firms. This study focused on the impact of External Knowledge (EK), R&D expenditure and ICT usage on firm innovation performance with the moderation role of informal competition. We used Resource Dependency Theory and Contingency theory as the theoretical background. A cross sectional data from the World Bank Enterprise Survey (WBES) 2019 on 3105 firms from CEE regions namely Czech Republic, Hungary, Slovakia, and Poland was analysed using logistic regression. These countries were selected because firms face elevated level of informal competition in the business environment. The study confirmed the hypotheses that, internal R&D, external knowledge and website availability and usage have positive and significant direct effect on technological innovation. Our study contributes to the literature of R&D and firm performance by highlighting the moderating effect of business environment (informal competition).

Keywords: Technological innovation, external knowledge, external and internal R&D, website, CEE countries

1. Introduction

Over the century, firms, academic institutions, and governments have invested and continue to invest hugely in research and development (R&D), acquisition of external knowledge and information and communication infrastructure. New knowledge, collaboration, and innovation are key determinants of competitiveness in the era of a knowledge-based economy (Prokop, Hajek, & Stejskal, 2021). Firms have therefore found the need since early 1980s to assess the outcomes and impacts of R&D expenditure (Cho, 2018), external knowledge (Mina et al.,2014) and ICT (Yunis et al.,2018) on their innovation performance. Innovation literature has classified innovation into technological and non-technological innovation (Mothe, and Thi, 2010). Technological innovation assumes the form of new products and services while non-technological innovation is related to the novel changes in the organization and marketing activities of the business. This study focuses on technological innovation. This is because it is the main innovation output activity performed by firms. According to Gogokhia, and Berulava (2021), an important prerequisite for economic development and technological innovation is the firm's capability of learning and appropriating knowledge in the business environment to earn more profits. Thus, extant literature posits the impact of R&D expenditure, external knowledge, and ICT on technological innovation, however, the indirect role of the business environment cannot be questioned in (Alam et al., 2020). For instance, Jia (2020) investigated how informal competition moderates the relationship between cooperate social responsibility and firm performance. On the other hand, Pérez et al., (2019) examined how informal competition impact on the innovation in formal firms.

To the best of our knowledge, no study has investigated the impact of R&D expenditure, external knowledge, ICT on firm technological innovation and how the informal competition moderates the relationship between R&D expenditure and technological innovation. This is the gap our study seeks to fill. A cross sectional data from the WBES 2019 on 3106 firms from the CEE namely Czech Republic, Slovakia, Hungary Poland was analysed using logistic regression. These countries were selected because firms face high number of competitors in the business environment of several catching-up economies in South-East Europe and Central Asia (Williams & Bezeredi, 2018). It is therefore interesting to investigate firms among the selected countries that fall within the catching-up economies to see how informal competition in the business environment would impact the relationship between R&D and firm performance. Also, our study was theoretically built on the contingency theory (CT) and the resource dependency theory (RDT). The CT suggests that the relationship between two variables is contingent on the level of a third variable (Adomako et al., 2021). This implies that, the introduction of a moderator variable into the relationship between two variables may allow specific understanding and prevent misleading conclusions regarding the contingency relationships. Similarly, RDT suggests that external environmental factors influence the organization's behaviour (Hillman, Withers and Collins, 2009; Adomako et al.,2021). A key assumption of RDT is that reliance on 'critical' and important resources influence firm behaviour

and organizational decisions and actions. Thus, the focus of this study is to investigate whether the informal competition moderates the relationship between R&D expenditure and technological innovation in selected CEE countries using the RDT and contingency theories.

Our study contributes to literature in three (3) ways. First, it integrates ideas from the literature on R&D expenditure, external knowledge, ICT infrastructure with informal competition in perspective (Gogokhia & Berulava, 2021). Second, our study fills an important gap in literature, specifically the dearth of research on how the level of informal competition in a firm's business environment moderates the relationship between R&D expenditure. Third, our study theoretically extends the body of knowledge on RDT and contingency theories. Our findings have key implications for firm managers in CEE and globally.

The next section is the theoretical framework which discusses extant literature and formulate the hypothesis of the study. Section 3 discusses the empirical model, data and methodology used for the study. Results and discussion are captured in section 4 while section 5 gives the conclusion of the study.

2. Conceptual background and hypothesis

New knowledge is created through R&D and shared through various process to create value for firm's product and service (Cho,2018) leading to economic growth (Zhylinska, 2020). The R&D process is capital intensive and requires huge expenditure to carry it out. Both internal and external R&D have positive impact on patent (Artz et al., 2010), process and product (Damanpour & Gopalakrishan, 2001). On R&D, our study focused on firms' internal and external expenditure made on research and development (R&D) activities. External R&D has positive and significant impact on process innovation (Medda et al, 2020). Medda et al., (2020) did not indicate how elements in the business environment affect the relationship between external R&D and product innovation. It is also pertinent to note that, the ability of firms to invest in R&D is dependent on the resource available to the firm. We examine how external and internal R&D influence technological innovation of firms with informal competition moderating the impact of the relationship.

Development from within is gradually shifting to development from without. Firms are increasingly developing outwards strategies to engage other firms externally through interfirm cooperation and collaboration. This is to gain external knowledge and share ideas to promote innovation. Service firms have been found to be leveraging on external knowledge for their innovation than manufacturing firms (Mina et al., 2014). The search for external knowledge is also influenced by several factors such as proximity (Belderbos et al., 2021) and cost (Mina et al., 2014). While firms are likely to cooperate with other firms closer to them for external knowledge, it is important to note that, the search for external knowledge is not costless. The varied preferences of customers and the need to maintain customer loyalty and remain competitive in the business environment influence firms to seek more knowledge outside their jurisdiction and manage it effectively towards technological innovation. The more diverse external knowledge, the better its impact on productivity. Acquisition of external knowledge is not necessarily a guarantee to innovation, but its strategic use is also vital. The more complex an innovation, the broader knowledge is required, and the more likely firm will seek external knowledge (Mina at al., 2014). External knowledge is good for firms, but they should not be sought at the expense of internal knowledge. Firms therefore need to have a good balance developing internal knowledge and effectively incorporating external knowledge into their innovation activities (Gallego et al., 2013).

Distance among firms create is a barrier to collaboration and partnership. Knowledge diffusion through labour mobility facilitates transfer of knowledge from one firm to another. However, the use of ICT creates more avenue for transfer of knowledge among firms to promote technological innovation. In the current knowledge and digitized economy, businesses, households, and individuals use information and communication technology (ICT) to make activities effective. ICT on its own cannot create the needed potency towards innovation and businesses profitability. ICT usage is a major determinant in product, service, and process innovation. Although it was found that ICT can be a substitute for geographical proximity, this requires strategic management to coordinate knowledge transfers related issues (Omobhude & Chen,2019). ICT and the digitization of organizations give opportunities for people to work from remote locations (Li, Lee& Kong2019) and firms to cooperate with ease regardless of the distance. The cost of acquiring ICT infrastructure could be a hindrance to several firms the incorporate ICT in their production activities. The foregoing arguments show that internal R&D, External R&D, external knowledge, and ICT usage influence firm technological innovation. Therefore, we hypothesize that:

H1a: External R&D has positive and significant effect on technological innovation of firms.

H1b: Internal R&D activities positively influence technological innovation of firms.

H2: There is a positive and significant relationship between external knowledge and technological innovation of firms.

H3: The use of internet positively influences firms' technological innovation.

2.1 The moderating role of business environment (informal competition)

Firms do not operate in a vacuum. They depend on the current happenings in the business environment for survival. While dynamic business environments have a positive moderating effect on firm's innovation performance, industry competition in business environments abate this relationship (Gogokhia & Berulava, 2021). Also, other previous researchers have acknowledged that, disturbances in the business environment can moderate the extent market orientation affects firm performance (Gogokhia & Berulava, 2021). Employees, technology, government regulations, suppliers and competitors are elements in the business environment (Kozubíková., Dvorský, & Ključnikov, 2020) which influence activities of firms into loss or profitability. This study suggests the moderating role of the informal competition in the business environment rather than its direct effect on firm technological innovation. The case of caching-up economies provides a good example for illustration of business environment variability across countries. The contingency theory as well as resource dependency theory posit that, firm's actions are influenced by the external environment (Adomako et al., 2021) leading to improvement or otherwise productivity. This study introduced informal competition in a firms' external environment as a moderator between R&D expenditure (internal and external) and firm technological innovation. This supports the axiom of the contingency theory. Similarly, firms could depend on the opportunities that informal competition in the business environment presents to innovate their product, process and marketing systems. Cooperation is an important determinant that helps to spread the existing knowledge and to create new knowledge (Stejskal, Hájek & Prokop, 2018) to improve technological innovation among firms.

By implication, a firm's strategic decisions in handling the level of informal competition in the external environment has unrestrained consequences on the overall innovation output. Informal competition in the business environment brings about heterogeneity in consumer choices and preferences and firms must always be innovative enough to keep and add to the customer base. Following the above arguments, we expect industry competition to moderate the relationship between R&D expenditure and technological innovation. We therefore hypothesize that:

H4a: The positive and significant relationship between external R&D expenditure and technological innovation of firm is moderated by informal competition
H4b: The positive relationship between internal R&D expenditure and technological innovation of firm is moderated by informal competition
The prediction equation is

$$\log(p/1-p) = \beta\ 0 + \beta1(ext_RD) + \beta2(int_RD) + \beta3(ext_know) + \beta4(website)\ldots\ldots (1)$$

log(p/1-p) denotes the dependent variable; β0 is constant; β1+ β2+ β3+ β4 denote the independent variables

The prediction equation after introduction of an interactive term is

$$\log(p/1-p) = b0 + \beta1(ext_RD*info_compt) + \beta2(int_RD*infor_compt) + \beta3(ext_know) + \beta4(website)\ldots. (2)$$

log(p/1-p) denotes the dependent variable; bo is constant; β1 and β2 denote the introduction of interactive variables to the first two independent variable + β3 and β4 denote the independent variables without interactive variables

3. Data and methodology

3.1 Data

We used cross sectional firm-level data from the World Bank Enterprise Survey (WBES) 2019 database. The WBES contains firm level data about R&D, informal competition, external knowledge, website, innovation and management. WBES provides data about enterprises in the manufacturing and service sectors using globally accepted standardized survey instruments and uniform sampling methodology (Prokop et al., 2021). The data from 3105 firms was obtained from four CEE countries-Czech Republic, Hungary, Slovakia, and Poland. To estimate the impact of external R&D, internal R&D, external knowledge, and website on technological innovation, we considered firms that have spent on research and development activities either in-house or contracted with other companies (Jose et al., 2019), engaged with other firms for external knowledge and have website.

3.2 Description of variables

We discuss the operationalization of the variables included in our model next and present a summary in table 2.

Table 1: Variables and measures

Conceptual variable	Notation	Operationalization	Sample reference
Dependent variable	DV		
Technological innovation	Techinno.	This is the introduction of new or improved product or service by the establishment in the last three years	Jia, 2020
Independent variable	IV		
External R&D	Ext._RD	Expenditure of the establishment on research and development activities contracted with other companies	Singh et al., 2021
Internal R&D	Int._RD	Expenditure on research and development within the establishment	Anzola-Román et al.,2018
External knowledge	Ext._Know	Expenditure on acquisition of external knowledge such as purchase of patent and non-patent inventions and know-how from other companies	Hipp, 2010 Mina et al., 2014
Website	Website	The establishment having its own and functional website	Omobhude & Chen,2019
Moderating variable	MV		
Informal competition	Info. _compt	The establishment competing against unregistered or informal establishments	Gogokhia & Berulava, 2021
Control variable	CV		
Country	Country	1-Slovakia 2-Poland 3-Hungary 4-Czech Republic	Prokop, Hajek, & Stejskal, 2021

Note: WBES (2019) is the data source

The focus of our study was to investigate the extent to which the parameters of the study impact technological innovation and to assess moderating effect of informal competition on the impact. We used external R&D, internal R&D, external knowledge, and website as the independent variables. Technological innovation was used as the dependent variable, informal competition as the moderating variable and country as controlled variable. Except for the four countries which were assigned values from 1 to 4, all other variables were dummy variables which too the value 1 if the event happened and 0 if the event did not occur. The Informal competition was used as the proxy for business environment, website as the proxy for ICT and internal R&D and external R&D as proxies for R&D expenditure. We controlled for country because the sizes of the four countries differ (Prokop, Hajek, & Stejskal, 2021). The action was to limit its interference in the relationship and impact of the independent variable on the dependent variable.

4. Data analysis and results

We used logistic regression to test our hypotheses and estimate the influence of external and internal R&D, external knowledge and website on technological innovation. Logistic regression was used due to the dummy variables used in the study (Costa e Silva et al., 2020).

Table 2: Logistic regression analysis and the interactive term

Variable	Co-efficient	Std Error	P-value	z
Ext_RD	.2556847	.1890239	0.176	1.35
Ext_RD*Info_Compt	.5842303	.465751	0.210	1.25
Int._RD	1.05287	.1409518	0.000	7.47
Int._RD*Info_Compt	-.6652711	.3203523	0.038	-2.08
Ext._Know	.8415959	.1594443	0.000	5.28
Website	.7902477	.1523783	0.000	5.19
Info_Compt	.3776643	.1345607	0.005	2.81
Country				
2	-.1545934	.1567581	0.324	-0.99
3	.3013064	.2018669	0.136	1.49
4	.535508	.1707072	0.002	3.14
Pseudo R2 0.1152	Prob > chi2	0.0000		

Note: Significant at p<0.05 level

The coefficient values indicate the relationship between technological innovation and external R&D, internal R&D, external knowledge and website. The p-values indicate the significant level of the relationship at p<0.05. Our hypothesis 1a sought to examine the direct and significant effect of external R&D on technological innovation of firms. As indicated in Table 2, although the relationship between external R&D and technological innovation is positive, there effect on technological innovation is not statistically significant (β= 0.2556847, p=0.176). On the other hand, hypothesis 1b assessed the extent to which internal R&D activities positively influence technological innovation of firms. The results indicate a positive and statistically significant relationship between internal R&D and technological innovation (β=1.05287, p=0.000). This means hypotheses 1a is rejected because it does not support our model but 1b is accepted because it supports our model.

The results (β=0 .8464884, p=0.000) support hypothesis 2 that, there is positive and statistically significant impact of external knowledge and on technological innovation of firms. On the use of website and its impact on technological innovation, hypothesis 3 supported our model because, the results (β=0.7591678, p=0.000) showed positive relationship and statistically significant impact of internet website by firms on technological innovation. Our model also sought to assess the extent to which informal competition in the business environment moderates the relationship between R&D expenditure (external R&D and internal R&D) and technological innovation. We therefore introduced an interactive variable to external R&D and internal R&D variables in the model. Hypothesis 4a states that, the positive and significant relationship between external R&D expenditure and technological innovation of firm is moderated by informal competition. Table 2 indicates after the introduction of interactive variable (external R&D*informal competition), there is positive relationship between the interactive term and technological innovation but the impact of the interactive term on technological innovation is not statistically significant (β=.5842303, p=0.210). The coefficient for external R&D before the interactive variable has increased from 0.2556847 to 0.5842303 after introducing the interactive term. This means the presence of informal competition has positively improved the relationship between external R&D and technological innovation although the p-value is not statistically significant. Hypothesis 4a is therefore rejected. On the other hand, after introducing an interactive term, the results show that (β=-.06652711, p=0.038) there is negative relationship between internal R&D and technological innovation but the impact of the interactive term on technological innovation is statistically significant. This means the results support our hypothesis 4b.

Table4: Test for robustness

	Robust			
Variable	**Co-efficient**	**Std Error**	**P-value**	**z**
Ext_RD	.2556847	.195891	0.380	0.88
Int._RD	1.05287	.1459258	0.000	7.56
Ext._Know	.8464884	.1605655	0.000	5.23
Website	.7591678	.1442025	0.000	5.22

	Robust			
Variable	**Co-efficient**	**Std Error**	**P-value**	**z**
Country				
2	-.1555555	.1498535	0.300	-1.04
3	.3068353	.1916902	0.131	1.51
4	.5141331	.1651935	0.002	3.11
Pseudo R2= 0.1046 Wald chi2 261.49 Prob > chi2 = 0.0000				

Note: Significant at p<0.05 level

Except for external R&D, all variables in the model were statistically significant. The test for robustness of the model in table 3 showed Pseudo R^2= 0.1046 and Wald chi2 261.49 at p=0.000. According to Mehmetoglu, and Jakobsen (2022) Psuedo R^2 explains the extent of variations of the explanatory variables in the model. Pseudo R^2 of 0.1046 therefore means, all other things being equal, our model explains 10.46% of the variation in the independent variables. Also, the Wald chi2 is statistically significant at p=0.000. This mean that, the independent variables used in the model namely external R&D, internal R&D, external knowledge, and website availability collectively contribute significantly to the model of the study.

Table4: Results of marginal effects

	Delta-method			
Variable	**dy/dx**	**Std Error**	**Prob.**	**z**
Ext_RD	.0269294	.030635	0.379	0.88
Int._RD	.1732429	.0219475	0.000	7.89
Ext._Know	.1319366	.024698	0.019	5.34
Website	.1213006	.0231799	0.000	5.23

Table 4 shows the marginal effect (dy/dx) of the explanatory variables on the technological innovation of firms. On external R&D, it shows that, a unit change in external R&D results in2.69% change in technological innovation while a unit change in internal R&D shows 17.325 change in technological innovation. Also, a unit change in external knowledge results in 13.19% change in technological innovation. This is more than a unit change in website which results in 12.13% change in technological innovation. It shows that all the explanatory variables affect technological innovation at various degrees when there is one unit change in any of the intendent variables. It is important to note that, among the variables in the model, internal R&D is the bigger predictor of technological innovation.

5. Discussion and conclusion

Past research on firm level technological innovation has focused on key factors such as R&D expenditure having a positive effect on technological innovation in Czech Republic, Slovakia, Hungary and Poland. These researchers failed to assess the impact of elements in the business environment on the relationship of these key factors have with technological innovation. Our study has dealt with not only the extent R&D expenditure (internal and external), external knowledge and website availability on technological innovation. Our results reveal that, there is internal R&D has a positive and significant impact on technological innovation. This confirms Medda (2020) findings on R&D expenditure and its impact on technological innovation. However, on external R&D, our results surprisingly showed that, it is not statistically significant. But when informal competition was introduced to the model, it had two different effects. First, it changed the positive relationship between internal R&D and technological innovation to negative. Second it strengthened the positive relationship between external R&D and technological innovation. This means that, firms tend to rely more on internal R&D in the monopolistic market or markets with less informal competition. However, in a market where there is high level of informal competition, firms rely less on internal R&D but more on external R&D to promote technological innovation.

This further extends Jia's (2020) work on industry competition having a moderation effect on the relationship between cooperate social responsibility and firm innovation performance. Our study further confirmed the support of hypotheses 2 and 3 that there is a positive and significant impact on the relationship between external knowledge and website availability and technological innovation. That firms in selected the CEE countries rely on external knowledge for technological innovation in a either in an environment with or without informal competitors. The use of ICT in the operations of firms remain vital to the promotion of technological innovation. Our finding supports studies by Kong et al. (2019) and Yunis et al., (2018) that the use of ICT such as firms having a functional website promotes technological innovation.

In addition, the findings highlight several theoretical and practical implications. The examination of the explanatory variables and the moderating factor suggest that their relationships are contingent on the level of informal competition. This reflects an axiom in the contingency theory that, the relationship between two variables depends on the level of a third variable (Adomako et al.,2021). The addition to this theory stems from the fact that, informal competition is a contingent variable that determines how strong or weak external R&D and internal R&D, external knowledge and website could impact technological innovation. This is a novelty in relation to extant literature. On the other hand, the RDT theory posits that elements in the external environment could serve as critical resource in determining the decision performance of a firm. Firms could depend on the informal competition and collaborate and develop a wide range of network relationships with stakeholders and other firms of similar interest to boost technological innovation. How a firm manages the level of industry competition in the business environment could be a valuable resource to improve innovation or a threat to the firm's innovativeness. By implication, managers and stakeholders of firms should have a critical assessment of the effects informal competition presents in the business environment. And develop strategies to compete effectively to the advantage of the firm. If managers remain oblivious of the opportunities and threats informal competition poses to firm innovation, the value of expenditure innovation would be stifled and be competed out of business. In an era where the business environment is witnessing keen competition from both local and foreign firms, the actors in the firms must be abreast of the current issues in the business environment to promote technological innovation.

5.1 Limitations and future research

Although our findings were supported by our hypotheses, it is important to interpret those findings in-line with the limitations of the study. First, the cross-sectional nature of research does not allow for the drawing of causal claims. We therefore suggest that future researchers to use longitudinal research method to further examine the moderating effect of informal competition between R&D expenditure, external knowledge website and technological innovations. Second, since most of the CEE are still catching-up in terms of development and support government give to firms as compared to countries from Western Europe, we suggest a comparative study with the Western European countries. This allows for an opportunity to examine whether strategies put in place by firms to manage informal completion is the same or different between the two blocs and how they could learn from each other. Our study contributes to the RDT and contingency theories by providing specific conditions under which informal competition could be a dependent resource to firms and the extent to which firms could use it as an opportunity or succumb to it as a threat in the business environment.

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Resistance to Digital Transformation: The role of middle Management Personal Networks

Konstantin Bagtationi, Thomas Wolfgang Thurner and Olga Gordienko
HSE University, Moscow, Russia
kbagrationi@hse.ru
tthurner@hse.ru
oagordienko@edu.hse.ru

Abstract: This paper studies the digital transformation process of one of Russia's largest freight forwarding companies that was met with resistance from its middle management which put the entire change process in jeopardy. With the move to a digital platform business, the middle management had to follow enterprise-wide rules imposed by the underlying information system. Preferred treatment of hauliers as established by regional managers were no longer possible and it was this loss of autonomy that stood at the core of resistance among the firm's middle management. The practice of such extra organizational networks is described in Russian bz the term 'blat'. The blat originated during the Soviet Union and described a system of personal favors that ensured the functioning of society in times of scarcity. The paper describes eight instances of middle managers' resistance who resisted the organisational change. Data was collected through interviews and document studies. We describe the circumstances that triggered resistance behaviour of each middle manager through their own words, the viewpoint of project managers and the company's top management. Our findings describe how individual resistance was overcome and – in many instances – converted into support for the change agenda. The original value of our paper is that the company overcame the resistance and successfully implemented its change agenda and entered a period of economic growth. Although the change process had to overcome many obstacles, the result proved economically very successful. Today, the company is one of the top transportation firms in Russia.

Keywords: digital platforms; blat; readiness for organizational change; employee resistance; innovation

1. Introduction

The term 'business model' describes how a firm creates value for its customers and how these activities are monetised (e.g., Casadesus-Masanell & Ricart, 2007). The economic impact of a new technology is a function of how successfully industry actors can convert it into business models (Breschi et al., 2000). The emergence of the internet age provided quick access to data and new monetisation mechanisms and yet again changed the business models of entire industries, such as the music industry. These developments enabled the emergence of digital platforms, originally designed as efficient mechanisms for procurement (Giaglis, Klein & O'Keefe, 2002) with much greater disruptive power than efficiency-based B2B transactions (Parker et al., 2016).

Business models in general and digital platforms in particular have been described as a complex activity involving various actors (e. g. Kolloch & Dellermann, 2018). The concept of business model transition has been under-researched, especially in the light of emerging digital platforms, where outstanding success stories, such as AirBnB and Uber (Parker, G. G., Van Alstyne, M. W., & Choudary, S. P. (2016). Platform revolution: How networked markets are transforming the economy and how to make them work for you. WW Norton & Company.; Evans & Gawer, 2016), incentivised firms to abandon their established way of business and transform into platforms. Change processes of such a nature have previously been identified as a major reason for resistance to change by a firm's staff (e. g. Rafferty et al., 2013). While the literature on the management and marketing, etc. of platform businesses has grown substantially in recent times, how to actually convert an organisation into a platform business is a subject that still awaits a detailed analysis.

Change in the business logic of a firm is probably the deepest change possible, as all established principles, procedures and skillsets are at risk. Not every organisation though is ready to engage in such deep-rooted change. The readiness for change is intimately connected to leadership which has been defined as central to capturing the value of digitalisation through connecting and engaging with employees (World Economic Forum, 2018). Research has also shed light on the ever-increasing roles and requirements of leadership to facilitate and enable digital change in the execution of the change agenda. This is a challenge for top management which needs to set the frame of change, define its means and objectives and, due to this prominent role, receive the lion share of attention.

However, for most employees, it is their line manager, and not the company's CEO, who represents the firm and sets top management directives into daily orders (Teulier & Rouleau, 2013). Middle managers conveyed and constantly readjusted the shared vision of the organisational change and reframed the technology to have a more inclusive approach: middle management act as key change agents. Despite their vital role, we are not aware of studies that shed light on cases in which middle management fall short of their expected roles due to their own resistance to change.

2. Middle Management: Blat

Middle management in a firm might be bound by personal ties between their peers and connected external actors – their blat. The term blat refers to an informal interpersonal connection between people who expect reciprocal benefits and special consideration (Michailova and Worm; 2003). It describes dyadic relationships to help friends or relatives, which were indispensable during the Soviet Union time, when goods were in short supply, and direct access to them in informal relationships. Hence, having a job that provides access to a commodity could be traded against other benefits. Money as such was much less in demand than in the Western countries, since goods were limited. In a way, blat was a substitute for market mechanisms of exchange based on social status and the ability to help other people (Ledeneva, 2009; Onoshchenko & Williams, 2013). Thereby, the blat system ensured the functioning of the larger societal connections through social ties (Ledeneva, 2009) and helped to overcome the inefficiencies of the command economy. A person who got a job in an organization through blat was associated with their patron. Thus, blat facilitates a network based on strong ties (Granovetter, 1973).

As shown by empirical research, most Russian managers use their blats to get the job they desire (Clarke, 2002). Still, some argue that the blat system has reorganized under the same principles, now to maximize personal profits (Smith and Stenning, 2006). Since the new form of blat is more money-related and aimed at enriching the members of its network (Smith and Stenning, 2006), it becomes much less socially acceptable and receives a negative connotation (Michailova and Worm; 2003). Today, blats are mentioned in connection with corruption or nepotism (e.g. Ledeneva, 2009). Hence, an organizational culture of “blat” builds on negative “power over” to stop organizational development instead of positive “power to” actively instigate change (Balabanova, 2021).

3. Methodology

We understand organisations to be socially constructed networks of social actors that are created and re-created through interaction. Consequently, change is a sequence of events initiated by individual actors. Also, change is dependent on the situational circumstances and needs to be studied against this background.

In order to understand the situation, we spoke to the CEO of the company and the head of the project management team. After we had familiarised ourselves with the current situation, the project management team gave us access to their written notes that had been collected throughout their team meetings and during meetings with middle management teams. The close association with the leader of the project management team allowed us to benefit from the rich and deep ‘local knowledge’ which served as a first layer of triangulation.

Based on these data we proceeded, applying purposeful sampling (Gilmore & Gilson, 2007), to selecting a total of eight middle managers that resisted change. We captured the social dynamics in the firm at the time of change, and how the resistance was overcome. We spoke to at least two individuals with intimate knowledge of the subject matter to bring the given statements into perspective. Some of our interview partners gave information on more than one case. In total we spoke with twelve members of the organisation.

The first author conducted the interviews with the chosen organisational members. They were asked specifically regarding their view of the change process and how they interpreted the stark resistance that the company experienced. These in-depth interviews followed a guideline and lasted about 45 minutes on average, the shortest taking 32 minutes and the longest one hour. The interview partners were chosen based on their positions and their insights into the events. Table 1 lists the employees we interviewed. The interviews were framed around the events of the change process and how the interviewees perceived these changes. We asked about implementations of the changes, the presence of intra-group structured antagonism and resistance behaviour.

Table 1: Interviews

Position	Work experience within the company
Road Transport Specialist – 3 pers.	13 years, 8 years, 3 years
Senior Road Transport Specialist – 2 pers.	10 years, 12 years
Transport Manager	5 years
Head of Logistics Department – 3 pers.	13 years, 7 years, 6 years
Regional Manager – 2 pers.	12 years, 8 years
CEO	12 years

4. Findings

At one of the first meetings, the case of the head of the logistic department in the central region (case 1) came to the attention of the project management team. The performance of the department was above the company's average, and the manager was in good standing with the company's top management. She was building trusting relationships both with representatives of clients and with representatives of hauliers, which allowed her, within the framework of the old system, to use these relationships, both in the interests of the company, as well as for her personal interests. Often, these interests coincided, that is, she could agree with clients to receive orders outside the standard distribution schemes. She supported the change process and shared top management's view on the potential efficiency gains. Though she favoured a rather cautious policy of small steps as she was worried about the department's overall rating in the company. "Change is good, but in small steps", she frequently said during our interview. The process was rolled out though not at all done in a manner she had favoured. As a consequence, the performance of her unit was lowered, and the manager started to initiate and orchestrate resistance among her team members as she felt responsible for them. This quickly resulted in a generally negative attitude towards the change project throughout her entire department. The lady - who spoke with a loud and authoritative voice - worked in an open plan office, which made sure that every team member could hear her opinion. Additionally, she would use the company email system to spread her opinion. The negative attitude towards change travelled quickly into other regional divisions to which she had personal ties.

Top management took notice of the resistance though decided against any action, especially as the manager never scaled her actions up or adopted active resistance. In the eyes of the top management, she never really imposed a threat to the change process towards the new strategy. In her team though she held a lead position, and when she voiced her dissatisfaction, her colleagues showed her loyalty and adopted her mindset. Due to her experience and standing within the company, a lot of time and training was directed to discuss with her and to convince her that after all, she and her team will master the new system. As time progressed, the overall rating of the unit increased even above the previous rating. Once the success of the project became clearer and insecurity vanished, she used her influence to align her team back with the company's strategic vision and she became a central advocator for the firms' change process.

Another manager from the central region with vast experience in the industry was supportive of the upcoming changes to stay competitive (case 2). Within his division, the majority of work procedures in place were developed by him as he led this division from the very moment of its foundation. The manager welcomed the push towards a digital platform, but only as long as they didn't interfere with his established principles of work.

The manager went a long way to ensure that everyone perceived him as a change agent, while in fact trying to roll out his work procedures throughout the entire company. These procedures though contradicted some of the imposed changes as intended by top management, which frequently led to heated debates in meetings. When his team members proposed to rearrange the workflow in line with top managements' orders, he resisted the change and insisted on his established procedures. The division's performance though remained on a fairly high level (albeit the growth rate was lower than the company's average), and top management let him prevail. "He will have to follow the rules of the new information system anyway", the project management team noted on a meeting note. Not all activities were digitalized at the same time though but rather were transferred to the

new system step by step. Especially those processes that required action from the firms' partners were scheduled for a later stage. Hence, the communication processes between hauliers and managers were still done telephonically. In a second stage though, the hauliers' communication was captured electronically, and the information system-imposed selection criteria for hauliers was made mandatory. The manager, after approving the "non-priority haulier" (giving contracts to hauliers against the according to the logics of the IS), was obliged to provide the prioritized haulier with another order within two days. He still circumvented the system and ensured that hauliers that were part of his network could still continue to do telephone conferences with the unit's head. The project management team flagged this fact as a major weakness and recorded numerous attempts of the manager to negotiate preferred conditions for a number of hauliers over the telephone line. When confronted, the manager blamed the bad IT knowledge of the haulier. The manager was able to span networks and bring in experiences from other organizations with the company's hauliers in his region. He saw these connections as his major asset – which he said would benefit the firm. His attempts to fence off the control through the IS could no longer be ignored, and the manager was asked to explain why he diverted from the company's processes. His true intentions to reestablish his way of doing business was revealed and trust in him vanished.

These cases describe well-preforming units led by managers with very high standing. Though, also in remote regions, far away from the company's headquarters, managers saw the opportunity that the proposed changes offered. A manager in a region in the far east (case 3) felt incapable to qualitatively develop his branch, since his region is the region of the "last mile"[1]. Competition for the few reliable hauliers is very high, and incoming traffic is much lower than in the central regions. The new system though allowed hauliers who have capacities on incoming travels to offer this opportunity through the company's platform. After the organizational change, the number of transports increased significantly. The division was unprepared to act accordingly and to make use of this opportunity as the operational organization proved suboptimal. The manager acted from a peripheral position in the network and understood that this new opportunity would open up ways to improve his position in the social space and embraced the upcoming changes.

Other managers indeed improved their position based on the organizational change (case 4). A manager with great standing in her unit - all inter-department activities were established by her - and established a set of work principles that most other departments adopted – competed in a region with a very strong competitor. This kept the development of her division down, as the majority of the customers and hauliers worked with the company's competitor. Under the established business model, it was not possible to change the situation for the better, and hence she became an active supporter of the digital platform. She believed the new system would break the blat between the clients and the company's main competitor in the region by offering clients much more favourable conditions through greater choice of hauliers and more competitive pricing.

Moreover, she supported the implementation of a new system in her branch and arranged training for her team. Thanks to her activity, the implementation of changes in the branch was made easy and the branch received a new impetus for development. The division's position in the region's market has subsequently strengthened. The division's elevated performance was well perceived by top management and the neighbouring region's branch was added to the regional managers' portfolio (head of the division where she was a head of logistics Department). The previous head of the neighbouring branch who has resisted the change has left the company.

During the meetings to discuss the worsening of units after the change process, a department manager stood out who showed a high degree of resistance (case 5). She was an informal leader and was highly influential as an opinion maker throughout the entire company. She was opposing the change plans right from the start, but her opposition became fierce when her unit showed a really bad performance under the new regime. The manager invested a lot of time and energy to find various ways to circumvent the procedures of the information system, and she proudly shared her success stories among members of various regions. In fact, more and more employees started to follow her suggestions. The new platform limited her freedom to maintain her blat with the hauliers who demanded higher prices for the services they provided in exchange for their loyalty.

[1] "a term used in supply chain management and transportation planning to describe the movement of people and goods from a transportation hub to a final destination" Wikipedia - https://en.wikipedia.org/wiki/Last_mile_(transportation)

The change management team had to react, but it was unclear how to change her mind. Then, the IT department communicated that they closed these blind spots that she had revealed. In fact, the IT department was working alongside her multiple attempts and found it helpful to identify weaknesses of the system. The manager was subsequently promoted to search for weaknesses in the new electronic platform. She mentioned during the interview how important it was to see that the project management team and top management appreciated her work and took her comments seriously. Thereby, she changed her perception and became a central promoter for the new business model. This gave her credibility, especially as top management started to appreciate the skills that she developed. She subsequently received a promotion to an elaborated position.

The case of the head of a regional division in the south (case 6) could not be brought to a successful end. He was acting in a very competitive environment, and he had already informed top management that the position of his division in the regional transportation market was weakening.

This manager's special relationships were built primarily with hauliers in his region, but also, to a lesser extent, with representatives of major clients. As the platform was rolled out, clients' ability to maintain special relationships began to decline. In addition, the implementation of the system was accompanied by renegotiation of contracts with hauliers and checking them for the possibility to provide their service to the company.

He suggested a new pricing policy and lower entry requirements to contract in new hauliers. At the same time, when the process of implementing changes began, the branch's indicators actually began to decline. At the regular meetings to discuss the changes, the manager gave contradictory explanations for the lack of development of his division, often referring to the bad implementation strategy of top management, or the unwillingness of team members to use it, and the low motivation of employees in general. This raised red flags with the change management team. Over an extended period, the situation in the branch did not change for the better. The manager continued to blame the new IS, often with absurd requests like changing font size of the website. The project management team recommended that the CEO should replace the Head of this division, which he did eventually (although the CEO resisted this move for a long time as this manager was his protégé in the past). After replacing both the regional manager and the head of the logistics department, the new management more consciously joined the updated processes. Four months later (after the on-site training activities), the branch began to return to steady growth. A year later, the division performance only marginally lagged behind the leading region.

Another regional manager (case 7) was satisfied with the status quo as she had mastered the craft to optimize the performance indicators and was hence doing exceptionally well for herself. The regional manager grounded her success in the collaboration with “special treatment” hauliers. The introduction of a new information system was consequently a threat which she expressed at each meeting with her peer regional managers. The statements made though were abstract and not built on factual arguments. When the project management team asked to provide evidence for her claims, she refused to collaborate. In order to alleviate the situation, the manager received another branch. Striped of her personal connections with hauliers and forced to deliver results, the manager adopted the rules of the new system.

However, not all resistance to change ended in such a manner. The division head did not see the need for any changes in the work of the branch, as under the old system she enjoyed a high standing as one of the most effective managers (case 8). The regional division was creating 75% of its revenue through one client, and thanks to this client, she was the highest paid head among the regional division. The introduced organizational change processes now changed this advantage, and the KPI system drastically reduced the manager’s remuneration. Moreover, the transition to the digital platform and the change in the principles of work required this manager to develop relations with other clients of the region, which quickly revealed “bottlenecks” in the processes of her division. Realizing the importance of a key client for the company to which she had a very close connection, she frequently threatened to leave the company. As the top management didn’t give in to her threats but actually approved her wish to leave, she decided to stay on.

Nevertheless, she made a lot of efforts to maintain the previous work procedures. Due to her personal relationship with the CEO and her well-established relationship with the priority client, it was decided to increase this division’s own fleet of vehicles in the region in order to keep the client. This approach also succeeded in ceasing the manager’s resistance. Her refusal to take the final step and to leave opened up new ways to discuss alternative options. And indeed, due to her connection to the main client – she could actually guarantee access

to economic capital. In choosing a more amicable approach, she convinced top management to follow her suggestion and to give special status to her department.

5. Discussion and conclusion

The push towards digitalisation and the conversion to a platform business rests on the streamlining of business processes as repetitive activities become automatised and information travels freely within an organisation. These developments change the roles and responsibilities of members of the organization and consequently might threaten an individual's role in an informal network. Due to the previously isolated ways of doing business by the company's units, most energy was diverted towards strengthening intergroup connections. For headquarters, however, the way business was done in the region was of little importance, as long as the financial results were satisfying. This gave a lot of space to emerging blats – from which the resistance the company was facing originated. As such, the presented case company is also an example of resistance against centralised control, as well as the streamlining of business processes by means of digital technologies.

Unlike the cases in 20th century industrial firms which were driven by workers against management, the resistance cases of the digitalisation age are likely to stem from middle management that fear losing their jobs and their role in the blat that their positions ensure due to the adoption and integration of new business technologies. Hence, the study field of resistance to digital transformation in companies is less a subject of technological applications and rather a matter of organisational development. As seen in the research, some managers defended their way of giving favorable contracts to hauliers of their networks. Others tried to defend their creative accounting practices to ensure that their team members would stay on top of the income level which ensured their standing in their blats.

On the other hand, our research also showed that many of the middle managers with whom we engaged acted out of a deeply rooted belief that the proposed actions might not be the right decision for the organisation. Such concerns have already been identified in previous research (e.g., Daniel, W. W., & Hogarth, T. (1990). Worker support for technical change. New Technology, Work and Employment, 5(2), 85-93.; Hauschildt, 1999; Jansen, K. J. (2000). The emerging dynamics of change: Resistance, readiness, and momentum. People and Strategy, 23(2), 53.; Dunican, B. (2015). Acceptance of Change: Exploring the Relationship among Psychometric Constructs and Employee Resistance. Bowling Green, KY: Western Kentucky University.). More training or mediation sessions can easily resolve the situation and reduce uncertainty. Such investments may quickly convert key personnel with high social standing among colleagues into change agents. As seen in our Case 5, the manager improved her skill set in order to prove how badly executed the change process was. The firm realised that this resistance was in fact a valuable resource, and promoted her to a position which expected her to find flaws in the change process, especially in the information system.

One option for the organisation is to focus on these actors who will find themselves on the winning side and actively support the change process. In Case 4, the manager came from a remote area, but quickly realised that the new organisational changes offered the economic setting which allowed him to expand the firm's activities. The person was indeed subsequently rewarded with a promotion and a different region to manage. Such persons, who actively drive and support the proposed changes, are of utmost importance as change agents in the early stages of change. Especially the resistance cases, as shown in Case 1, would require such agents who can convince them of the positive aspects. Nevertheless, research has shown that positions on the periphery of a social space do take up such opportunities quickly, even though they might not have the required abilities (Emirbayer, M., & Johnson, V. (2008). Bourdieu and organizational analysis. Theory and society, 37(1), 1-44.; Battilana, J., Leca, B., & Boxenbaum, E. (2009). 2 how actors change institutions: towards a theory of institutional entrepreneurship. Academy of Management annals, 3(1), 65-107.). As shown in Case 3, enthusiasm and a valid business case do not guarantee economic success. Often the sudden increase in business results in overwhelmed business structures and held up work-flows. Here, it would have been helpful to provide early stress-tests to the business units, especially as they had such a high degree of freedom as in the far-flung units of the organisation presented here. In other instances, as presented in our last case, it might be sensible for an organisation to allow deviations from the change process, especially if there is a good business case to support such a decision.

Most likely, transformation driven by technology will become the new constant (Aldrich, H., & Ruef, M. (2006). Organizations evolving. London: Sage.). It is, henceforth, of great importance to generate value not only derived from control over present processes, but also from mastery of change. How could a system of reward for

successful participation in such activities look like? The analysis of processes that create social standing for a firm's employees in transformation would offer a rich study field. Still, a focus on early signs of resistance might confuse resistance behaviour with actual meaningful critique of a digitalisation strategy. Hence, it is vital to establish communication lines to ensure that critique can be voiced and is appreciated. In order to reduce the likelihood of resistance on a company level, it should be a priority to communicate the benefits – not only to the firm's profit and loss statement, but also to the employees. Such statements on how all stakeholders benefit should be made a mandatory part of the firm's digitalisation strategy.

This paper describes the resistance behaviour evoked by the transformation towards a platform business model of a transport company. Although the change process had to overcome many obstacles, the result proved economically very successful. This highlights the discussed organisation's efficacy in introducing change and renders it well suited as a model/a source of valuable suggestions for other organisations. Furthermore, the paper goes against the general trend in the literature which looks into firms that are mired in resistance or have failed in their change process.

The paper presented eight cases of resistance and showed how the company responded to them. In most cases, the resistance was overcome - even converted into positive results. The analytical view taken of the presented cases of resistance shows how they are all uniquely interwoven with the events that accompanied the change process. However, the research into resistance to digital transformation has started only very recently, and there is much to learn for organisational psychology. In this paper we outlined some questions which we find of relevance and invite scholars to contribute their understanding of the underlying processes. For future research, we propose to level up the study of personal networks and to look into Bourdieu's (1977) concept of *capital* – especially *social capital* – as a potentially helpful underlying framework that does lend generalisability to the different cases. Bourdieu's concept of social capital is an indicator of personal and professional experience or skill sets acquired in an individual's past professional and personal life worlds.

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Measuring the Impact of a Shared Vision on the Perceived Meaningfulness

Lisa-Maria Baumgartner, Alexander Kaiser and Clemens Kerschbaum
Vienna University of Economics and Business, Vienna, Austria
Lisa-Maria.Baumgartner@wu.ac.at
Alexander.kaiser@wu.ac.at
Clemens.kerschbaum@wu.ac.at

Abstract: In this paper we describe an approach to assess the impact that a shared vision has on the perceived meaningfulness of work in an organization. Our measurement system is based on the essential principles of performance measurement. Building on this assessment logic, we present the process and respective scales that allow us to measure changes in perceived meaningfulness that occur through a shared vision development process. With this work, we provide a practically applicable measure to evaluate whether the creation of a shared vision is beneficial for an organization.

Keywords: Shared Vision, Meaningfulness, Performance Measurement, Sustainability, Purpose, Vision Development

1. Introduction

Corporate Visions are said to be an important aspect for the strategic alignment of organizations. In the realm of Knowledge Management (KM) for example, they establish a shared value system and guide the creation of new knowledge (Nonaka, 1995). This means that the vision of a company (or any organization) provides a frame of reference for all members of the organization and thereby connects its actions to its purpose. Additionally, the vision can also be used to restructure the existing knowledge system. Therefore, it is important to note that such a knowledge vision goes beyond mere considerations of the products or services a company has to offer, but it should create an image of what the company does and how it aspires to leave an impact in the world. Nonaka mentions that a (knowledge) vision serves to enhance personal commitment from middle managers and frontline workers as it provides meaning and a sense of direction to the tasks these people perform every day (Nonaka, 1995 p.228).

Acknowledging these claims, a vision seems to be a powerful tool in the arsenal of executives. Still, from a research standpoint we must admit that there has not been a lot of research conducted on the actual impact of a corporate vision. This is not to say that there has not been any research, as for example Kaiser et al. analyzed corporate vision statements of companies listed in the Forbes 2000 list and found that an elaborate vision statement seems to have a positive impact on the success of a company (Kaiser et al., 2022). However, the success of a company in this study was measured along the Forbes 2000 criteria, which is heavily focused on financial performance.[1] Apart from financial success, it stands to reason that a corporate vision also impacts other facets of the organization such as the already mentioned personal commitment or employee satisfaction, the perception of work as being meaningful, as well as the broad topic of organizational culture in general. All of these are worthwhile considering in an era of workforces increasing dissatisfaction with their jobs (consider for example a recent phenomenon known as the "anti work movement"[2]) and in times, where we witness an ongoing demand to shift from a profit driven to a more purpose driven way of organizing (Laloux, 2014; Nonaka and Takeuchi, 2021).

These current developments result in a need for action for executives. Yet, reasonable management requires actions to be based on reasonable judgment of a given situation. This in particular includes the evaluation of actions taken in order to learn about and improve the condition of the organization - a process referred to as performance measurement. Concerning the evaluation of the impact of corporate visions, we argue that we currently lack adequate mechanisms or tools to measure precisely which effects the vision has on the organization in general, and the individuals engaged in the organization in particular - apart from eventual positive financial performance.

[1] Forbes compiles the Global 2000 list by a combination of sales, profits, assets and market value. See https://www.forbes.com/2011/04/20/global-2000-11-methodology.html?sh=d3054382a225.

[2] See for example https://www.bbc.com/worklife/article/20220126-the-rise-of-the-anti-work-movement.

With our contribution we, thus, pursue two main goals: firstly, we present an initial idea on how (and what) we could measure in order to evaluate the impact of a shared vision; and secondly, we aim to open up a scientific discussion on how we can practically measure the impact that a shared vision has on individuals in the context of the organization. Hence, in the following sections we clarify what we mean by the term shared vision and why (and how) we plan to measure it.

2. Theoretical Background

2.1 Performance Measurement

Performance Measurement is a term that is equivocal in the literature (Franco-Santos et al., 2007). All approaches have in common, however, that there are certain performance measures accompanied by some supporting infrastructure that records performance data respectively (Franco-Santos et al., 2007). Apart from the obvious goal of measuring performance and, thus, supporting the execution of strategy, a performance measurement system can also impact organizational learning processes and the overall improvement of the organization. Furthermore, it can influence corporate members' behavior as well as internal and external communication (Franco-Santos et al., 2007). Concerning the concrete measures of performance, there exist a variety of opinions about what should be included to depict the actual performance of an organization. Initially, measures were primarily concerned with financial performance (profit, ROI, productivity) and derived from accounting. This was until markets began to change in the late 80's when the rise of new technologies and production philosophies required performance measures to account for more subtle differences like timeliness of production, the efficiency of manufacturing strategy or operational measures which also lower management could use in their daily decisions (Ghalayini and Noble, 1996; Striteska and Spickova, 2012). This also shows in the fact that already in the late 90's, only a fraction of a company's market value could be depicted by traditional performance measures (Webber, 1999). A look at today's most valuable companies reinforces this image even more.

In an effort to capture and measure this new value in the so-called *New Economy* that stems from information and knowledge within a company, the notion of Intellectual Capital began to develop (Guthrie, 2001). It aims exactly at capturing what Petty and Guthrie describe as *knowledge-based* intangibles which include processes, organizational knowledge, and the capacity to solve problems (Petty and Guthrie, 2000). Research on intellectual capital has identified dimensions to subclassify and specify the superordinate concept into structural capital, human capital, relational capital and social capital (Ferenhof et al., 2015).

However, as we are looking for a measure to assess the impact of a shared vision, we are focusing less on measuring the value but rather the strategic implications for a shared vision. Thus, we built our approach for measurement along the principles of performance measurement. Still, it is worth noting that the process of creating a shared vision can be seen as a knowledge creating process in itself (Kaiser et al., 2013). Hence, it adds to the organizational knowledge base which can be described through Intellectual Capital.

2.2 Vision

A vision is different from a goal or an objective. A vision is a documented purpose that is detailed, customized, unique, and reasonable. A goal is a general statement of an intent that persists until it is achieved or no longer needed. An objective, on the other hand, is a specific and product-oriented statement of an intended accomplishment that is attainable, observable, and measurable by specifying the what, where, when and how. In contrast to an objective, a vision focuses on why. Therefore, a vision does not change but only becomes refined over time, whereas plans or strategies to pursue a vision (e.g., goals, objectives) remain flexible and changeable (Kim & Oki 2011, p.250).

There are various definitions for the term "vision". O'Connell condensed a majority of these definitions by stating that a vision "is an idealized goal state, a set of blueprints for the future, an agenda, a map for members to follow, and an image of what needs to be achieved. It may include both long-term, future-oriented goals and emotional appeals embedded in a set of values; it is focused on change and depicts a future that is credible, realistic, attractive, inspiring, and better than the status quo" (O'Connell et al. 2010, p.105).

For Collins and Porras for instance, a company's vision consists of two major components, namely a core ideology (yin) and an envisioned future (yan). The yin contains the unchanging reasons why we live and what defines us. The yan is our envisioned future, what we want to achieve in our lives and who we want to become (Collins &

Porras 1996, p.66). The authors stress that it is crucial to develop a vivid description of this envisioned future as it requires "such a big commitment that when people see what the goal will take, there's an almost audible gulp" (Collins and Porras 1996, p.75).

Based on various definitions of a vision, our definition is the following: *a vision is a clear image of a fulfilling and desirable future which can be described to others and which is possible to be realized in any – maybe extremely challenging – way, shape or form.* This definition of a vision is the same for individuals as well as for social systems regardless of their size or dimension.

Literature suggests that there are four approaches to develop a vision (O'Connell et al. 2010, p.109f): In one approach, the leader creates the vision and communicates it to his or her followers. A second approach suggests that a key leader teams with a group of top managers to create and communicate a vision to followers. In the third approach, visions are co-created by a leader and followers in a sense-making and sense-giving process, where the leader proposes a vision which is being iteratively modified through exchanges between the leader and followers. Finally, a vision may be developed when the organization as a whole engages in a large group collaborative process.

2.3 Shared Vision

Literature on shared vision is largely separated into a "top-down" and a "bottom-up" camp. While the top-down camp argues that a leader's vision is shared through communicating the vision top-down, the bottom-up camp (e.g. (Kaiser and Fordinal, 2010), (Senge, 1990), (Wang and Rafiq, 2009)) argues a vision should be developed or created bottom-up through sharing several personal visions in a group or organization.

The "top-down camp" sees a shared vision as resembling the leader's personal vision which is communicated in specific ways to followers in a top-down manner. This approach aims at followers taking over the vision of the leaders. Within research and practice, the emphasis is on the proper way of communicating the vision to followers (e.g. through mental imagery, vivid descriptions and authentic emotions) (Carton and Lucas, 2018), (Carton et al, 2014), (Venus et al., 2013) with the goal of creating a shared cognition. Empirical research, especially on the properties of vision communication, has been conducted extensively (Carton and Lucas, 2018), (Carton et al, 2014), (Eldor, 2019).

The "bottom-up camp" advocates behaviors that delegate "authority to employees, promoting their self-directed and autonomous decision-making, coaching, sharing information, and asking for input" (Sharma and Kirkman, 2015). This approach fosters the communication between leaders and followers and letting go of control from the sphere of the leaders towards the sphere of the followers (Amundsen and Martinsen, 2014), (Kearney et al, 2019), (Kim et al., 2018). Here, the importance of the single individual for the organization is advocated and the top management supports the individual self-expression within the organizational frame. Contrary to communicating visions top-down, shared visions are built bottom-up and emerge from each personal vision. In other words, the organizational vision is an emergent property of each personal vision.

3. Measuring the Impact of a Shared Vision (Research Design)

The authors of this paper have been involved in and facilitated many shared vision development processes in small, medium and large organizations, both in the profit and in the non-profit sector. From our anecdotal experience, most of the interventions turned out highly beneficial for the organizations we worked with and the feedback we received was usually positive throughout all the organization's members. People, for example, reported that the process itself was an interesting experience and that they learned much about the organization and the needs that underlie the functioning of the whole system. We also observed an increase in commitment to the common cause realized through the organization during and after the development of a shared vision.

However, all these impressions are to date only personal and thus subjective observations that may well indicate that something in the organization must have changed, but do not precisely show what the actual outcome of an intervention was. For this reason, we were looking for adequate tools to better understand and eventually measure the impact of the development of a shared vision on an organization in order to evaluate our interventions. Such a tool should enable us to (1) see what has changed, (2) measure to what extent it has changed and (3) enable a comparison between different interventions and/or different organizations. As we could not find any existing tool that meets our requirements, we began thinking about developing an individual solution, based on the principles of performance measurement. Basically, every Performance Management

System must consist of at least a source of information (*information provision*), a measure (*measure design and selection*) and some sort of data storage (*data capture*) (Franco-Santos et al., 2007) to be considered a Performance Management system. Thus, our measurement system must also include at least three processes (measure design, data capture, information provision).

In the following we illustrate our initial approach to design such a system. We would like to note that our intention is not to create a new measurement scale, but to make use of already tried and tested, existing scales to build an appropriate performance measure that is both meaningful and easily applicable in the practical process of organizational vision development.

3.1 Measure design and selection

The toolbox of performance measures is manifold and offers measures for all sorts of variables. From a knowledge and learning perspective, however, we need to focus particularly on the individual members of an organization. This is reinforced against the background of a demand for purpose driven organizing that puts people at the core of strategy creation (Nonaka and Takeuchi, 2021). Following the claims that a vision should impact the sense of direction (Nonaka, 1995), give motivation (Mirvis et al., 2010)**,** and - as an image of purpose - act as a guiding pillar for action (Laloux, 2014; Robertson, 2015), we ought to measure exactly that. A shared vision should, on the individual level, lead to the perception that the purpose of the organization is important and meaningful for every stakeholder of the organization. Contributing to that purpose of the organization should thus be perceived as meaningful by the members of the organization. Accordingly, we concluded to base our measure design on the measurement of meaningfulness on an individual level.

We acknowledge that this ultimately is a deliberate choice, nevertheless it appears as a promising way to get some insight into the supposed impact of a shared vision. In this regard we draw on researchers' intuition (Kump, 2022) and abductive reasoning as a starting point for the selection of appropriate data for empirical study (Behfar and Okhuysen, 2018). The rationale is, that when we consider what a vision ought to induce in an organization, we must favor the “soft” individual level over common financial measures.

3.2 Data capture

The logic of data capture for our measurement is straightforward and consists of an initial assessment before the creation of a shared vision in an organization, an assessment right after the intervention and one or more assessments after the shared vision has been created and communicated (roughly one year after the intervention). Respective scales for the measurement will be presented in the next section. A practically important criterion here, is the ease of use of the scale to enable its actual application in shared vision development processes.

To ensure applicability and the ease of use we intend to test data capture with groups of undergraduate students at our institution. This is to test whether the questions make sense to participants and also has the advantage that we can install different pre-conditions as a point of reference. For all groups, the three data collection points are the beginning of the course, shortly after the creation of a shared vision and after the final exam.

3.3 Information provision

The aspect of information provision aims to process the results of the performance measure and present them in an intelligible manner (Franco-Santos et al., 2007). In a company, this usually means the regular interpretation of the results in order to make decisions based on them. To do so, the results must be made accessible and comprehensible for the decision makers. In our case of a primarily research oriented project, however, the aspect of information provision plays a rather subordinate role. Yet, in case an organization would implement a regular measure of meaningfulness of work, the provision of information would rise in its importance.

4. Measuring Meaningfulness

Meaningfulness can be described as the perceived value of a purpose on the basis of subjective ideals and standards (Lips-Wiersma and Wright, 2012). Thus, measuring meaningfulness appears as a promising way to assess the impact of a shared vision. However, meaningfulness is obviously a latent variable and must be operationalized in terms of a reliable scale. In the literature, there exist six fundamental dimensions of meaningfulness in the context of work: balance, belonging, calling, enjoyment/enablement, significance, and work as an end and not as a means (Baumgartner and Kaiser, 2021).

Balance is characterized by balancing mental and physical health, especially in regard to reversed items such as „How often have you been emotionally exhausted?" (COPSOQ) In order to perceive one's work as meaningful, the balance of one's own needs and feelings, as well as needs of others is necessary (e.g., "I have a good balance between the needs of others and my own needs.", CMWS)

Belonging is characterized by an encouraging and respectful community at work, in particular the relation to co-workers and the pleasant atmosphere provided by them. Items range from taking pleasure in working together to value systems, respectively shared values, in the form of moral decisions (e.g., "At work my sense of what is right and wrong gets blurred," reversed, CMWS), and speaking openly about values.

Calling is characterized by the feeling to be "meant to" pursue a kind of work (e.g., "I am pursuing my current line of work because I believe I have called to do so.", CVQ). It is not pivotal whether one has already been called to a line of work or is trying to discover one's calling.

Enjoyment and enablement are characterized by getting a sense of personal satisfaction when completing projects, solving problems, or losing track of time when working. Subtopics of this dimension include motivation and involvement, personal development (e.g., "I view my work as contributing to my personal growth", WAMI), inspiration (e.g., "The vision we collectively work towards inspires me.", CMWS), hope, and a good fit between work and life's purpose.

Significance is characterized by perceiving work as impactful on society or customers (e.g., "I want to find a job that meets some of society's needs.", CVQ). Individuals define their work as significant when it serves a greater purpose or the common good, and makes a positive, truly important difference in the world.

Work as an end and not as a means is characterized by perceiving one's career as a path to purpose and life meaning. Items of this dimension include better understanding oneself and the world around oneself through work, feeling inspired and more alive during this activity, as well as viewing work as meaningful in general (e.g., "It is mainly through work that I will become what I was "meant to be" in life.", EMWI).

We build our measurement of the impact of a shared vision on these six dimensions that can be assessed using the following scales:

- the Comprehensive Meaningful Work Scale (CMWS; Lips-Wiersma and Wright, 2012),
- the Work and Meaning Inventory (WAMI; Steger, Dik, and Duffy, 2012),
- the Existential Meaning of Work Inventory (EMWI; Fairlie and Flett, 2004),
- the Copenhagen Psychosocial Questionnaire (COPSOQ; Kristensen, Hannerz, Hogh and Borg, 2005),
- the Vocation Identity Questionnaire (VIQ; Dreher, Holloway and Schoenfelder, 2007), and
- the Calling and Vocation Questionnaire (CVQ; Dik, Eldridge, Steger, and Duffy, 2012).

However, not every dimension will be influenced to the same degree by a shared vision. *Table 1* shows which scales include items of the six dimensions, including the exact number of items:

Table 1: Distribution of items among scales, based on Baumgartner and Kaiser (2021)

Scale's name	CMWS	WAMI	EMWI	COPSOQ	VIQ	CVQ
Number of dimensions targeted (out of 6)	6	3	4	4	3	4
Number of relevant items	28	10	12	17	9	24
Items targeting balance	4			7		
Items targeting belonging	8			7		
Items targeting calling	2		2		1	8
Items targeting enjoyment/enablement	8	1	3	1	7	1
Items targeting significance	5	5	2	2	1	8

Scale's name	CMWS	WAMI	EMWI	COPSOQ	VIQ	CVQ
Items targeting work as an end and not as a means	1	4	5			7

Depending on the dimensions of interest, relevant items can be selected on the basis of table 1. While some of these scales only have a rather narrow focus on only a few dimensions, others such as the CMWS, are comprehensive.

When choosing items of different scales for the same assessment, it must be considered that the scales have various response formats, given in table 2. It is advisable to limit the number of different response formats used, to achieve clearly structured and coherent results.

Table 2: Response format of meaning measurement scales, based on Baumgartner and Kaiser (2021)

Scale's name	Response format
CMWS	dual response format: frequency and importance; five-point Likert-scale
WAMI	five-point Likert-scale
EMWI	seven-point Likert-scale
COPSOQ	five-point Likert-scale
VIQ	five-point Likert-scale
CVQ	four possible options from "1 Not at all true of me" to "4 Absolutely true of me"

From the scales presented, WAMI (Steger, Dik, and Duffy, 2012) is the most frequently used scale (e.g., Akin et al, 2013; Fouché et al, 2017). However, only CMWS (Lips-Wiersma and Wright, 2012) covers all six dimensions of meaningfulness. Hence, we recommend relying on CMWS in order to notice changes in every possible dimension of meaningfulness that could be affected by a shared vision.

5. Conclusion & Limitations

In this paper, we have described an approach to assess the impact that a shared vision has on the meaningfulness of work in an organization. We argue that meaningfulness is a reasonable measure, because according to the literature, it is closely related to a (shared) vision that depicts the organization's purpose. Our assessment of meaningfulness is based on the essential principles of performance measurement and consists of *scale selection, data capture* and *information provision*. Based on this assessment logic, we present respective scales that allow us to measure changes in perceived meaningfulness that occur through a shared vision development process. Ultimately, we suggest using Lips-Wiersma and Wright´s CMWS, as it provides the most comprehensive selection of meaningfulness dimensions.

We believe that specifying this impact is crucial to raise awareness to the importance of creating and communicating a shared vision among both researchers and practitioners.

With our approach, we focus primarily on the impact of a shared vision on the individual perception of the meaningfulness of work in the context of an organization. Thus, our unit of analysis are the individual members of an organization. Further study might incorporate more of an organizational perspective and thus also use (organizational) measures such as financial performance or the increase of Intellectual Capital, or address other individual aspects apart from meaningfulness, that could be influenced by a shared vision (changes in behavior, peoples motivation, workplace satisfaction, etc.).

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Achieving Public Value in Universities Through Knowledge Management: The Need of Rationalization Regarding Investee Companies

Marco Berardi, Andrea Ziruolo,Fabrizia Fontana and Simone Cifolelli
Department of Management and Business Administration, Università degli studi "G.d'Annunzio", Pescara, Italy.
marco.berardi@unich.it
andrea.ziruolo@unich.it
fabrizia.fontana@unich.it
simone.cifolelli@unich.it

Abstract: International literature deeply investigates the contribution of Knowledge Management in the process of cost rationalization in public universities to achieve public value through performance management strategies. What emerges is a literature gap in relation to specific analysis concerning the impact of the "rationalization" of the companies owned by public universities and the sustainability of the investments made in universities especially during a "pandemic period". This work, through a qualitative analysis of the planning documents provided by Italian universities on the subject regarding "*rationalization of investee companies*", aims to highlight the contribution of knowledge management on internal planning on the rationalization processes put in place by universities with a focus on the "Accountability during emergencies". The analysis we conducted will show how the rationalization objective is nowadays far from being considered efficient due to a lack in "Knowledge management" approach despite a "Strictly bureaucratic" system that does not guarantee the achievement of public value and at least, contribute do the destruction of it.

Keywords: Universities Performance, Public Value, rationalization

1. Introduction

The measurement of university performance is increasingly common within universities, driven probably by the rise of New Public Management (NPM). Although changing over time and varying from country to country, NPM involves the use of private sector methods in the public sector. Traditionally, performance measurement in universities has had a developmental role – helping individuals to improve their (future) performances. This paper aims to conduct a preliminary study on Italian Universities considering an innovative aspect of performance evaluating the capability to plan a proper strategy of rationalizing costs within private companies and start-ups that are both owned or controlled (Higgins, 1989, Alach, 2017, Kirsi-Mari Kallio et. al, 2017; Grossi, 2020).

As a matter of fact, starting from 2013 the Italian legislator introduced a new tool for rationalize costs in the public sector: the "rationalizing costs plans" that is basically a document in which public bodies describe their assets and plan a strategy of costs rationalization in the long run.

As suggested by part of the literature, the quality of planning is crucial to the achievement of public value vis a vis it should create many difficulties while introducing new aspects that are proper of the private sector.

In this paper we focus on the quality of the "rationalizing costs plans" for public universities and how they are trying to achieve public value showing that even with the enormous efforts conducted, the planning suffers of a lack of Knowledge caused by an extreme "bureaucratization" of internal procedures.

As will be seen, both practice and literature highlight a common aspect: the bureaucratization of planning, control, and evaluation cycle of the rationalization results.

This limit is to be found (Guarini et. Al; 2018) where: "*the structure of the system of programming, control, and evaluation of results in public administrations is strongly influenced by legal regulations*" which are often interpreted regardless of the cognitive needs regarding management and administrators determining "bureaucratic economic systems without decision-making utility" (Guarini et. al, 2018).

The issue of the rationalization of public spending and the consequent reorganization of the companies owned by local authorities has been the subject of a massive regulatory reorganization, which is seen in the "Spending Review" by prof. Carlo Cottarelli, appointed in 2013 "Extraordinary Commissioner for the Revision of Italian Public Expenditure", marking the starting point of the reform process.
At the same time as the process of "rationalization" of public spending, "the subsidiaries, controlled, connected or otherwise financed by public administrations", had to meet the request by the European Union for "Transparency" in a logic of prevention with respect the onset of corruption and "maladministration" (ANAC, 2013).

Integrity of the local authority has found its operational declination through the preparation, by universities, of the so-called "Three-year plan for the prevention of corruption and transparency - PTPCT": an autonomous "internal control system" on which the controls on "investee companies, subsidiaries, associates or financed by universities" must also be included (ANAC, 2013).

So, on the one hand, the will of the legislator to “rationalize” public spending is linking with transparency. On the other hand, even Italian public universities “undergo the reform process” and the consequent “compliance burden” standing far from the logic of knowledge management.

Thus this paper will provide a first theoretical contribution aimed at bridging the gap in the literature in terms of “achievement of public value through rationalization logics” showing how Italian universities are far from adopting knowledge logics of Management in rationalization processes (Deidda Gagliardo, 2012; Ziruolo, 2013; Bigoni et. Al, 2021).

2. The reference regulatory context and the need to rationalize university spending

The rationalization of the investee companies consists in analyzing the structure of joint-stock companies in which the entity holds a direct or indirect shareholding (by an indirect company we mean a shareholding held through a company in which the entity has the control).

The analysis must be carried out in reference to the “investee companies held as at 31.12 of the previous year” to the one in which it is carried out and must be conducted by taking priority as a reference the criteria provided for by c. 2 of art. 20 of the “Consolidated Law on Investee Companies – TUSP” according to Legislative Decree 175/2016:

- company investments that do not fall into any of the categories allowed by the TUSP;
- companies that have no employees or have a number of directors higher than the number of employees;
- equity investments in companies that carry out activities similar or similar to those carried out by other investee companies or by instrumental public bodies;
- equity investments in companies which, in the previous three years, have achieved an average turnover not exceeding one million euros;
- equity investments in companies other than those set up for the management of a service of general interest that have produced a negative result for four of the five previous years;
- need to contain operating costs;
- need for company aggregation.

These requirements, where found, lead the body to prepare the so-called “rationalization plan” containing the actions that are intended to be adopted within the following year.

As anticipated in the introduction, even before the TUSP, the Italian universities were subject to a logic of rationalization of the investee companies, in compliance with the provisions of Law 190/2014 (2015 Stability Law) which “to ensure coordination of public finance, the containment of expenditure, the good performance of administrative action and the protection of competition and the market “established that public bodies (including universities), starting from 1 January 2015, had to start processes to rationalize companies and of the2ompanyy shareholdings directly or indirectly held to achieve their reduction by 31 December 2015 regarding:

1. elimination of companies and shareholdings not indispensable for the pursuit of their institutional purposes, including through liquidation or sale;

2. suppression of companies that are composed only of directors or by a number of directors greater than the number of employees;
3. elimination of equity investments held in companies that carry out activities similar or similar to those carried out by other investee companies or by instrumental public bodies, including through a merger or internationalization of functions;
4. aggregations of local public service companies of economic importance;
5. containment of operating costs, also through the reorganization of the administrative and control bodies and company structures, as well as through the reduction of the related remuneration.

If we consider specifically for "Universities", the "traditional two functions of teaching and research" are flanked by the so-called "Third mission" or "terza Missione".

"Third mission" is the "set of activities in support of young graduates in the phase of entry into the labor market along with research enhancement" vis a vis with the creation of spin-offs and university research centers.

The achievement of the "third mission" is interconnected with the ability of universities to "network" with the territory by undertaking or consolidating relationships with external entities (public or private) through the signing of agreements or joining consortia and companies.

Therefore, once the rationalization criteria have been defined, in 2015 the Italian universities adopted the first "Operational plan for Shareholding rationalization " following the criteria shown in table 1.

Table 1: Rationalization criteria introduced with the TUSP and integrated with those envisaged by the 2016 Finance Act

RATIONALIZATION CRITERIA	NORMATIVE REFERENCE
Aims	investments only in companies strictly necessary for the pursuit of their institutional purposes (Article 1, paragraph 611, Law No. 190/2014; Article 4, paragraph 1, Legislative Decree No. 175/2016)
Number of employees	equity investments in companies without employees or companies in which the number of directors is greater than the number of employees (Article 1, paragraph 611, Law No. 190/2014; Article 20, paragraph 2 b) d. lgs. 175/2016).
Performed activity	equity investments held in companies that carry out activities similar to those carried out by other investee companies or by instrumental public bodies (art. 1, c. 611, l. n. 190/2014; art. 20, c. 2 c) d. lgs. 175/2016).
Revenue	equity investments in companies which, in the previous three years, have achieved an average turnover not exceeding one million euros (art. 20, c. 2 d) d. lgs. 175/2016).
Operating result	equity investments in companies other than those set up for the management of a general interest service that have produced a negative result for four of the five previous years (art. 20, paragraph 2 e) d. lgs. 175/2016).
Management costs	need to contain operating costs (art. 20, paragraph 2 f) d. lgs. 175/2016).
Aggregation	need for aggregation of companies having as their objective the activities permitted under Article 4 of Legislative Decree 175/2016 (Article 20, paragraph 2 g) d. lgs. 175/2016)

Moreover, Italian universities underlie the logic of "transparency" as "*total accessibility of data and documents held by public administrations, to protect the rights of citizens, promote the participation of interested parties in administrative activities and encourage widespread forms of control over the pursuit of institutional functions and the use of public resources* "(ANAC, 2013).

This provision is implemented as a measure to prevent corruption with the "2013 National Anti-Corruption Plan", through which the National Anti-Corruption Authority (ANAC, 2019) has identified administrative transparency as one of the essential and therefore mandatory measures functional to the preservation of integrity in the scope of the local authority.

So, Italian Universities guarantee transparency through the publication on the institutional websites of the "rationalization plans".

3. The rationalization of investee companies as a tool for creating public value: analysis of the literature

Mark Moore (1995) is probably the first author who defines public value as "as an organizational principle in a public sector organization" providing a focus in the context in which individual employees are free to pursue and propose new ideas on how to improve the functioning of the organization, in terms of efficiency or services.

In his work, Moore considers public value as the "result of assessments of how the primary needs of individuals, groups, and society as a whole are affected in relationships involving the public", also considering the public as an operational fiction indispensable of society.

M. More also believes that any impact on the shared experience on the quality of the relationship between the individual and society can be described as the creation of public value, finally concluding that "the creation of public value lies in the relationships between the individual and society, founded in individuals, consisting of subjective assessments concerning primary needs, activated and realized in emotional-motivational states, and produced and reproduced in experiential practices ".

Furthermore, M. Moore creates a link between the creation of public value and the ability of a firm to create capital gains: "The definition that remains identifies managerial success in the public sector with the start-up and remodeling of public sector enterprises in ways that increase its value to the public both in the short and long term".

According to this framework, public organizations seeking to use public value as a principle must create a corporate culture in which the pursuit of public values by employees is rewarded as well as the pursuit of shareholder value is rewarded in private companies.

The evolution of literature has, over time, perfected the definition formulated by Mark Moore. Among the most cited in the literature, we find that of Talbot (2006) who defines the public value (or capital of public value) as the "combined view of the public on what it considers precious". Bozeman (2007) contributes to the literature by defining public values as "Those who provide a normative consensus on the rights, benefits, and prerogatives to which citizens should (and should not) be entitled, the obligations of citizens to society, the state and others, and the principles on which governments and policies should be based ".

In recent years, the theme of public value has been taken up by numerous authors (Ziruolo, 2016; Deidda Gagliardo, 2002, 2015; Borgonovi & Mussari, 1996, 2011; Rebora 1999, pp. 108, 110; Anselmi, 2014). The national literature sees with Deidda Gagliardo (2015) the redefinition of public value as "*a balanced value and at the same time aimed at satisfying the final needs of the reference community and the functional needs of the institution*" concluding that "public sector creates public value managing financial resources, functionally improving intangibles to meet social needs and strengthen the economic growth of a community ".

This definition, the most cited in the national scientific literature, includes the classic concepts of efficiency, effectiveness, and economy and aims to "*reconcile the business logic of evaluation of the administrative activity with a more general evaluation of the effective capacity of the entity that pursues institutional purposes* "(Ziruolo, 2016; Valotti, 2000, pp. 50–51 😁. This definition also aims at achieving the so-called "Corporate Public Value" pursued through operational programs (Operational VP) and strategic programs (Strategic VP), contributing to the creation of the so-called "Institutional Public Value".

Public Institutional Value (Rebora 1999, p. 47; Del bene, 2009, pp. 96–98) takes place when the operational and strategic programs carry out the institutional missions contained in the mandated program. Therefore, to increase the probability of creating Public Value and reduce the risk of its consumption and destruction, the PA must be conducted according to appropriate governance models and boosted by a KM approach.

In this sense, KM deeply impact this framework as previously invisestigated by some authors. On one side, some authors (Mohayidin et. al., 2007) reveal that KM system requires every academician to practice appropriate

management of knowledge in his or her teaching and learning activities, which includes, generating, acquiring, storing and disseminating knowledge effectively to users of knowledge, especially students. Moreover, other authors indicate KM as the key factor to boost a public service reform and consider it as a boosting driver to achieve public value (Pan and Scarbrough, 1999) that can be achieved only with the rationalization of internal costs through a KM approach of internal procedures.

Therefore, to guide towards the generation of value, governance models must be based on planning, control, and evaluation logic due to permit KM to be effective on boosting internal procedures (Newman et. al.,1999).

Regarding this point authors such as Metaxiotis et. al. (2003) indicates the "right way to make KM effectives on Public Services" considering the rationalization of internal procedures to reduce internal costs can be effective only if a public reform comes out and is accepted by citizens and public utilities along with local governments.

To achieve public value through KM it is necessary to plan adequately the objectives to be achieved then clarify paths to be followed, the resources to be used and carefully check the results achieved, the paths followed, the resources used (Wickramasinghe, 2002).

Finally, consciously, and objectively assess the individual (executive and managerial) and organizational (operational and strategic) contributions to the creation of Public Value, rewarding the positive ones and sanctioning and/or correcting the negative ones. All this with the goal of satisfying the needs of users, stakeholders, and all citizens of the reference territories (Deidda Gagliardo, 2015).

The relationship between planning and creation of public value can be analyzed through the identification of performance indicators or KPIs repeatedly referred to in the most cited academic literature based on Scopus on the subject of "rational planning and creation of public value in the local authority" and indicated below (Table 2).

Table 2: Literature KPI's

Item	Authors	Numerosity
Formality	Ansoff et al. 1970; Gershefski 1970; Thune & House 1970; Herold 1972; Rue & Fulmer 1973; Grinyer and Norburn 1975;Karger & Malik 1975;Burt 1978;Wood & Laforge 1979;Kudla 1982; Robinson & Littlejohn 1981; Sapp & Seiler 1981; Jones 1982; Kudla & Cesta 1982; Robinson 1982; Robinson & Pearce 1983; Acklesberg & Arlow 1985; Orpen 1985;;Bracker & Pearson 1986;Rhyne 1986; Capon et al. 1987; Gable and Topol 1987; Pearce et al. 1987; Bracker et al. 1988; Cragg and King 1988;Odom and Boxx 1988; Shrader et al. 1989; Kukalis, 1991; Powell, 1992; Veliyath & Shortell 1993; Capon et al. 1994; McKiernan & Morris 1994; Priem et al. 1995; Powell 1994; Hopkins & Hopkins 1997;Slevin & Covin 1997; Boyne, 2001; Zhang et. al. 2019	38
Completeness	Ansoff et al. 1970; Gershefski 1970; Thune & House 1970; Herold 1972; Grinyer and Norburn 1975;Burt 1978; Kudla 1980; Klein 1981; Robinson & Littlejohn 1981; Sapp & Seiler 1981; Kudla & Cesta 1982; Robinson 1982; Acklesberg & Arlow 1985; Orpen 1985;Bracker & Pearson 1986;Ramanujam et al. 1986; Capon et al. 1987; Gable and Topol 1987; Pearce et al. 1987; Bracker et al. 1988;Odom and Boxx 1988;Frederickson & Iaquanto 1989; Shrader et al. 1989; Powell, 1992; Glick et al. 1993; Veliyath & Shortell 1993; Capon et al. 1994; McKiernan & Morris 1994; Priem et al. 1995; Powell 1994; Goll & Rasheed 1997;Slevin & Covin 1997	32
Intensity	Frederickson 1984;Frederickson & Mitchell 1984; Robinson et al. 1984; Orpen 1985;Ramanujam et al. 1986; Capon et al. 1987; Capon et al. 1994; Hopkins & Hopkins 1997;	8
Quality	Leontiades & Tezel 1980;	1

Item	Authors	Numerosity
Comprehensiveness	Wood & Laforge 1979; Robinson 1982; Frederickson 1984; Frederickson & Mitchell 1984; Robinson et al. 1984;Ramanujam et al. 1986; Frederickson & Iaquanto 1989; Kukalis, 1991;	8
Commitment	Leontiades & Tezel 1980 ; Orpen 1985 ;Ramanujam et al. 1986 ; Rhyne 1986 ; Robinson et al. 1986 ; Pearce et al. 1987 ;	6
Implementation	Shrader et al. 1989; Kukalis, 1991; Powell, 1992; Veliyath & Shortell 1993; Capon et al. 1994; McKiernan & Morris 1994;	6
Flexibility	Rue & Fulmer 1973; Karger & Malik 1975; Klein 1981; Sapp & Seiler 1981; Orpen 1985;Whitehead & Gup 1985; Gable and Topol 1987; Kukalis, 1991;	8

This framework analyses eight KPIs (Key performance indicators) as fundamental and essential elements to be considered when preparing a planning document: formality, completeness, intensity, quality, comprehensibility, commitment, Implementation, flexibility.

Formality is the extent to which objectives are explicitly stated and strategies expressed in a written document. This is widely regarded as an essential feature of planning. For example, in the research by Capon et al. (1987, p. 47), "for a company to be classified as one that planned, a physical document had to be prepared, the procedures used are prescribed and the phases of the process are monitored by declining an appropriate intervention plan (calendar)".

Completeness provides that "where all phases of the planning cycle are undertaken, we can obtain a definition of the desired results, generate alternative strategies, and evaluate their impacts by periodically monitoring the results".

By completeness, we mean the conjunction of an operational practice to the traditional definitions of "rational decision-making in the public sector" (Leach 1982; Forester 1984).

Intensity is the level of resources committed at each stage of the planning cycle. Ansoff et al. (1970, p. 2) state "the costs of planning are very tangible and often considerable, particularly if top management provides the involvement and support required by an active planning process."

The "Quality" considers whether each phase of the cycle is according to a satisfactory standard, namely the accuracy of forecasts and the validity of indicators for monitoring results (Leontiades & Tezel, 1980).

Understandability refers to the ability to produce a "comprehensible" planning document to the outside by the subjects interested in the contents to guarantee "supervision and control" by the stakeholders directed towards the published information (Wood & Laforge, 1979).

Completeness is translated into the literature with the answer to the question: "Are all organizational functions included in planning or is coverage selective?" Miller and Cardinal (1994, p. 1651) argue that one of the primary purposes of strategic planning is to help managers integrate and control various parts of a company.

Similar to "Completeness", "Commitment" can be translated with the research question: is planning taken seriously by the organization's staff or is it simply a remote ritual that only interests planners? According to Hopkins and Hopkins (1997, p. 637), "planning has no value in and of itself, but only takes on value when busy people energize it."

Finally, flexibility is seen as the extent to which plans are regularly reviewed and adapted to reflect new circumstances, rather than set up for the entire period covered by the initial version of the plan (Rue & Fulmer 1973; Karger & Malik 1975; Klein 1981; Sapp & Seiler 1981; Orpen 1985; Whitehead & Gup 1985; Gable and Topol 1987; Kukalis, 1991).

4. Methodology

Starting from the theoretical framework described, an analysis was carried out on the Italian "University rationalization plans" to verify the correspondence between what is foreseen in the literature and the actions implemented by the respective universities.

Similarly to what has already been presented by a part of the literature (Della Porta et. Al, 2019), the analysis went on to verify the "quality of programming" in a logic of "rationalization of programming for the achievement of local public value in a logic of knowledge management ".

The analysis was conducted on the rationalization plans published on the University websites of the 67 Italian public universities (MIUR Census, 2021) and regarding the 2015-2020 period, also verifying the transparency of the rationalization process (table 3).

Table 3: Results of the study conducted on the "Rationalization Plan of Italian Universities"

KPI	Plan 2015	Plan 2016	Plan 2017	Plan 2018	Plan 2019	Plan 2020	Plan 2021
Formality	54	54	60	67	67	67	67
Completeness	52	52	58	67	67	67	67
Intensity	52	52	58	67	67	67	67
Quality	47	52	58	67	67	67	67
Comprehensiveness	67	67	67	67	67	67	67
Implementation	67	67	67	67	67	67	67
Flexibility	67	67	67	67	67	67	67
Transparency	52	52	52	67	67	67	67

The individual plans have been clustered according to the indicators identified in the literature (Table 3) to determine the adequacy of the same to the requests of the legislator and the need for cost rationalization common to all universities.

In this regard, some of the literature suggests that where a process of cost rationalization is implemented, it is essential to take into consideration not only the so-called regulatory compliance but also aspects related to the "smart" management of business processes (Van Dooren et. al, 2008).

Therefore, it was verified whether the actions implemented by the Italian universities also respect the logic of Knowledge rationalization of processes (Kukalis, 1991) or whether attention was paid to implementing the actual strategies of only formal adaptation to the requests of the legislator.

International literature agrees that the "*rationalization processes compliance with the Formality is not sufficient to guarantee, in the long term, effective and efficient rationalization strategies*" where not accompanied by a process of total reorganization of the management of business processes.

In this sense, the quality of the rationalization lies in the declination of objectives reducing management costs of services that are achievable and measurable over time.

Furthermore, many authors highlight how the Comprehensiveness, Implementation and Flexibility of intelligent programming processes can only be achieved where the subjects responsible for programming have adequate benchmarks or best practices based on which they can formalize rationalization logics that can be considered intelligent and comparable to each other.

5. Results

What emerges from the analysis conducted is what in the literature is defined as "awareness and management of programming knowledge in an innovative logic of operational management of the operational processes of local authorities" (Vial, 2019).

Part of the literature highlights how the adaptation to what have been the numerous changes to the regulatory sector of reference, the introduction of the TUSP on all, the need for "time" for an adaptation of the management of the processes defined as innovative by local authorities similarly to what happened in local authorities with the introduction of the Single Programming Document (Bartocci and Del Bene, 2019).

In this regard, literature has highlighted how the approach to the service management of organizations has improved over a lapse of time, introducing in operational practice the use of a wide range of tools and systems introduced by information and communication technologies as group support"systems" (Jessup and Valacich 1993).

Therefore, the alignment process of the "Rationalization plans of the companies in which universities are held" has undoubtedly been affected by these variables.

In particular, the introduction of innovative electronic communication tools, designed to support decision-making processes through the analysis of alternatives, negotiation, and "vote" on the choices to be applied (DeSanctis and Gallupe, 1987; Ellis et al 1991) and which characterized the work of the public administration and the internal reorganization in a logic of "Smart Governance", especially with the occurrence of the COVID-19 pandemic event.

In this regard, it should be noted that the analysis conducted showed an alignment of the "Rationalization plans" with the requests formalized by the legislator, directly correlated with the degree of digitization of the operational processes of local universities only starting from 2018 (Miur, 2019).

This phenom linked with literature as local authorities were not ready to take action to the "new" requests of the legislator (Della Porta et. al, 2019).

In this sense, the analysis highlighted how the creation of public value still seems to be linked to logic attributable to "Bureaucratic public management" or limited to the application of specific legal dictates in a purely compliant logic: "*fulfill to function*".

What emerges from the analysis conducted is that in the face of a request for cost rationalization, is that Italian universities had to dedicate four years to formally align themselves with the request of the legislator.

As shown in table 4 all the indicators suggested by the literature are only operationally confirmed since 2018 when, at the state of the art, the Italian universities have all begun to work concretely for the rationalization of investee companies which since 2018 alone have been decreased by 18% per year until 2020.

Until 2018, evident "bureaucratic" errors related to non-compliance with the legislator's request had emerged. One above all is the lack of understanding of university spin-offs in the context of investee companies.

These evaluation errors inevitably led the institutions to change their rationalization strategies during the year and in as many as 14 universities to 7 changes to the design conducted in 2017.

Therefore, the strategic alignment with the operational one occurred exclusively in 2018 when, thanks also to the digitalization of the processes in the administrative offices of the universities and the introduction of typical tools of Knowledge Management such as, for example, the re-engineering of business processes and '' introduction of new company software dedicated to the long-term projection of the effectiveness of company rationalization.

It is also evident from the "Transparency" indicator that, until 2018, adequate legal publicity was not given to the rationalization processes carried out by omitting the publication of the rationalization plans in clear contrast with the provisions of both the legislator.

Legal publicity for the rationalization processes carried out by omitting the publication of the rationalization plans not in compliance with Italian transparency law.

Lack of transparency is also considered in the literature as an indicator of inefficiency so, in our case, it contributes to do not achieve public value.

6. Conclusions

This work, starting from the studies conducted (Higgins, 1989, Alach, 2017, Kirsi-Mari Kallio et. al, 2017; Grossi, 2020), retraced the main regulatory interventions aimed at introducing the rationalization of investee companies within Italian universities to achieve public value (Moore, 1995) with a KM approach (Pan and Scarbrough, 1999; Malone, 2002).

The analysis conducted on the rationalization plans concerned all Italian universities, thus including private companies and spinoffs during the period 2015 – 2021. The data was acquired directly from the institutional sites of the state universities under investigation.

Our analysis shows that in front of the efforts made, the process of rationalizing the costs associated with shareholdings that started in 2015 appears to be "performing" exclusively starting from 2018, focusing more on formal rather than substantive aspects and not adequately justifying in what terms the reduction in the number of subsidiaries is directly related to company performance almost confirming what happened in past years in other universities (Mohayidin M. G.,2007).

The reduction of management costs alone is in no way justifiable in the face of an accurate impact analysis of the services provided by the discontinued subsidiaries and as seen, far from a KM organizational learning (Huber, G. P., 1991).

The entire rationalization process was guided solely by compliance with "ministerial protocols" (Table 1) linked to performance indicators applied in a standardized manner by all Italian universities.

Similar cases of standardized rationalization by mere regulatory compliance have shown (Grossi, 2020) how in the long-run universities lose competitiveness (Papi et. al. 2018) while rationalization processes created "ad Hoc" would allow achieving public value.

In conclusion, our analysis would suggest reviewing the entire process of rationalizing the costs associated with university holdings as it seems to be not more than a formal act despite an action aims to create public value.

If from the documentary analysis conducted, there are evident positive economic impacts on the financial statements of Italian universities, international operating practices and much of the literature promote rationalization tools that contribute to the achievement of public value through non-standardization of operating practices.

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Knowledge Discovery in Case Studies: The Case Insight Method for Case-Based Problem Solving

Marco Bettoni
Steinbeis Consulting Center Knowledge Management and Collaboration, Basel, Switzerland
marco.bettoni@weknow.ch

Abstract: The topic of this paper is a new method of knowledge discovery in documents called "Case Insight" (abbreviated to CI). The research question that led to this development was "How can we discover knowledge through case studies and make it usable for case-based problem solving?" To answer this question, this research took a Systems Thinking and Networked Thinking qualitative approach. Case-based problem-solving uses knowledge contained in authentic case descriptions (i.e. "good practice" or even "best practice" cases) and adapts it to the requirements of a new problem. Who can use this? Managers and management consultants who are starting out in their careers can benefit in particular from the CI method as it allows them to expand their repertoire of experience in problem-solving on the basis of case studies, i.e. without being involved in projects. All those interested in solving complex management problems in a case-based way also form part of the target audience. Case studies contain a great deal of problem-solving knowledge but only part of that knowledge can be absorbed through simple reading. The rest remains difficult to access, a hidden treasure, so to speak. Why is that? The reason is that knowledge discovery in case studies is made more difficult due to two obstacles: firstly, the texts are not sufficiently brain-friendly and secondly, they are not designed holistically enough. The CI method makes it possible to overcome these obstacles by means of CI tools and CI models. Firstly, CI tools are used to analyse case studies by comparing concepts, ideas, etc. and combining them into a whole; secondly, CI models make knowledge discovered in this way usable in the form of brain-friendly and holistic knowledge structures. Thus, knowledge discovery through the CI method complies with Immanuel Kant's definition of knowledge as "a whole of compared and linked ideas".

Keywords: Case-based knowledge discovery, case studies, case-based problem-solving, case-based reasoning, brain-friendly documents, knowledge visualisation

1. Introduction

In connection with expertise, which is primarily developed by practising in challenging situations (Ericsson 1993), it is interesting to note that experts, when solving challenging problems (very complex problems and/or in areas where there are no formalisations, e.g. medical diagnosis: ten Cate at al. 2018) strongly draw on a particular type of experience: past cases they have been involved in or know from other sources, in other words, they use *case-based problem-solving* (Zumbach et al. 2008). From these aforementioned past cases, experts search for suitable knowledge, identify it, evaluate its similarity with the new case and if this past knowledge is found to be similar enough, it is adapted to fit the requirements of the new problem. This process of *case-based reasoning* can be divided into two main steps:

1. Cases must be recalled where similar problems have been solved.
2. These earlier solutions must be adapted to the current problem.

But what do you do if you are not (yet) an expert and have not yet been involved in many past cases? One solution to this problem could be using a large repository of *case studies* that can be easily accessed and searched through. In fact, in international academic education, learning from case studies plays a fundamental role and research in cognitive psychology emphasises the importance of *case-based reasoning* for learning (ten Cate at al. 2018; Kolodner 1997; Schmidt & Boshuizen 1992).

Unfortunately, there is a big problem here: although case studies contain a great deal of problem-solving knowledge, only a small part of that knowledge can be absorbed through simple reading. The rest remains difficult to access, a hidden treasure, so to speak. Why is that? This research shows that knowledge discovery in case studies is made more difficult due to two main obstacles: firstly, the case study texts are not sufficiently *brain-friendly* (Probst et al. 2012) and secondly, they are not sufficiently based on *networked, holistic thinking* (Gomez & Probst 1999; Benesch 1987,1988). So the question is: How can we discover knowledge through case studies and make it usable for case-based problem-solving? This is the main research question here. Up until now, *knowledge discovery* has been considered the process of automatically searching large volumes of data for patterns. This research proposes a completely new and complementary approach. The target data involves carefully selected case studies that an interested individual analyses by applying the new method presented here and which, as a result, leads to the discovery of knowledge hidden within the case study text.

2. Literature Review

About 80% of business-relevant information is encoded in natural language (Wimalasuriya et al. 2010) and therefore unstructured. This is a huge amount of data and explains why, up to now, techniques and processes for knowledge discovery (KD), like text mining (Feldman & Sanger 2007), concept mining (Li et al. 2018), natural language processing (Kurdi 2016), knowledge discovery and data mining (Fayyad et al. 1996) and the like are all focused on the automated processing of large volumes of data: we could call this the "Huge Data KD". Typical tasks of *huge data KD* include text categorisation, text clustering, concept/entity extraction, production of taxonomies, sentiment analysis, summarisation and entity relation modelling. The outputs are long lists of patterns that would otherwise be impenetrable to automated processing and this knowledge – facts, business rules, and relationships – is presented in a machine-readable form for further processing.

In principle all of these functions could be applied also to single, carefully selected documents that someone wants to analyse in detail. But that would contribute only *knowledge fragments* taken out of context, which would not be very useful for case-based problem-solving. Text analysis, for example, aims to derive insight solely from the lexicon of a text itself, without considering semantics. It provides data about frequency of words, presence or absence of words, length of sentences, etc. This makes sense when analysing huge amounts of texts (for example customer conversations over one or more years) to find out keywords relating to the main issues and trends. But when applied only to one document, such an approach would be of little use. Like in text analysis, with other *huge data KD* techniques, outputs are conceived as contributions to statistical evaluations of large volumes of documents; what you get are huge amounts of *knowledge fragments* that have lost their context: this type of knowledge is not very useful for case-based problem-solving.

Case-based problem-solving requires case knowledge in the form of one or more *knowledge models for the case*. This case knowledge is context-related, unbroken knowledge, made up of knowledge items that need to be connected; connections can take many forms, for example feature vectors, production rules, frames, ontologies, semantic nets or other networks (El-Sappagh & Elmogy 2015). This is a very different type of knowledge representation than the one provided by the established *huge data KD* approach.

As a consequence, we need a completely different approach to knowledge discovery, one which does not discover knowledge fragments but rather knowledge models of the cases. This is what the Case Insight method presented in this paper does. Its development is based on research into case-based problem-solving (Zumbach & Mandl, 2008), case-based reasoning for learning (Staempfli 2020; ten Cate at al. 2018; Kolodner 1993; Schön 1983), knowledge externalisation (Probst et al. 2012), knowledge visualisation (Eppler & Burkhard 2004), psychocybernetics (Benesch 1987,1988), networked, holistic thinking (Gomez & Probst 1999; Benesch 1987,1988; Vester 2007) and reverse engineering (Vinesh & Fernandes 2008).

3. Methodology

To answer the main research question (how we can discover knowledge through case studies and make it usable for case-based problem-solving, see above), this research takes a Systems Thinking and Networked Thinking qualitative approach. A Systems Thinking approach is a way of thinking which enables us to better understand and design complex issues. Systems Thinking and Networked Thinking require (Haberfellner 2002; Vester 2007):

1. the systemic definition of concepts: the new concept of *knowledge discovery* is defined in this way;
2. the use of these concepts in the context of a holistic view: the CI method deals with the *document as a whole*, instead of searching only specific parts;
3. the use of systemic models: *CI models*, the outcomes of the CI method, are such models;
4. the use of holistic, interconnected thinking: this has been applied in the *construction of the CI method*.

4. Results

After defining the new concept of knowledge discovery used in this research, three types of knowledge contained in case studies are distinguished and two main obstacles hindering knowledge discovery are specified. Furthermore, the CI method for overcoming these obstacles is presented along with a toolbox for working on both problem and solution case studies and a few application examples from a knowledge management case: a corporate wiki.

4.1 Case-Based Knowledge Discovery: Definition

The approach to knowledge discovery presented here differs in several aspects from all the established techniques of knowledge discovery previously mentioned in the literature review (section 2):

1. *Volume of data*: the number of case studies involved is such that it can be easily managed and scanned through by a person.
2. *Typical task*: the performed analysis is holistic instead of partial: it deals with the whole document, instead of searching only specific parts (like concepts or entities or sentiments, etc.)
3. *Typical objects*: the task objects are single, well-selected documents, not a large collection of written resources (corpus).
4. *Typical process*: the text analysis process is a conscious reasoning process of natural intelligence similar to reverse engineering, not a computational, automatic, artificial intelligence process.
5. *Typical outcomes*: the outputs are a small set of holistic knowledge structures (models) for each task object, not huge lists of similar parts found in a big corpus of many objects.

These characteristics of the concept of Case-Based Knowledge Discovery are summarised in the following definition:

> *Case-based knowledge discovery (CBKD) is the process of examining a case study by means of conscious, natural intelligence reasoning similar to reverse engineering that performs the task in a holistic way, dealing with the whole document and producing as the outcome a small set of holistic knowledge structures* (models).

4.2 Knowledge in Case Studies

Each case study contains much more knowledge than we usually see at first glance. It is a treasure trove of problem-solving knowledge but it is often difficult to access, so it represents a hidden treasure, so to speak. The CI method helps you to discover and use these treasures. On the one hand, it enables you to expand your pool of problem-solving experience - simply by studying case studies and independently of carrying out your own projects. On the other hand, it enables to use this experience and the CI tools for the case-based resolution of new problems.



Figure 1: Knowledge in case studies (adapted from: Paolo Calleri, Ulm, 2010)

The problem-solving knowledge contained in case studies can be divided into 3 types of knowledge:

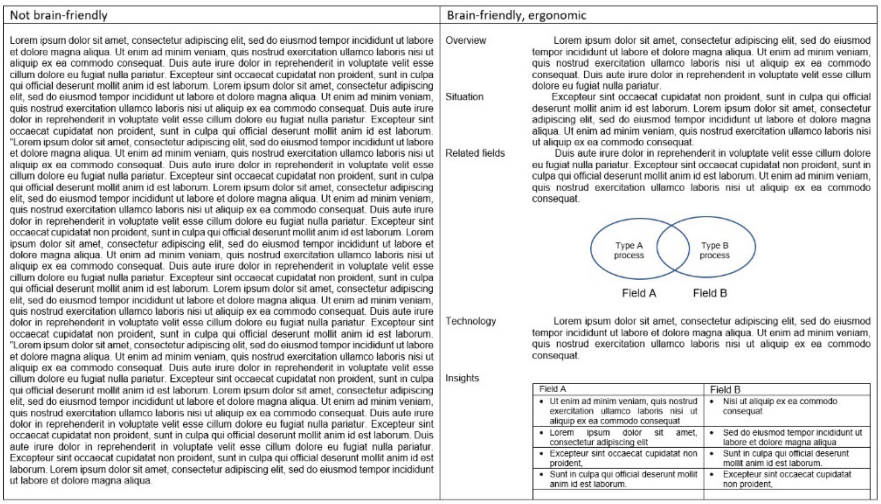
1. *Problem* knowledge. This is knowledge of the structure of the problem (parts and their connections);
2. *Process* knowledge. This is knowledge of the procedure, i.e. how to find the solution;
3. *Solution* knowledge. This is knowledge on which the implemented solution is based.

Why is the treasure trove of problem-solving knowledge in case studies difficult to access? Two obstacles make knowledge discovery difficult:

- Obstacle 1: case study texts are not or not sufficiently designed in a brain-friendly manner.
- Obstacle 2: Case descriptions are not or not sufficiently holistic.

4.2.1 Obstacle 1

If the case description contains knowledge, then one would perhaps expect that it can be easily accessed by reading the document. Why would we need a method of accessing such knowledge? Let's look at an example of a description: it uses dummy text because at this point the focus is only on the text design.



Not brain-friendly	Brain-friendly, ergonomic
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Figure 2: Brain-friendly editing of documents – adapted from Probst, 2012, p. 189

When textual descriptions resemble the example on the left, then by simply reading such a description, it will be very difficult to use the knowledge it contains. On the right-hand side, the same text has been edited in a brain-friendly manner which makes it somewhat easier to access the knowledge but not easy enough because the document sections still contain a lot of linear text. So we need a method that enables us to access the entire knowledge of the case study in a brain-friendly manner. This is the function of the CI method. Why is linear text not brain-friendly and what is meant here by "brain-friendly"? A description is "brain-friendly" if it is "*oriented towards the processing mechanisms of the human brain*" (Probst 2012 p. 189), especially the brain mechanisms of knowledge processing. How is knowledge processed in the brain? According to a principle by H. Benesch (1987, 1988), the so-called *CPM principle (carrier, pattern, meaning)*, at a basic level, knowledge processing in the brain works like this:

1. Carrier: the processing is carried out by the nerve cells (neurons and others) which are extensively interlinked with one another.
2. Pattern: the activation of the neural networks creates patterns.
3. Knowledge (meaning): is generated and processed through structural pattern formation (so-called "figuration").

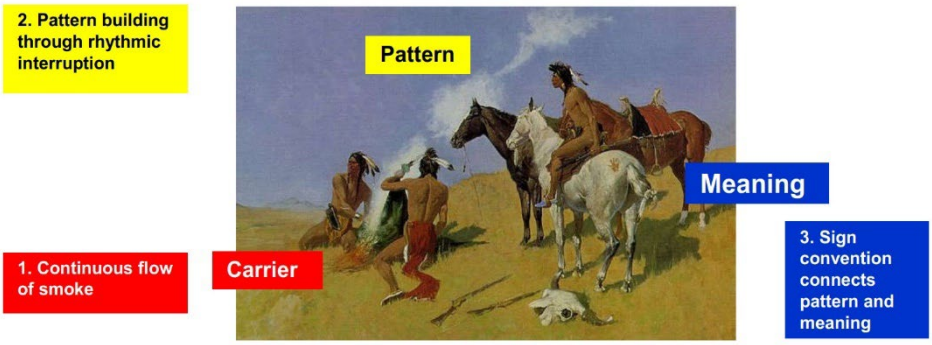


Figure 3: Knowledge processing in the brain: the CPM principle (Benesch 1987, 1988)

In terms of this principle then, a description is "brain-friendly" if it is spatially structured and has patterns because it then supports the structural formation of patterns in the brain.

4.2.2 Obstacle 2

A description is "holistic" if it supports the networked thinking that is necessary for dealing with complexity. How does networked thinking work? I would like to illustrate this with a small exercise (idea by H. Benesch, 1987). Let's consider a short cartoon story about Snoopy and Lucy. The sequence of the 4 pictures is reversed. They should be properly ordered according to the title "The Kiss". To this end, various aspects are to be interpreted within their networked context: a) What does the individual image represent? b) How can the

utterances be arranged? c) What is the effect of Snoopy's kiss? In this way, you reach the logical sequence: 3, 4, 1, 2.



Figure 4: Networked Thinking – adapted from H. Benesch, 1987, vol.1, p. 187

Networked thinking is therefore the integration of:

- Different points of view
- With the networked interrelationship of the parts

4.3 Case Insight (CI) Method

We can overcome obstacles to knowledge discovery in case studies by creating knowledge structures which:

1. Are brain-friendly: spatially structured knowledge structures that support pattern recognition
2. Are holistic: knowledge structures that emphasise the networked interrelationship of the parts and take various points of view into account.

This is exactly what the CI method offers. Case-based problem-solving in management is a two-stage process consisting of knowledge discovery (stage 1) and knowledge use (stage 2):

- *Knowledge Discovery*. This is where the CI method is applied: with the help of *CI tools*, knowledge from authentic case studies is analysed from different perspectives and the knowledge discovered through this processing is made visible and usable in the form of *CI models*, i.e. brain-friendly and holistic knowledge structures.
- *Knowledge Use*. The knowledge structures from stage 1 are adapted to the requirements of new problems and used together with the CI tools for problem-solving.

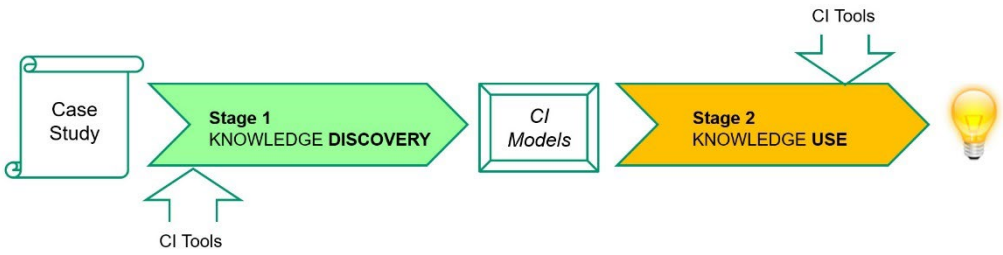


Figure 5: Case-based problem-solving in management with the CI method

Knowledge discovery with CI consists of 4 steps; they are run through several times per tool and are therefore arranged as a circular process, the so-called *CI cycle*. The 4 steps lead from selection of a suitable case study to findings about the problem, the process and the solution from the case study.

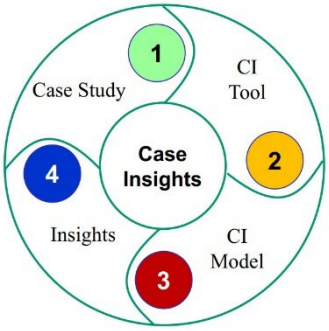


Figure 6: The CI cycle

According to their main subject, the 4 steps can be distinguished as follows:

- Step 1: *Case study*. The case study is at the beginning of the CI cycle, i.e. step 1. You have to look for case studies, define your own criteria for selection, collect suitable case descriptions, select the best one, read it and get a rough idea of the most important characteristics for you. This will take you to step 2 where you will deal with the CI tools.
- Step 2: *CI tool*. First of all, you need to choose a tool. The first will most likely be the project profile (One-Pager, see next). This tool provides orientation knowledge and thus creates good conditions for selecting further tools afterwards. If problem knowledge proves to be important, then you should choose the Triadic Defect Analysis tool. Solution knowledge will certainly always be important: there are several tools available for this that complement each other. After making your selection, you need to make sure that you know the tool well. With this knowledge, you then return to the case study and mark any terms or sections in it that match the chosen tool.
- Step 3: *CI model*. In step 3, you first check whether the marked words can be used as parts of the model. The model, i.e., the knowledge structure, is then iteratively built up and expanded from the appropriate text sections.
- Step 4: *Insight*. Finally, in step 4, the created model is examined carefully and reflected on: what findings does it provide? What questions does it leave open? What information and links are still missing or are redundant? Etc.

So these are the 4 steps of the CI cycle. An important note on this: it is not sufficient to run through the cycle only once per tool; the models would then probably be too rough. To refine it, two types of iterations are necessary: 1) On the one hand, a model-specific iteration through steps 2 and 3 when the first version of a model is created; 2) On the other hand, a cross-model iteration through the various models to ensure the consistency and complementarity of their knowledge structures: they should not contradict or overlap but rather complement one another.

We saw that CI is a method of knowledge discovery. But what is it that is "discovered" in the process? What is knowledge? Immanuel Kant, the famous German philosopher who proposed an innovative theory of knowledge which today is still revolutionary (Bettoni 1997), wrote in his main work that knowledge is: "*a whole made of compared and linked ideas*" (Kant 1781/1966 p. A97). This is exactly what we do with every CI tool: we search for and discover *ideas* in case studies (terms, ideas, etc.), *compare* them and *link* them into a whole. This "whole" is precisely the CI model, a knowledge structure.

4.4 Basic CI Toolbox

The basic toolbox for discovering case-based knowledge by means of the CI method consists of 11 tools, divided into 3 groups:

1. CI tools for problem knowledge: for discovering knowledge about the structure of the problem
2. CI tools for solution knowledge: for discovering knowledge on which the solution is based
3. Generic tools: for discovering generic knowledge

These 11 tools are selected as suitable for working on both problem and solution case studies, namely problems and solutions from any management discipline.

4.4.1 CI tools for problem knowledge

1. The *One-Pager Window* offers orientation knowledge, a panoramic view of the knowledge included in the case study: on a single page, the most important aspects of the project, the what, why, how and who, are described in a few words. This makes it easier to gain an overview of the core idea of the project.
2. The *TDA chain* provides a kind of "bird's eye view" of the problem area which can be very helpful as a basis for formulating the project goals. The focus is on organisational provisions and their consequences, especially with regard to defects. Their links thus provide problem knowledge that is very important for the formulation of the project goals.
3. The *PTO map* focuses on differentiating between important aspects of the main task according to the three categories of people, technology and organisation (Ulich 2011, 2016). The problem knowledge presented here answers the questions: which concept (aspect) in the case study is primarily human, which primarily technical and which primarily organisational and how are these areas structured? References to connections between the parts complete the knowledge structure.
4. The *Stakeholder Window* is an easy-to-understand representation of the main stakeholders in a project who are divided into 4 categories (Pentacle 2015): 1. Are not necessary + benefit; 2. Are not necessary + suffer damage; 3. Are necessary + benefit; 4. Are necessary + suffer damage. This knowledge is very important in order to be able to assess the role of the 4 groups in the project in an individual, appropriate way.

4.4.2 CI tools for solution knowledge

1. The *Means-Ends Hierarchy* makes it easier to oversee and reflect on project goals, especially with regard to weighting and complexity (Haberfellner et al. 2002). Goals are often insufficiently reflected upon or even remain unmentioned. By looking at the goals for a certain hierarchy level, you can see which goals have the same or a similar degree of abstraction; and when looking at all the sub-goals of a goal across different hierarchy levels, you can see, for example, the degree of complexity involved in achieving the goal. This knowledge is very important in the analysis in order to assess the solutions appropriately.
2. In an *SFM Network*, needs, objectives and solutions appear explicitly as independent elements (Bettoni et al. 2013). In addition, they are brought into a recognisable (not hidden, not implicit) connection based on the three connections - meaning (B > Z), achievement (Z> L) and fulfilment (L> B). Units in which all three categories are represented and which link the three elements with one another, so-called triads, are a particularly important knowledge content of the SFM network because they mark the most valuable solutions.
3. The *Structure Network* shows solution knowledge in the form of an order or arrangement pattern and thereby helps to better reflect the principles of order (Haberfellner et al. 2002). It visualises components of the main structure and the associated structural relationships with which the components are connected. When analysing organisational forms, these are leadership relationships, social relationships or command paths. In the case of processes, e.g. information flows, material flows, work sequences, etc., the structure relationships are functions or operations of the process between input and output.
4. The *Causal Network* contains knowledge about mechanisms of action (impact mechanisms). It shows the root of a problem or a solution and supports what is known as "thinking in cycles" which is an important resource for successfully dealing with complexity (Obeng & Gillet 2008). Thanks to the causal network, special effect patterns become visible which are shaped as cycles. Such cycles are like "motors" that drive what happens in the network. These networks thus provide critical knowledge for understanding the mechanisms of action of the system under investigation.
5. The *Time Arc Map* is a mixed diagram: an extension of the project schedule (timeline, Gantt chart) with a breakdown structure plan (task tree, activity tree) and conceptual map (relationships between sub-tasks or sub-activities). This knowledge can be useful when designing (drafting) a new solution to optimise the process of implementation; but also, when analysing an implemented solution, such a mixed diagram can be useful as it helps to better understand the logic of the implementation.

4.4.3 CI tools for generic knowledge

1. The *Mind Map* is a hierarchical diagram used to visually organise thoughts or concepts (Buzan & Buzan 1993). It is always suitable for knowledge discovery when it is not yet clear how the terms are linked to one another (relationships).

2. The *Concept Map* is a diagram that visualises concepts and their relationships (Novak 2004; Sowa 1984). It has the advantage of making all elements of a thought comprehensible at a glance. It thus offers the opportunity to make better use of knowledge e.g. through quick reflection.

4.5 Application Examples

The following figures show CI models obtained by applying the basic CI tools to an authentic management case study, the KAPPA case study (Stocker & Tochtermann 2010) which describes the solution to a problem in the field of knowledge management by means of a corporate wiki.

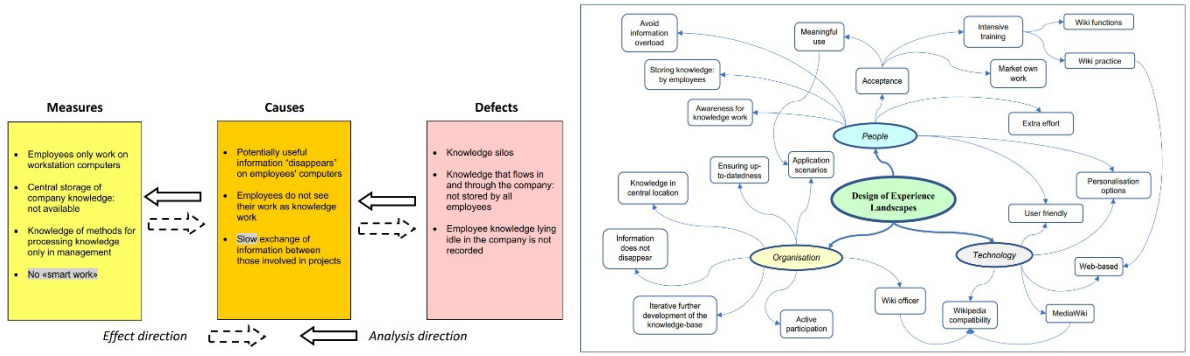


Figure 7: Tool [4.4.1.2 TDA chain], left and tool [4.4.1.3 PTO map], right.

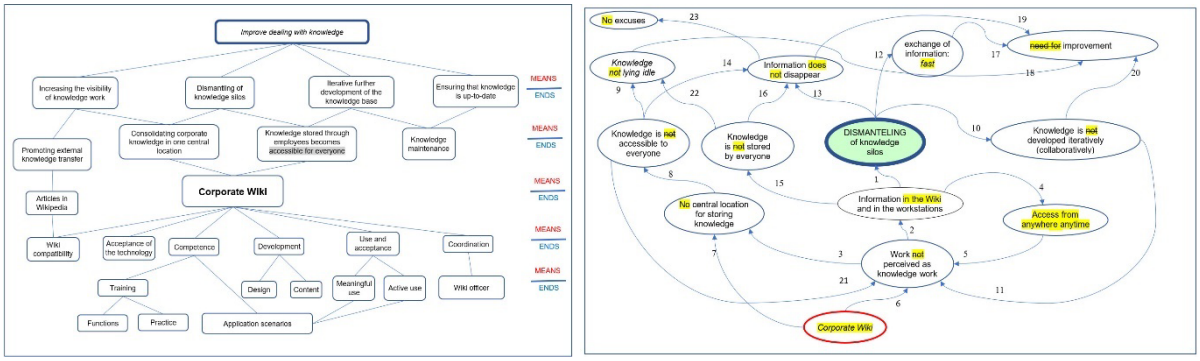


Figure 8: Tool [4.4.2.1 Means-Ends Hierarchy], left and tool [4.4.2.4 Causal Network], right

5. Discussion

Ksenia, a young knowledge manager who was working at a Ukrainian SME located in Chernihiv until February 2022, had to flee to Poland due to Russian war crimes in her city (killing of civilians and bombing of houses and civilian infrastructure). She now lives with other refugees and is looking daily for a new job. In her spare time, although she is not involved in any business project, she has found a way of expanding her repertoire of management experience on the basis of case studies: using the CI method.

On the internet, Ksenia searches for freely accessible collections of knowledge management case studies: best practice or good practice reports. After defining her own criteria for selection, she selects a suitable description, reads it and gets a rough idea of which aspects of the project are most attractive for her. She then selects four tools from the CI toolbox, updates her knowledge by carefully reading the tools' descriptions and for each tool, marks in the case study terms or sections that match the chosen tools.

For each tool, she then checks whether the marked words can be used as parts of its CI model and iteratively builds up the model with content taken from the appropriate text sections. Finally, she carefully examines the created knowledge structures and reflects on the results: what findings do they provide? What information is redundant or missing? What questions are still open? After this, she repeats steps 2 and 3 for each model. As a last step, she then performs a cross-model iteration across the four models to ensure the consistency and complementarity of the four knowledge structures produced in the process of knowledge discovery.

This use case makes clear three aspects which are crucial to successful application of the CI method. *First* of all, collections of case studies need to be easily accessible. For users in a big company, this can be provided by an internal repository of post project reviews (Carrillo 2010) but for a SME, you need the availability of external repositories. *Secondly,* since the 11 tools of the basic toolbox are probably not sufficient to match the type of knowledge hidden in the case study or the criteria of the user, there is a need for a larger toolbox, perhaps even a big repository of tools. *Thirdly,* the reflection phase could also be supported, for instance, by appropriate evaluation tools.

6. Conclusion

The basic idea of the Case Insights method, abbreviated to CI, which has been presented in this paper is to discover knowledge through case studies and to make it usable for problem-solving. Case-based knowledge is contained in authentic case descriptions i.e. “good practice” or even “best practice” cases. Case-based problem-solving uses this knowledge and adapts it to the requirements of a new problem.

Case studies contain a great deal of problem-solving knowledge but only part of that knowledge can be absorbed through simple reading. The rest then remains difficult to access. The Case Insight method makes it possible to discover this hidden treasure by enabling the creation of brain-friendly and holistic knowledge models of case studies.

The successful application of the CI method presented in this paper depends on three conditions: 1) easily available collections of high-quality case studies; 2) a repository of tools which is large enough to cover a big variety of case studies; 3) evaluation methods for supporting a critical examination of the knowledge discovered. These are points on which future research should concentrate.

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Knowledge pills in Education and Training: A Literature Review

Ettore Bolisani[1*], Enrico Scarso[1*], Malgorzata Zieba[2*], Susanne Durst[3], Alexandra Zbuchea[4*], Anna M. Lis[2] and Tomas Cherkos Kassaneh[1 5*]
[1]Department of Management and Engineering - University of Padua, Vicenza, Italy
[2]Faculty of Management and Economics, Gdansk University of Technology, Gdansk, Poland
[3] Department of Business Administration, Tallinn University of Technology, Tallinn, Estonia
[4]Faculty of Management - National University of Political Studies and Public Administration, Bucharest, Romania
[5]Bahir Dar Institute of Technology - Bahir Dar University, Bahir Dar, Ethiopia
[*]International Association for Knowledge Management (IAKM)
ettore.bolisani@unipd.it
mz@zie.pg.gda.pl
enrico.scarso@unipd.it
susanne.durst@taltech.ee
alexandra.zbuchea@facultateademanagement.ro
tomascherkos.kassaneh@studenti.unipd.it
Anna.Lis@zie.pg.gda.pl

Abstract: Object and purpose: Knowledge pills (KPs) are a technique for transferring knowledge through short factual batches of content. In education and vocational training, they can help learners acquire specific pieces of knowledge in a few minutes, through a "microteaching" approach where learners can be involved in active and interactive exercises, quizzes, and games. Thanks to the advancements of multimedia platforms, they can contain a mix of contents, i.e.: lecturer voice, images, videos, or other e-learning applications. This paper explores the state-of-the-art literature on KPs, with a special focus on their actual use as a mechanism to boost effective knowledge transfer and learning processes. The goals are a) to clarify the definition and peculiar characteristics of KPs; b) to classify their main typologies; c) to analyse their implications under a knowledge management perspective, and d) to highlight actual application fields, pros, and possible cons. Methodology: This study is based on a literature review by means of a search in global citation databases and on a snowball effect, with collective participation and sharing among all the authors. The articles found were then selected and carefully analysed. Findings: The advantages of KPs can be related to the division of knowledge into small parts, which also fits today's needs of learners to "study faster" and acquire the specifically required knowledge. In addition, KPs are made of reusable materials and can be more easily updated than traditional supports. Possible limits are that designing a KP can be difficult, and careful consideration of the actual learning process and the mechanism by which a certain type of knowledge is transferred from a "knower" to a "learner" is required. Research limitations: Research is based on a limited literature review. However, this limitation is going to be overcome in future research. Practical implications: Findings provide useful insights not only for academics and researchers but also for teachers and trainers dealing with all types of education.

Keywords: knowledge management, knowledge pills, e-learning, literature review

1. Introduction

Access to knowledge and information is quite easy nowadays, however, this is not enough, because knowledge only becomes powerful through its appropriate application (Durst and Zieba, 2018). At the same time, organizations often face problems related to knowledge, for example, lack of up-to-date knowledge, or knowledge gaps that may hinder their operations (Durst and Zieba, 2020). This brings the need for new solutions that could help organizations in upskilling their employees and updating their knowledge. One such solution is a knowledge pill. Knowledge pills (KPs) are a technique for transferring knowledge through short factual batches of content (Sánchez et al, 2010a). They can help learners acquire specific pieces of knowledge or practical skill in a few minutes, through a "microteaching" approach where they can be involved in active and interactive exercises, quizzes, and games (Cancela et al., 2012). This explains the growing popularity of KPs, especially in areas like vocational training (Gracia-Morán et al., 2013) where people need to learn as fast as possible. Thanks to the advancements of multimedia platforms (Bakala, 2018), KPs can contain a mix of contents, i.e., lecturer voice, images, videos, or other e-learning applications.

This paper explores the state-of-the-art literature on KPs, with a special focus on their actual use as a mechanism to boost effective knowledge transfer and learning processes. More precisely, the goals are a) to clarify the

definition and peculiar characteristics of KPs; b) to classify their main typologies; c) to analyse their implications under a knowledge management perspective; and d) to understand actual application fields, pros, and cons.

The literature analysis was done by means of a free search into the citational database Google Scholar performed individually by each author of the paper during the first months of 2022. A selection of relevant sources was made, and additional material was included by further analysing citations and references in a sort of "snowball" technique. The pertinent articles and books were critically examined to extract and classify the information, presented in this paper in a preliminary and synthetic way.

The paper is organized as follows. In the next section, a mention of the emergence of new active teaching/learning methods and the connection to the knowledge management field is made. Section 3 examines the existing literature on KPs, the current definitions, types, and applications. Also, the connection with the knowledge management field is highlighted. The paper terminates with a conclusion section that summarizes the main findings.

2. Knowledge management processes in active learning and teaching

It is now widely recognized that, in education and vocational training, learning involves many capabilities, requires active participation and contribution by learners, and is also based on the individual and social experience of "what is being learned" (Merriam and Bierema, 2013).

Indeed, the new emerging types of jobs that continuously appear every day, lead to switching the focus on learners from purely passive "receivers" of pieces of knowledge transferred from teachers, to engaged "creators" of their knowledge by means of active learning processes that help them construct and personally assimilate interpretations and applications of knowledge. In addition, very rarely a person owns all the knowledge that is required to face a situation, and collective learning processes are needed, where people work together, share communication languages, and make decisions with others. Finally, learners must be ready to continuously assimilate new updated content and skills, from a lifelong training perspective, to face the challenges of dynamic societal and technological changes.

For specular reasons, the role of the instructor is not that of merely "transferring" the knowledge they possess to learners, but rather to help them process and assimilate knowledge contents, activate autonomous learning processes, and build their own knowledge base for their professional career and life. Active learning/teaching methods, i.e., "any instructional method that engages students in the learning process" so that they "do meaningful learning activities and think about what they are doing" (Prince, 2004), are becoming popular. The literature has already indicated how active teaching and learning can engage both students and learners in new knowledge management processes both at an individual and collective scale (Bolisani, 2019). New forms and methods of teaching become important (Merriam and Bierema, 2013), and technologies and e-learning tools are deemed important to improve this process, by activating new forms of knowledge sharing, construction, and assimilation (Maabreh, 2018). The importance of KPs can be framed in this context.

3. Knowledge pills as an innovative teaching method – literature review

The literature about KPs is still scarce and mainly devoted to the education field. A rapid search for this term on the citational database Scopus carried out on 16th March 2022 yielded less than ten references. On the contrary, this instrument seems to raise more interest among practitioners, as confirmed by the fact that a search on Google carried out on the same day produced more than 10,000 results. In the following sections, some information about definitions, classifications, advantages and problems of KPs applied to organizations are presented.

3.1 Definitions

One can find different definitions of KPs in the literature. For example, Bengochea and Medina (2013) refer to them as "little pieces of didactic material, created with the goal of promoting audio-visual learning, and designed to complement traditional strategies, making comprehension easier for students, either because of its conceptual depth, or its technical complexity" (p. 82). Similarly, Wozniak-Zapor et al. (2020) defined knowledge pills as a way of "transferring knowledge" by means of short but factual batches of material, so that "small fragments of knowledge concerning selected fragments of a wider issue are provided in a condensed form". The 'WeLearning" Team defined a KP as a short, concise piece of content provided to the user quickly and efficiently.

Some other authors (Bakala, 2018) considered KPs as digital instruction materials – short multimedia tips, which are one of the didactic means of innovative and interactive learning process, enhancing modern methods of education, known as smart learning (Ashfaque et al., 2014). The American KM Institute (www.kminstitute.org) used similar terms (knowledge base, or Knowledge Nuggets) to refer to a refined or granular knowledge content on a specific task.

Carrera (2011) considered a KP as a small unit of explicit knowledge in a multimedia format to be used from the "just-in-time" training perspective. Like pills someone takes for the instant relief of some state of illness, KPs enable the user to immediately overcome a situation in which there was a lack of knowledge that needed to be supplied right away (Carrera, 2011). This definition specifically refers to the use of KPs in business, for professional or vocational training. The author affirms that the KP approach allows for efficient education and knowledge sharing in the company, since it uses a set of tools designed to share knowledge and skills easily and effectively among employees. Using KPs in businesses offers several advantages (Mazur et al., 2015; Carrera, 2011):

- It facilitates know-how development
- It transforms each employee into a training agent inside the organization to which she/he belongs.
- It consolidates the existing knowledge in the organization.
- It avoids the permanent repetition of informal training processes.
- It reduces the costs of traditional training.
- It enables the training of employees, customers, and partners.
- It enables training when it is necessary and as many times as it is necessary.
- It enables more involving learning processes than simple reading a text.
- It is particularly effective in environments where there is a rotation of personnel.
- It doesn't require previous knowledge for the learner

3.2 Types and applications

Based on their aim, three main categories of KPs can be singled out (Sánchez et al, 2010b; Carral et al, 2010), as follows.

- *concept learning pills*, pertaining to the knowledge of concepts, classifications, definitions, theories, description of phenomena, etc. For example, they can be used in a course to introduce or summarize some basic conceptual points that are important for the learners to assimilate for further understanding other parts of the course;
- *exercise learning pills*, that can be used to acquire competences or skills that may involve both problem solving and practical activities – of delimited scope – where learners are invited to apply pieces of knowledge acquired elsewhere (or in another part of the course). This can be, for example, the mathematical resolution of an equation, the execution of some manual activity, the solution of a practical problem, etc. They can be provided in a form that includes the presentation (for instance, in a video) of the problem or goal to achieve and, later, a possible solution of the problem. The learner first reflects on the proposed problem, then she/he can learn from the instructor a possible way to deal with or solve it. The pill can end with another version of the problem (for example, an equation with different data) to which learners can try to re-apply the knowledge acquired in the first part to the newly proposed problem.
- *testing knowledge pills*, that can be used to evaluate the level of knowledge of students. These can be proposed as intermediate or final tests in a course. They can be used for learners to self-assess their level of acquired knowledge, or as ways for teachers to assess what (and how) was learnt by students, and can also serve as feedbacks for instructors themselves. KPs can be provided in the form of written or online quizzes (even with animations), and can be followed by explanations of the solution by the instructor. In some cases, students can be allowed to repeat the test pill as many times as they like (so it also serves as a way to consolidate the acquired knowledge). Generally, these tests have a delimited scope so that they can be performed in a short time.

The use of a typology or another can be connected to the aim or expected impact of the educational approach (Franco et al., 2017) and in particular can be aimed:

- to favour *conceptual enrichment*, namely the comprehension and assimilation of specific contents of a subject

- to implement *procedural development*, for instance, to learn the steps to perform a specific action, operation, etc.
- to facilitate *attitudinal changes* and the development of some social or personal skills.

KPs can have different possible formats, and can include audio, video, animations, graphic and multimedia presentations (Carrera, 2011), even combined to one another. The use of an online e-learning platform (or another digital portal) is often recommended. A major advantage of this format is the ability to convey knowledge in a fast and accessible way for almost all devices with just an internet connection.

The most common form is a short video, presented in an attractive form, for example, an instructional presentation showing how to perform various activities within particular jobs. A video format can be effective (Carrera, 2011) because a KP has the purpose to overcome the mere delivery of content (as would be done by a book) and, instead, to simulate an indirect interaction between the instructor and the learner: for example, the learner can see how the instructor performs a specific activity, can hear comments and perceptions directly from the instructor's voice, can contextualise that activity by seeing where the instructor operates, etc.

KPs can find a wide range of applications. For Gracia-Morán et al. (2013), an elective application is vocational training: "Firstly … professionals can only devote a limited amount of time. And secondly, its prior learning can be quite heterogeneous. As a result, units of content should follow the design of knowledge pills, they should remain available 24/7/365 (so they must be online) and, for each unit, precise identification and assessment of prior learning and learning outcomes should be done". The use of KPs, thus, aims to strengthen the professional competence of learners. Once made, KPs can be used many times, only with a slight supplementation or update sometimes. In this case, KPs should be delivered by an online e-learning platform, where they can be easily uploaded and updated.

For some employees, KPs can be a good solution for filling a specific competence gap, while for others, they can help learn by repetition. KPs are also commonly used in personal development for acquiring specific skills for purely private purposes, or for building or strengthening one's position in the labour market (Bakala, 2018), i.e., by improving the personal CV.

A KP can be proposed as a standalone training tool in case of specific purposes, or in combination with other KPs as a series to completely cover a topic, they can also play an introductory role or can consolidate the didactic content presented in traditional or distance classes (Woźniak-Zapór et al., 2020), due to their condensed way of presenting the most important information on a given topic.

3.3 KPs and knowledge management in organizations

KPs can be seen as Web 2.0 tools (specifically video tools) that can be used to enable KM (Mazul et al., 2015). In particular, KPs can support two knowledge processes, that are knowledge identification and knowledge sharing. Therefore, they can be a useful tool for organizations to fill their knowledge gaps or to update their obsolete knowledge. They may also allow better knowledge sharing among employees who need a particular type of knowledge.

The mentioned advantages of KPs (see section 3.1) can also be related to knowledge management processes and activities, for example:

- KPs can facilitate the acquisition or consolidation of professional know-how and can enable the designing of training tailored to the knowledge needs that are specific to a duty. Especially for practical tasks or procedural activities, people often learn and memorize better by seeing than they can do by reading a manual
- They can transform each employee into a training agent inside the organization, because she/he can easily transmit knowledge by creating a KP, for example in a video format showing how a particular activity must be performed
- KPs can consolidate the knowledge already existing in the organization, by creating a sort of organizational memory
- They can avoid the permanent repetition of informal training processes and can reduce the costs of traditional training; training can be performed, even in a self-service mode, whenever it is necessary and as many times as it is needed

- They can easily enable the training not only of internal employees but also customers and partners; they are particularly effective in environments where there is a rotation of personnel.
- No previous knowledge is necessary to be trained through the use of this method because its access is easy and comfortable; the speed of training content creation is also high.

Additional to or outside a formal training system, KPs can support acquiring new skills by effectively organizing knowledge and tasks, and also offering evaluation tools (Arce-Fariña et al., 2013; Ulloa et al., 2011). They are, in themselves, a self-learning tool, nevertheless, they might be incorporated in a learning community of practice, allowing not only knowledge sharing but also the connection to other learning objects integrated into dynamic repositories and e-learning platforms (Álvarez-Bermejo et al., 2017).

KPs are mostly effective for transferring knowledge and building abilities related to simple tasks and topics. However, they can also be useful to understand complex concepts effectively because they can be used to summarize ideas and to provide short tutorials regarding the basics of a complex concept and process (Woźniak-Zapór et al., 2020). Used additionally to classical instruction methods, KPs can increase learners' performance (Vázquez-Rodríguez et al., 2019), in traditional education but also in businesses.

However, the implementation and use of KPs can have some drawbacks and issues. Some studies on the impact of KPs as means to transfer knowledge show that they are evaluated as useful and attractive by students, but they can be less motivating, as well as too slow (Bakala, 2018). Another key problem is that designing and applying KPs are complex processes, which need time and preparation. Ensuring the quality of the products, both considering contents and form, is challenging. Choosing the appropriate ideas, synthesizing complex knowledge contents, adopting the right length and format, and ensuring the communication quality of the product are some of the core issues. Therefore, a significant amount of time is required to collect and select the materials, to record and to edit multimedia content (Mazur et al., 2015). All this can be demanding, especially considering the limited scope of each produced KP. Therefore, creating KPs makes sense if the costs for their production can be spread over a sufficient number of users. This is possible when many individuals need the same piece of knowledge, as in the case of students of a course or members of large organizations who have to study the same topic. The situation changes deeply when smaller companies are involved, or if the needs of students change: in this case, a KP could be of use only for a specific and limited number of users, and for a limited time span.

In terms of pedagogical approach and to ensure an effective knowledge transfer, there are three main dimensions to consider: subject matter content (i.e., focus of the KP, its usefulness and significance), methodology (namely, the proper way to engage students and activate learning), and technology (i.e., choosing and designing the appropriate tool) (Bakala, 2018). The communication format is also critical: KPs should be synthetic, interesting, and dynamic (Woźniak-Zapór et al, 2020).

Learning based on KPs is also an example of collective learning, based on the involvement of many individuals and leading to the accumulation of knowledge through the implementation of specific practices. The sharing and modification of these practices form the basis of learning (Beerepoot, 2008). Collective learning is thus a social process in which knowledge is acquired through interactions with other actors, such as meetings, conversations, etc. (Capello, 1999). Social learning, therefore, goes beyond individual learning and competence acquisition and is based on engaging in collaborative activities (Rozkwitalska and Lis, 2020). Through social learning, participants learn from each other using the demonstration effect. Geographical proximity helps this because the short distance between the actors and the resulting cultural commonality fosters the initiation of interaction and the development of informal relationships (Boschma, 2005). Besides, the shorter the distance between partners, the lower the cost of sharing knowledge and information (Doloreux, 2002).

The above arguments take on a slightly different meaning in the face of the development of technologies which partially remove the physical distance barrier and at the same time contribute to the development of communicative proximity (Lis and Lis, 2021). Communication proximity consists of three other dimensions of proximity: relational proximity, referring to inter-organizational relationships (Eklinder-Frick et al., 2011); virtual (electronic) proximity consisting of indirect distance communication facilitated by digital technologies (Zeller, 2004); and communication proximity, i.e., temporary geographic proximity involving direct face-to-face contact, but for a limited time (Torre, 2008). Thus, in the era of the dynamic development of digital communication technologies, geographical proximity is not indispensable for effective learning based on social processes.

Communication proximity, especially in the virtual dimension, can be treated as an important substitute for geographical proximity, fostering knowledge transfer. For this, KPs can be a particularly appropriate approach.

4. Discussion and conclusion

Nowadays, knowledge, as a fundamental resource of societies, has to be properly delivered or accessed by learners in a fast and convenient way. The consequent shifts in education and training, which can currently be noted, are connected to multimedia. However, though the internet contains millions of didactic materials, selecting those which are really useful can be very difficult and discouraging. To mitigate such problems, the use of KPs might become important. They are purposely designed short multimedia tips, enabling students and company trainees to strengthen their competences. For this reason, as our analysis showed, they have been recently noticed as a promising teaching and training method based on multimedia and e-learning systems. Their use also provides better alignment of educational and training materials, and lead to improved effectiveness of teaching-learning. A significant part of the literature considers KPs in the context of higher education, especially for young and dynamic groups of students, whose main goal is to acquire knowledge as fast as possible, in a standalone modality or as a part of a longer and more complex teaching program. A significant and emerging context is that of vocational training for business purposes and especially in companies for their employees, where the use of KPs tends to be quite specific and activates some special attitudes and processes.

In general, today's learners perceive the internet and interactive tools as common means of information and knowledge development (Crespo and Sánchez-Saus Laserna, 2020), so KPs can meet their favour. As Bakala (2018) showed, most of the surveyed learners consider KPs to be a very good and useful didactic material, and other studies show a willingness to be used, especially by those spending more hours online (Antolin-Lopez and Garcia-de-Frutos, 2015; García-de-Frutos and Antolin-Lopez, 2016). There is an increasing need for easily-found guidelines, which should be logically categorized, short and available, and this explains why there may be a need for increased and better use of KPs in education and training. Indeed, the interest of both the academic and business world in KPs is rising, and they are deemed to be an excellent means of education within blended learning or online learning programs (Bakala, 2018).

The advantages of KPs include the possibility to be used independently from one another or easily connected in a series; their content is easy to remember, and they can easily adapt to the learning level; simpler and faster learning than formal training sessions becomes possible; finally, flexibility in use on various platforms, with various teaching methods, and for different expected outcomes should finally be mentioned (Bakala, 2018; Woźniak-Zapór et al., 2020). Another positive aspect is that when students find it difficult to quickly identify the knowledge they need, KPs can contribute to addressing this difficulty because their content can be easily grasped at a first glance with no waste of time (Barcena and Sanfilippo, 2015).

In contrast, the adoption of KPs implies some potential problems and risks. Not only proper methods and technologies must be adopted to easily define and implement KPs, but also teachers and learners must be aware of how to get the most out of them. A careful selection of content to be provided is necessary, because KPs are, by definition, a fast-learning technique. KPs, if not properly designed, may simply be intended as a presentation of a set of pre-defined knowledge elements that the learners must accept with no critical examination. In other words, a proper methodology has to be used in the design and creation of KPs, to allow the activation of personal learning processes by learners and their increased interest and motivation. Special expertise by teachers and instructors that are willing to use this method must be developed, which can raise the cost of their adoption. The literature also showed that there are different categories or versions of KPs, therefore there is a need for instructors to choose the proper format in accordance with the specific pedagogical needs and, also to the KM processes which the KP is aimed to activate and facilitate. Finally, KPs may require some sort of maintenance for keeping them updated.

This study proposed a summary of the extant literature on KPs, but it does have some limitations. First of all, it is based on the analysis of a subjective selection of scientific and business publications. However, it must be remembered that there is still scarce literature on this topic and not many empirical studies that examine this training method. So, this paper must be intended as a preliminary study on KPs, and more research is required on how this method can be used for effective management of knowledge and learning processes. This also represents a future research agenda.

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Digitization and Business Intelligence at the Heart of a Business Strategy Within African Industries Founds

Jean-Pierre Booto Ekionea
Faculté d'administration, Université de Moncton, New Brunswick, Canada
MIS associate Professor at *Institut supérieur de commerce de Kinshasa (ISC/Kinshasa), D.R. Congo*
jean-pierre.booto.ekionea@umoncton.ca

Abstract: This paper focuses on the possibility of collecting information and with a view to the digitization of business processes with the strategic thought of identifying private investment opportunities in the provinces entities which would allow it: - To better collect information on the collection of resources in order to enable it to replenish its fund and meet management and financing needs in the provinces entities ; - Improve the decision-making process at all organizational levels with the help of digitization. This study is based on the application of the knowledge management organizational capacity maturity model (Booto Ekionea, 2012) in the context of African industries Founds to identify the current state of knowledge management organizational capacities towards an ideal model which facilitates the appropriate recommendations.

Keyword: Digitization, business intelligence, business strategy, knowledge management capabilities.

1. Introduction

The objective of this paper is to propose a plan for the progressive digitization of the management tasks of African Industries Founds (AIF). As a public company, it is called upon to achieve performance according to the mission and objectives assigned to it, namely: to promote industrial development. To intervene in its field, it uses resources from the tax for the promotion of industry (TPI). The lack of technology to support good decision-making at all organizational levels makes it difficult to make good decisions and complicates the work of senior management and other decision-making. This demonstrates the lack of leadership, which should be filled as soon as possible, at the level of information systems management to steer the new orientation of information systems. Added to this list are the technical and management skill limits of the current IT team, which needs to develop technical and managerial capabilities to support the implementation of the digitization of business processes.

The AIF digitization plan is the result of diagnoses established during in-depth investigations by university experts in information systems. The implementation of this plan aims to align the AIF Information System with the standard of Financial Institutions while guaranteeing security, availability, reliability, data integrity, integration of business processes and the differentiation of each actor in the action as well as in making good business decisions. In addition to the introduction and the conclusion, this article discusses the literature review, the organizational context, the challenges of digitization, the challenges of business intelligence, the challenges of knowledge management, the methodology, data collection, results, discussions, strategic reorientation: towards digitization.

2. Literature review

2.1 Digital transformation

Digital transformation is the use of technology to radically improve business performance (Karekla et al, 2021).

Certainly, the digital strategy provides business benefits, such as competitive advantage and high performance, easily accessible through digital technologies while providing unique and integrated business functions in a way that can adapt to changing conditions (Becker and Schmid, 2020). By digital connectivity we refer to the ability of companies to access and use technologies to connect to the internet and share digital information. While by digital penetration, we refer to the share of digital in economic activities, transactions, and policies, through the development of online, interconnected, and automated systems. This makes digital transformation a major issue affecting businesses in sub-Saharan Africa.

2.2 Digitization and business intelligence in the public sector

The development of organizational capabilities specific to information systems is defined around three dimensions: infrastructure of information systems, processes of information systems and skills in information

systems (Abou-Zeid, 2003; Chang & Ahn, 2005). Regarding the typical technological infrastructures of the AIF, such as organizational capabilities of information systems, they can be subdivided into a set of systems that support: 1- customer service; 2- administrative and regulatory processes; 3- decision making and quality improvement. All these categories are, technologically speaking, supported by 1- a good network architecture; 2- physical components (hardware components); 3- data architecture and software connectivity. To these ends, a good technological architecture should (Gargeya & Sorrel, 2005, p.58): 1- be ubiquitous, reliable, scalable, manageable and secure; 2- be able to support the transmission of data in the form of document, channel and multimedia, including applications such as teleconferencing; 3- use industry standard protocols and topologies, 4- be able to support various network infrastructure requirements associated with customer services, training and administration; 5- be less expensive both for implementation and operationalization. Because information technologies can improve the speed of integration and application of knowledge by automatically codifying organizational routines. Moreover, in terms of physical and logical security (Gargeya & Sorrel, 2005, p.58), a good technological architecture for the management of data, information and knowledge should: 1- use optical fibers in the cabling and install all electronic equipment in secure premises; the use of other means of protection, such as firewalls, would also be desirable; 2- use servers for authentication, security services, remote access, e-mail management (e-mail Gateway). Because certain safety rules must be respected (Gargeya & Sorrel, 2005, p.59): 1- administrative procedures; 2- physical security; 3- security configuration management; 4- technical security services; 5- technical security mechanisms; 6- electronic signature, etc.

3. Business Intelligence

Business intelligence (BI) is a process that consists of exploiting the internal and external data of companies to strengthen their capacities and help them improve in making good decisions (Veilleux, 2020). This in the same vein that Loshin (2012, p.10) argues that the concepts of business intelligence and analytics include tools and technologies that support a set of user communities in an organization, to the continued collection and organization of multiple sources of data to support decision-making at the operational, tactical, and strategic levels, with the goal of improving organizational performance. Gudfinnsson (2019). He adds that decision-makers who use information extensively with the help of information technology make decisions faster compared to decision-makers who use less information or even less information technology (Gudfinnsson, 2019). However, making decisions quickly is particularly known to increase organizational efficiency (Davenport, 2010).

3.1 The business intelligence and digital transformation relationship

The digital transformation enabled by BI solutions presents a huge opportunity to drive the growth and profitability of organizations. Moreover, when digital infrastructure and business strategy are merged, this ability for rapid scalability becomes a dynamic ability of the business to adapt to the dynamic requirement of the digital market (Bharadwaj et al., 2013; Turnali, 2017). Hence, the digital business strategy to be opted for will require understanding how to develop organizational capacities to better exploit the huge amounts of heterogeneous data, information and knowledge continuously generated (Bharadwaj et al., 2013).

3.2 Challenges of digitization

First, we would like to recall that digital transformation is a phenomenon that is implemented by a digital strategy that helps organizations govern the transformations from traditional strategies to digital strategy that result from the integration of digital technologies, as well as than in their exploitation after processing (Matt et al., 2015). Second, this transformation which is done through digital technologies makes it possible to improve the performance or the scope of organizations and allows them to remain competitive in the business ecosystem overwhelmed by digital technologies (Karekla et al, 2021; Verhoef et al., 2021; Venkatraman, 2017). However, research has shown that the technology itself is only part of the complex puzzle that must be solved and aligned with the organization's strategic goals for organizations to remain competitive and successful in a digital world (Matt et al., 2015; Vial, 2019; Venkatraman, 2017).

3.3 Business intelligence challenges

It should be added, however, that ensuring the sustainability of quality data is a major challenge for business intelligence systems (Gudfinnsson, 2019), since making decisions based on good data and precise and reliable is recognized as particularly important for companies (Guarda et al, 2018). Hence, the importance of successfully implementing this BI system, which will support the AIF's information systems, in the collection, storage, processing and dissemination of huge amounts of data/Information increasing exponentially. At the strategic level, support the continued development of new business and decision-making support strategies. Without

forgetting that knowledge management must be effective within the organization to clearly distinguish and choose what is useful and which will produce relevant data for decision-making, to achieve the strategic objectives of the organization. and those of the IT implemented.

3.4 Knowledge Management Challenges

Today's business ecosystem is particularly characterized by unpredictable and unprecedented changes, which means that contemporary companies must constantly seek innovation and knowledge management, as these are considered a vital factor for successful growth. Businesses and an efficient way to survive in the particularly complex and unpredictable ecosystem (Škudienė et al., 2021). Moreover, the ability of organizations to improve their performance increasingly depends on their ability to acquire and develop knowledge. Therefore, knowledge is considered the most important asset than other types of inputs or resources (Booto Ekionea and Fillion, 2021). Very often, knowledge management is essential for organizations to generate values from intellectual capital in the form of knowledge (Hassan et al., 2021).

3.5 Organizational context

The provincial entities encounter, among other major problems: - The inconsistency between the data entered in the provinces and those recorded and processed at the level of the General Directorate in Kinshasa; - The lack of equipment and access of provincial officials to software to produce the situations within their jurisdiction and verify the work done at the local level; - The difficulty of exhaustively associating the productions carried out by their respective entities to assess their performance; - The lack of training for leaders, managers and professionals on the management tools of their entities or the lack of follow-up for agents trained several years ago; - The obsolescence of the work tool and the unavailability of the computer network.

3.6 Vision and strategic axes of the AIF digitization and business intelligence plan

The achievement of organizational objectives implies: - A clear strategic choice on the part of the AIF; - The alignment of technologies and tools to be acquired with the strategic choice of the AIF; - Developing and strengthening organizational capacities to support strategic alignment; - Finally, the strengthening and development of business intelligence at all levels by implementing technologies and tools essential to decision-making. The strategic choice of a company develops according to whether the company opts for any strategic profile and the literature (Miles and Snow, 1978) in information systems proposes three types of business strategy scenarios: defenders, analyzers and/or prospectors. For the AIF, improving the quality of departmental services involves, among other things, providing them with tools that contribute to strengthening collaboration between departments, with customers and with partners. The AIF is an analyzer, that it is both a defender because it must develop robust infrastructures and prospectors because it must continue to seek new business opportunities with new promoters from of various sectors of national industrial activity.

3.7 Simplification of procedures thanks to e-government and strengthening of interdepartmental collaboration

The benefits of this project are numerous: - Make the forms made available more visible; - Clearly inform on the procedure required for each credit application as well as the necessary documents relating thereto; - Accelerate the processing of credit applications; - Allow partners and companies to formulate their requests outside the opening hours of the administration, and even remotely; - Digitization of documents; - To address the strategic objectives by improving the performance of each department; - Ensure the performance of the hardware infrastructure, the application system and ensure the performance of IS processes through the use of information and communication technologies; - Have integrated IS that ensures availability, accessibility and a standardized quality of service for strategic management by dashboard in order to move from one-off statistical monitoring to generalized monitoring of all the activities of the business departments and AIF support; - Guarantee the security of the hardware, application and data infrastructure of the AIF. Figure 1 below presents the vision and strategic axes of the target IS of the AIF. With this overall objective, four specific objectives are associated with it: - To bring back servicing and pre- servicing investments with structuring and propagating effects on the agro-industrial; - Financing the investment objectives of the private sector by favoring the approach of value chains; - Fund applied research projects likely to have an impact on local industry; - Modernize the governance of the AIF and comply with international standards. In this vision, the DSI is one of the actors in the process of modernizing the governance of the AIF and the information system is the support in the governance of the AIF.



Figure 1: Vision, strategic axes of the target IS of the AIF

Its particular specific objective is to "Improve the information and communication system of the company to guarantee: - Business intelligence and instantaneous decision-making; - The circulation and security of information; - Reinforcement of the organizational system of the AIF. The digitization plan of the AIF constitutes a compass in the implementation of the strategic objectives of the information system contributing to the materialization of the overall and specific objectives of the Establishment. Thus, four main activities should be carried out over the next five years, namely: - The effective implementation of business intelligence and instant decision-making; - The fluidification of the flow of information horizontally and vertically; - Securing the information system and the communication of the Company; - Strengthening of the organization system of the AIF; - Capacity building of AIF staff. These three areas are divided into 3 categories: 1 - Support for businesses: - Strengthen inter-departmental collaboration; - Facilitate interactions with partners (Client, partners, etc.); - Streamline the application landscape; 2 - Technical support: - Improve service to users; - Strengthen the security of information systems; - Continuous improvement of performance; 3 – Infrastructures: - Optimize the infrastructure; - Facilitate the use of tools.

4. Methodology

This model being an idealistic model, the definition of a target for the new information system will follow. The development of a multi-year action plan - or resource mobilization strategy - then guarantees the means for the implementation, monitoring and updating of the digitization and business intelligence plan. Approach by processes and the digitization plan and business intelligence: what links? The process approach makes it possible to specify the roles and responsibilities of each, to identify areas of overlap in terms of tasks, to make information circuits more fluid. The map of actors, as data collection techniques, to identify the stakeholders in the digitization plan and business intelligence. As well as the questionnaire for general management, directors, and professionals for AIF. There were also individual interviews which were necessary to deepen and understand certain subjects. The focus groups were also necessary to converge and validate the expectations at the level of each business line and at the level of general management. The organizational capability maturity model

questionnaire in information systems and knowledge management (Booto Ekionea, 2012) was administered across the organization.

4.1 Role of actors and organization

Role of the actors: - The information systems steering committee: defines the general policy of the digitization and business intelligence plan and appears as guarantor of the IS and controls the costs; - The group of users: has experience in the field, expresses the needs and the constraints to which they are subject and makes it possible to verify the realism of the proposals formulated; - The project group: brings together information systems professionals (computer specialists) specializing in the implementation of the digitization plan who propose solutions and work in close collaboration with other departments of the organization. They can be helped by external reinforcements.

Organization: Conducting a digitization plan project requires working structures: - Information systems management committee; - User group; - Project group. Standard scenarios: Thus, we can have several types of scenarios in a process of the digitization plan: - Trend scenario: proposes the reinforcement of the existing means to achieve the objectives; is part of the continuity of the organization's IS; - Innovative scenario: it relies on technological innovations and proposes a redefinition of the IS; - Compromise scenario: proposes an intermediate solution between the two trend scenarios – innovative. Action plans: Make it possible to specify the methods for implementing developments; are in principle limited to the first three years; provide for the studies and works to be undertaken. Monitoring procedures: Consist of using the values provided by various indicators and keeping an up-to-date directory of applications, projects, studies and reconciling observed activity with forecasts specific to the chosen scenario. Checkpoints make it possible to verify that all actions have been carried out.

4.2 Data collection and results

This study aims to better understand the process of developing organizational capabilities specific to organizational information systems in the context of a public finance company, in this case the AIF, to assess its impact on organizational performance. This process is part of the learning school (Cyert & March, 1963; Nelson & Winter, 1982; Burgelman, 1988; Cohen & Levinthal, 1990) which promotes a process of organizational learning and accumulation knowledge that can be spread over time and in several levels of maturity. Thus, using the maturity model of organizational capabilities specific to knowledge management (CSKM) which presents five levels of maturity (Booto Ekionea, 2012), this study presents a diagnosis of the digitization and intelligence of as shown in Figure 2. Thus, using a questionnaire of the maturity model of organizational capacities specific to knowledge management (CSKMMM), the results of this study present a summary diagnosis of organizational capacities specific to knowledge management. The maturity model recommends five levels of maturity and is based on two hypotheses inspired by Venkatraman (1994): 1- the lower the level of maturity of the organizational capacities specific to the knowledge management of an organization, the more the expected benefits are low, while 2- the higher the level of maturity of the organizational capacities specific to the knowledge management of an organization, the higher the expected benefits. The levels of maturity of the organizational capacities of the information systems of an organization are divided into two main categories: 1- levels of evolution (level 1: localized operation, and level 2: internal integration); 2- levels of revolution (level 3: reengineering, level 4: network redesign, and level 5: redefining the business mission). Thus, to better understand each level of the CSKMMM, we will use the three main dimensions as presented in the previous section. Also, to better understand each level of maturity of the CSKMMM, Table 1 describes the characteristics of each level of maturity of the organizational capacities of the information systems. The questions asked were inspired by the definition of the CSKM concept as developed by (Abou-zeid, 2003; Chang & Anh, 2005). The scale of five sub-questions to each of the 9 questions (characteristics) was inspired by the five levels of maturity that an organization can achieve (see also Annex 3 where the AIF questionnaire is contained). The following took part: 1- AIF general management staff at the decision-making level; 2- decision-makers and managers at the intermediate level; 3- the professionals of each department at the operational level. Table 1 presents the profile of the respondents to the questionnaire.

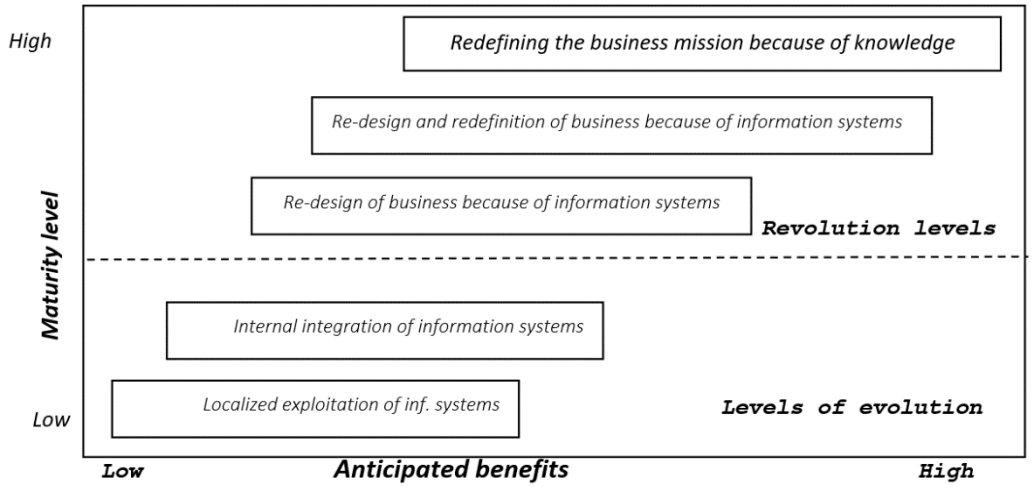


Figure 2: Maturity levels of inf. System within organizations (adapted from Venkatraman, 1994)

5. Discussions and strategic reorientation: towards digitization

The strategic orientations of the future information system come from the diagnosis of the MMCOSI. These orientations will relate to the infrastructures, processes, or applications (software) and human skills to be highlighted to implement and use information technologies.

Table 1: Profile of survey respondents for the AIF case study

No	Function/position	Direction
1	Decision Maker/ Professional	Executive management (DG)
2	Decision Maker/ Professional	Financial Department (DFI)
3	Decision Maker/ Professional	Information Systems Department (DSI)
4	Decision Maker/ Professional	Human Resources Department (HRD)
5	Decision Maker/ Professional	Provincial Coordination Directorate (DCP)
6	Decision Maker/ Professional	Legal Department (DJR)
7	Decision Maker/ Professional	Supervisory Department (DSU)
8	Decision Maker/ Professional	Directorate of Heritage and Logistics (DPL)
9	Decision Maker/ Professional	Department of Studies (DET)
10	Decision Maker/ Professional	Audit Department (managerial rank)
11	Decision Maker/ Professional	Tax Mobilization Directorate (DMT)
12	Decision Maker/ Professional	Projects Department (DPR)
13	Decision Maker/ Professional	Portfolio Management Department (DGP)

P.S.: Pseudonyms are assigned to respondents to maintain their anonymity.

5.1 The capacities of the information systems infrastructures

The capacities of the infrastructures of the information systems relate to the technological infrastructures, the specific structures of the information systems and the capacities of use of the information systems. In fact, for an organization to claim to develop organizational capacities specific to the management of information systems infrastructures, it must present the following characteristics: (1) at the technical level, exploitation of information technologies (IT) dedicated to the management of information and knowledge specific to the operations of the AIF, operation of the IT infrastructure and systems for managing information and knowledge of the operations of the AIF, customers and business partners, the emergence of IT as an asset to support the information and knowledge management of AIF's operations and AIF's business vision; (2) in terms of organizational structures, the existence of specific and effective structures or positions for information and knowledge management. Table 2 presents the characteristics of each CSKMMM maturity level.

Table 2: Characteristics of each CSKMMM maturity level

Maturity level	Characteristics
1	♦ → IT infrastructure: 1- at the technical level: localized and limited exploitation of IT (Venkatraman, 1994); IT does not emerge as an asset to support business, misunderstanding between IT and business (Luftman et al., 2004); 2- in terms of structural infrastructures: absence or non-functioning of IT-specific structures. ♦ → Data processes: 1- at the level of data generation processes: localized exploitation (Venkatraman, 1994); 2- Data manipulation: initial process, unpredictable and weakly controlled (Dekleva and Drehmer, 2001), initial process: ad hoc and chaotic organizational capacity expressed and implemented in processes that are not defined (St-Amant and Renard, 2004); 3- data application process: no formal process, reaction on a case-by-case basis (Luftman et al., 2004); ♦ → KM people: 1- capacities to facilitate continuous data management process: people apply their knowledge locally (Peppart and Ward, 2004); 2- abilities to develop the human infrastructure: little motivation or reward (Luftman et al., 2004); 3- ability to use available technologies: success depends on the efforts and skills of individuals (St-Amant and Renard, 2004); 4- knowledge management culture: absence of an organizational culture and vision aimed at encouraging the capture, conservation and sharing of data, information and knowledge (Armbrecht et al., 2001).
2	♦ → IT infrastructure: 1- at the technical level: internal integration of IT (Venkatraman, 1994), data management emerges as an asset to support business MAIF misunderstanding between the DSI and the business (Luftman et al., 2004); 2- in terms of structural infrastructures: specific IT structures but isolated and not integrated. ♦ → Data management process: 1- at the level of knowledge generation processes: internal integration of KM processes (Venkatraman, 1994); 2- manipulation of knowledge: structured and reproducible process (Dekleva and Drehmer, 2001); 3- knowledge application process: organizational capacity expressed and implemented in defined and documented processes (St-Amant and Renard, 2004; Harigopal and Satyadas, 2001; Kaner and Kani, 2004; Siemens, 2001; Klimko, 2001). ♦ → IT management people: 1- ability to facilitate continuous IT process: people integrate their knowledge (Peppart and Ward, 2004); 2- skills to develop the human infrastructure: improvement of efforts, skills and knowledge of individuals and the organization (St-Amant and Renard, 2004); 3- ability to use available technologies: success depends on efforts and organizational skills; 4- IT and knowledge management culture: data is perceived as a support for transactions and the various business functions for good decision-making (Luftman et al., 2004).
3	♦ → IT infrastructure: 1- at the technical level: internal integration of IT across the organization, IT supports businesses, understanding between IT and business (Luftman et al., 2004); 2- in terms of structural infrastructures: creation of IT-specific structures throughout the organization. ♦ → Data management process: 1- at the level of data generation processes reengineering of business processes because of IT (Venkatraman, 1994); 2- data manipulation: relevant and integrated IT processes across the organization (Luftman et al., 2004), standard, consistent, defined and well understood processes (Dekleva and Drehmer, 2001); 3- knowledge application process: definition and repetition of processes to improve the organization's capacities (St-Amant and Renard, 2004). ♦ → People in IT management: 1- capacities to facilitate continuous data management process: people interact with others (Peppart and Ward, 2004); 2- skills to develop the human infrastructure: definition of an organizational policy for rewarding and motivating employees; 3- skills to use available IT: development of technical skills specific to IT supporting business; 4- Knowledge management culture: IT strategies are aligned with business strategies (Abou-Zeid, 2002).
4	♦ → IT infrastructure: 1- at the technical level: the IT vision and architecture are integrated with the partners (Luftman et al., 2004); 2- in terms of structural infrastructure: creation of a department and a position of IT vice-president within the management committee. ♦ → KM processes: 1- at the level of knowledge generation processes: re-design of KM networks (Venkatraman, 1994); 2- knowledge manipulation: mastered, measured and controlled process (Dekleva and Drehmer, 2001), 3- knowledge application process: the practices are documented and their results are quantitatively controllable and measurable (St-Amant and Renard, 2004). ♦ → IT management people: 1- abilities to facilitate continuous IT management process: people coordinate their activities (Peppart and Ward, 2004); 2- skills to develop the human infrastructure: risks and rewards are shared (Luftman et al., 2004); 3- skills to use available KM technologies: the organization identifies skills, knowledge and best practices and integrates them into its action processes (St-Amant and Renard, 2004); knowledge management culture: knowledge management systems (KMS) facilitate and drive business strategies.
5	♦ → KM infrastructure: 1- at the technical level: IT infrastructure and CMS are extended to external partners; 2- in terms of structural infrastructures, creation of a specific structure within the organization to manage the integration of IT and CMS between the organization and its external partners. ♦ → KM processes: 1- at the level of knowledge generation processes: re-design of KM networks (Venkatraman, 1994); 2- knowledge manipulation: mastered, measured and controlled process (Dekleva and Drehmer, 2001), 3- knowledge application process: the practices are documented and their results are quantitatively controllable and measurable (St-Amant and Renard, 2004). ♦ → IT management people: 1- ability to facilitate continuous IT process: redefining the business mission because of IT (Venkatraman, 1994), process in continuous improvement (Dekleva and Drehmer, 2001); 2- skills to develop the human infrastructure: the business vision and the IT processes are developed with the partners (Luftman et al., 2004); 3- skills to use available IT: optimization and continuous improvement (St-Amant and Renard, 2004); knowledge management culture: the business vision and the IT infrastructure are adapted between the organization and its partners (Luftman et al., 2004).

The answers to the questionnaire provided the mapping of what are the organizational capacities in information systems (OCIS) within the AIF by highlighting the different levels of maturity reached by the AIF for each dimension and characteristic of the OCIS. At the end of the survey, and according to the format of the questionnaire submitted to the AIF (see Tables 3), the following results were observed. ***Information systems***

5.2 Process capabilities

The capabilities of information and knowledge generation processes concern the processes of handling information and knowledge, the processes of applying information and knowledge. Indeed, for the AIF to claim to develop organizational capacities specific to the management of information and knowledge in the process of information systems, it should meet the following characteristics: (1) at the level of knowledge generation processes, there is re-engineering of business processes because of information and knowledge management with re-design of information systems networks (Venkatraman, 1994) with its partners; (2) at the level of knowledge manipulation, there is the existence of relevant, integrated, mastered, measured and controlled processes of knowledge management across the organization (Luftman et al., 2004), management systems processes information standards, consistent, defined and fairly well understood (Dekleva and Drehmer, 2001), (3) knowledge translation processes: definition and repetition of processes for the improvement of

organizational capacities, practices are documented and their results are quantitatively controllable and measurable (St-Amant and Renard, 2006).

Table 3: Application of OCISMM within the AIF

Dimensions studied	Characteristics	Maturity level in OCIS reached by the AIF
Knowledge management infrastructure	Technological infrastructure	The AIF is at the 1st level of maturity of the OCISMM: the exploitation of technological infrastructures is absent or limited and localized. (Luftman et al., 2004).
	Specific structures	The AIF is at the 2nd level of maturity of the OCISMM: there is emergence of structures specific to information systems but isolated and not integrated into all the operations of the AIF.
Knowledge management process	Knowledge generation process	The AIF is at the 2nd level of maturity of the OCISMM: there is emergence of processes for generating new technologies and knowledge at the level of internal entities with the exchange of data and information.
	Knowledge manipulation process	The AIF is at the 1st maturity level of the OCISMM: the process of handling information and knowledge is unpredictable and weakly controlled and is initial: ad hoc and chaotic organizational capacity expressed and implemented in processes that are not defined.
	Knowledge translation process	The AIF is at the 1st level of maturity of the OCISMM: there is no formal process for applying new technologies and knowledge: ad hoc reaction.
Knowledge management skills	Knowledge management culture	The AIF is at the 1st level of maturity of the OCISMM: there is an absence of an organizational culture favoring the sharing of knowledge and there is an absence of an organizational vision aimed at encouraging the capture, conservation and sharing of information and knowledge.
	Information and Knowledge Facilitation Skills	The AIF is at the 2nd maturity level of the OCISMM: people integrate their data, information and knowledge but are not sufficiently motivated by management.
	Skills to develop human resources in information and knowledge management	The AIF is at the 1st maturity level of the OCISMM: there is very little motivation or reward for those who share their data, information, and knowledge.
	Skills to use information and knowledge management technologies	The AIF is at the 2nd maturity level of the OCISMM: the success of processes, operations and organization depends on the efforts and skills of individuals because people and entities are not encouraged to systematically share their data, information and knowledge with others.

5.3 The capabilities of information and knowledge management skills

Capacities on the culture of information systems and knowledge management concern the facilitation of information and knowledge management through motivation, the development of human resources for information and knowledge management and the skills to use information and knowledge management technologies. Indeed, for an organization to claim to develop organizational capacities specific to the management of information and knowledge in information systems skills, it must meet the following requirements: 1- on the cultural level, it makes sure to an organizational culture and vision aimed at encouraging the capture, retention and sharing of knowledge (Armbrecht et al., 2001); 2- it has the ability to facilitate continuous processes of information systems: people apply, integrate their knowledge and interact with others (Peppart and Ward, 2004) (redefinition of the business mission by the management of information and knowledge, Venkatraman, 1994); 3- it has the skills to develop the human aspects: motivation and reward of employees, definition of an organizational policy of reward and motivation of employees, sharing of risks and rewards, development with partners of the business vision and information system processes (Luftman et al., 2004); 4- it has the skills to use the technologies of the information systems available and to acquire: improvement of the efforts, skills and knowledge of individuals and the organization, identification of skills, knowledge and best practices, integration from these to its action processes, optimization and continuous improvement (St-Amant and Renard, 2006), development of technical skills specific to technologies supporting knowledge management.

6. Conclusion

The main contribution of this paper is the application of the KMMM in the context of AIF. That application shows the AIF maturity level in Table3. So the contribution of this paper is to show the current maturity level of the organization and, to predict where Organization could go if she needs to improve her capabilities in the terms of three dimensions: infrastructures of information systems, processes of information systems and skills in information systems. Indeed, its operation, the AIF has 22 representative offices across the country. Data is the raw material available to the AIF for its business strategy and it must be processed in real time to produce information and knowledge that can contribute to decision-making. Indeed, information systems transform business through their ability to support the daily conduct of business by integrating into the practices and organizational activities of companies as well as business strategies in order to: - Acquire a sustained competitive advantage; - Support for new business models; - The opening of new markets; - Increasing the performance of organizations; - Overhaul and improvement of business processes; - Increasing efficiency and effectiveness in business processes; - The information system of the AIF must first be the product of strategic thinking; - From this strategic reflection, it is necessary to highlight the choice of technology (software, database, network, etc.); - Decision makers will focus on sustainable technology that takes into account environmental realities while

developing a risk management system in all AIF business processes; - The AIF will be obliged to seek information on the technology used by its competitors, and whether it is efficient or not in order to adopt it (business intelligence); - Acquire sustainable IT infrastructure, while selecting pilot users; - Define the process to be followed by all. This study had the merit of understanding the phenomenon of digitization and business intelligence. Other studies could focus on the implementation of an instrument for measuring organizational capacities for knowledge management and business intelligence.

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Knowledge Dynamics and *Phronesis* in Performing Family Business

Constantin Bratianu and Adrian Motoc
Faculty of Management, National University of Political Studies and Public Administration, Bucharest, Romania
constantin.bratianu@gmail.com
adrian.motoc.fb@gmail.com

Abstract: The purpose of this paper is to analyze the role of *knowledge dynamics* and *phronesis* in performing family business and show that both constructs constitute core competencies for these specific organizations within the Romanian economic environment. Knowledge dynamics have different interpretations depending on the metaphorical thinking used in conceptualizing knowledge. We based our research on the energy metaphor and the theory of knowledge fields, adopting a thermodynamics perspective. Rational, emotional, and spiritual knowledge interact continuously, and each form of knowledge can be transformed into another form, like in thermodynamics. Aristotle introduced Phronesis when he explained that knowledge manifests in one of the following fundamental forms: *episteme*, *techne*, and *phronesis*. *Phronesis* represents prudence or practical wisdom in making decisions. Aristotle remarks that *phronesis* is concerned with action about good or bad things for the human being, underlying the spiritual characteristic of this form of knowledge. Today, there is a significant trend in the knowledge management research reflecting the need to better understand the role of knowledge dynamics and *phronesis* in developing wise organizations (see for instance, the recent book published by Ikujiro Nonaka and Hirotaka Takeuchi, and the works published by Raysa Rocha and Paulo Pinheiro). The present research focuses on the role of knowledge dynamics and *phronesis* in the family business, considering that relations between the family members differ from employees' relations in a company, from emotional and spiritual points of view. We performed qualitative research based on a series of interviews with members of such a family business. We processed the qualitative data based on the grounded theory. Findings demonstrate that knowledge dynamics and *phronesis* play a significant role in the process of decision making and achieving a competitive advantage in the business environment.

Keywords: knowledge dynamics, phronesis, grounded theory, family business

1. Introduction

The family business represents a significant component of the emerging economies and constitutes a very specific domain of research from a managerial point of view. The main differences between the generic business and family business come from the ownership structure and the manifestation of human relationships (Anderson et al., 2003; Fletcher et al., 2012; Lee & Marshall, 2013). The family business is owned by the family members, who also perform the managerial tasks in most of cases. Human relationships represent a blending system between family structure and the managerial hierarchy (Arrondo-Garcia et al., 2016; Gomez-Mejia et al., 2011). Therefore, their content and intensity have different knowledge dynamics than the manager-employees relations in a company where the focus is on rationality and economic performance (Daft, 2005; Robbins & DeCenzo, 2005).

Knowledge dynamics (Bratianu & Bejinaru, 2020; Nonaka & Takeuchi, 1995) is powered by emotional and spiritual knowledge in the family business, while rational knowledge remains the economic measure of all managerial decisions. Rational knowledge is the dominant force in command and control management, and the decisional framework is based exclusively on economic metrics. In the family business, emotional and spiritual knowledge create a new decisional framework (Bratianu et al., 2021; Motoc, 2020). The concept of *phronesis* was introduced by Aristole (1999) to connote prudence or practical wisdom in making decisions in a concrete social context. “Prudence is a state of grasping the truth, involving reason, concerned with action about things that are good or bad for a human being” (Aristotle, 1999, p. 89). In the family business, *phronesis* becomes a driving force in promoting the family interests and support for sustainable development (Fletcher, Melin, & Gimeno, 2012). Performing an extensive literature review in Web of Science, Scopus, Google Scholar and Research Gate, we found very few papers to address the role of knowledge dynamics and *phronesis* in decision-making in the family business, although the process is significantly different than decision-making in companies where the profit maximization represents the basic principle. In the family business the psychological climate is different and in the decision-making process dominant are emotional knowledge and spiritual knowledge. Thus, we found a knowledge gap between the literature dedicated to family business and the real life based on a powerful knowledge dynamics. Due to the scarcity of papers dealing with the importance of knowledge dynamics and *phronesis* in performing family business, our research question is the following:

RQ: What is the role of knowledge dynamics and phronesis in performing family business in the Romanian economy?

The structure of the paper is as follows. After this short introductory part, there is a literature review aiming at understanding the role played by knowledge dynamics and *phronesis* in the family business. Next, we present the methodology used in this research, followed by discussions. In the last section, we present some synthetic conclusions, limitations, and further possible directions for research.

2. Literature review

Family firms are usually characterized by high family involvement in ownership, management, and governance (De Massis et al., 2016), giving the family owners the authority and mechanisms to determine their goals and strategies (Chrisman et al., 2016; Lambrechts et al., 2017; Nordqvist et al., 2014). Based on the degree of family engagement in management, the authors suggest three family business configurations: 1) Operator Firms (OFs), 2) Supervisor Firms (SFs), and 3) Investor Firms (IFs). In addition to going beyond the pure dichotomy of whether non-family members are present in management, these configurations take into account the positions held by family members (rather than just the ratio of family members), better reflecting the complexity of the family engagement and the knowledge entropy of the firm (Bratianu, 2019). Depending on the company's generational stage, management may be concentrated by the founder, siblings, or a few influential family members. If the founder controls the business, it is likely to be dominated by the views of that owning manager, and a formal management body may be unnecessary. However, the business can be successful in this context if the founder has the necessary managerial competencies.

Operator companies controlled by siblings will require some type of management structure, such as top management, to deal with conflicting goals among family members. Nonetheless, informality will be preferred, and family members are anticipated to occupy significant managerial roles in top management. Family members are the best nonlinear integrators of the organizational capital (Bratianu, 2013), because the emotional knowledge is the glue for such a context.

In the case of supervisory firms, the top management will be made up of a mix of family and non-family individuals. Because non-family members participate more in top management and occupy certain significant responsibilities in top management, including the CEO, the degree of family engagement is likely to be lower than in operator businesses. Aside from enhanced diversity, top management composition will represent a higher level of formality and professionalization to suit the needs of both family and non-family top management members. In the case of the investment business, family members often have little or no involvement in top management, while critical roles like as CEO are held by non-family managers (Nordqvist et al., 2014). As a result, the management style of an investment firm will be quite similar to that of a non-family organization. In that sense, formality and professional management style are the norm, and control within senior management is disproportionately skewed toward non-family members. The decision-making process is dominated by the rational knowledge because the managers use the economic metrics. *Phronesis* is almost non-significant because the organizational culture is set up on economic values and mostly on short-term time horizon.

In the family business controlled dominantly by the family members, the tendency is to focus more on wellbeing than on economic goals (Berrone et al., 2012; Chrisman et al., 2015). That is possible by managing knowledge dynamics and creating a specific Ba and knowledge spiral (Nonaka & Takeuchi, 1995). Going beyond the SECI – Socialization, Externalization, Combination, and Internalization – cycle, knowledge dynamics based on the theory of knowledge fields (Bratianu & Bejinaru, 2020) can explain this tendency much better toward wellbeing (Chirico & Salvato, 2008; Motoc, 2020). A significant role is played by inter-generational learning, knowledge transformation from the emotional field into the rational field, and trust (Bratianu et al., 2011; Fletcher et al., 2012; Lee & Marshall, 2013; Motoc, 2022). Emotional knowledge is associated with the degree of family relations, while rational knowledge is associated with economic rationality and performance metrics. Also, the family business develops a powerful spirituality that influences decision-making and knowledge management (Rocha & Pinheiro, 2021) in concordance with the founders' value system and the behavior of wise teams and firms (Bratianu & Vasilache, 2009; Katzenbach & Smith, 2003; Nonaka & Takeuchi, 2019). As remarked by Nonaka and Takeuchi (2019), members of such a wise firm “should share feelings, emotions, and perspectives with each other, intuitively understand the contexts facing them, and take appropriate actions” (p. 5).

Wise companies cultivate *phronesis* and strategic thinking. Nonaka & Takeuchi (2019) emphasize that "*Phronesis* is experiential knowledge that allows people to make prudent judgments in a timely fashion, and to take actions guided by values, principles, and morals" (p. 25). Aristotle (1999) defines the knowledge framework in terms of *episteme*, *techne*, and *phronesis*. *Episteme* represents scientific or rational knowledge. *Techne* refers to the craft knowledge or the knowledge needed for production. *Phronesis* represents prudence or practical wisdom in making decisions. This framework is congruent with the theory of knowledge fields because *episteme* reflects rational knowledge, *techne* reflects emotional knowledge, and *phronesis* reflects spiritual knowledge. However, *phronesis* includes also spiritual intelligence being close to the construct of practical wisdom, which is wisdom applied in a concrete context. Pinheiro and Rocha (2020) underline that the integration of individual wisdom into organizational wisdom depends on the knowledge sharing and leadership competencies of decision-makers. The family business has many features of a wise firm, such that understanding the *phronesis* role in decision-making will contribute directly to the long term perspective of knowledge management and business development (Motoc, 2022; Rocha et al., 2021; Shatter & Tsoukas, 2014).

Phronesis is closely related to the working spirituality that influences the employees' behavior. Rocha and Pinheiro (2021) remark that working spirituality "is related to employee well-being, sense of meaning and purpose, interconnectedness, and community sense" (p. 109). That is in concordance with several studies which show that well-being is more important in the family business than profit maximization (Berrone et al., 2012; Fletcher et al., 2012; Gomez-Mejia et al., 2011). *Phronesis* manifests in both operational and strategic management. In operational management the role of *phronesis* is embodied in the working spirituality, while in strategic management *phronesis* is embodied in the vision and mission of the family business.

3. Methodology

This article's epistemology and its chosen ontological perspective are based on the social constructionism paradigm. Interactions with other people, the environment, and the behavioral characteristics of individuals all contribute to the understanding of these perspectives on the same reality. Metaphorical thinking and language influence how people communicate their experiences (Esterby-Smith et al., 2018; Lakoff & Johnson, 1999). The construct of knowledge is based on the energy metaphor and the theory of knowledge fields and knowledge dynamics (Bratianu & Bejinaru, 2020).

The study used Glaser and Strauss's (2017) grounded theory research design, which is characterized by an ongoing comparison of incoming data and literature. The grounded theory approach opposes the use of hypotheses and explicit research questions as research beginning points (Khan, 2014). It is founded on the meticulous examination and study of data and the foundation of all knowledge on the data. As a result, grounded theorists use a social constructionist approach that emphasizes the importance of maintaining an open mind (Khan, 2014). Traditionally, research designs are classified as quantitative, qualitative, or mixed. The grounded research design used in this study was qualitative in nature, as it classified concepts and categories as factors affecting the role of knowledge dynamics and *phronesis* in the decision-making process of family businesses. The in-depth responses are necessary for fully appreciating the study's phenomenon. This means that the study will rely on non-numerical data, such as spoken words and language, in order to gain a comprehensive understanding of the problem. In terms of temporal frame, cross-sectional research was chosen. This kind of research is a 'snapshot' of a particular period, including a variety of research items (Saunders et al., 2019).

Glaser and Strauss (2017) state that the grounded theory process entails concurrent data gathering and analysis, which is also iterative. The investigation was done using data gathered via semi-structured interviews. The interview instrument used in this study followed Carmichael and Cunningham's (2017) principles for purposeful interview guides in grounded methods. The study's aims guided the development of the research instrument. As grounded methodology theorists indicated, the interview guide was open-ended and included items derived from the study objectives. Eleven family-owned firms in a variety of industries were discovered and contacted (Table 1). This research included a total of 16 interviews. Purposive sampling was used in this study since it was based on a qualitative research methodology and a specific research issue (Easterby-Smith et al., 2018). The study's objective is to collect data on knowledge management processes from Romanian family firms. It is vital to acquire accurate and dependable data. Only a small handful of family company employees can supply accurate information. More precisely, from family members involved in decision-making, strategy development, and administration of the family company. This group of members is acutely aware of the firm's core

competencies and what role does knowledge play. Collecting data from individuals who do not fall into this category may result in inaccurate or misleading results.

Following the collection of empirical evidence via interviews, grounded analysis was chosen to be the most appropriate method for evaluating the data (Bryman & Bell, 2015). Easterby-Smith et al. (2018)'s stages for doing the grounded analysis were followed. The first stage in the procedure was to transcribe all recorded interviews. Both Word and Sonix.ai were utilized to enhance the transcription process. Following that, the data were translated from Romanian to English. Following each interview, data were collected, transcribed, and categorized carefully. After all, interviews had been conducted and all data had been collected, transcribed, and categorized, the analytic phase began. The coding process has been evolving in several phases as data was processed. Figure 1 illustrates the main phases of the coding process.

Table 1: Interviews details

No	Company	Country of origin	Family ownership	Industry	No. of employees	Role	Background	Duration
1	A1	RO	100%	Design/Furniture	12	CEO	Family	58 min
	A2					PR manager	Family	43 min
2	B1	RO	100%	Architecture	8	CEO	Family	48 min
	B2					Financial	Family	39 min
3	C	RO	100%	Transport	6	CEO	Family	60 min
4	D1	RO	100%	Manufacturing	9	CEO	Family	60 min
	D2					Head of product	Family	45 min
5	E	RO	100%	IT	16	CEO	Family	50 min
6	F	RO	100%	Manufacturing	13	CEO	Family	55 min
7	G1	RO	100%	IT	11	CEO	Family	60 min
	G2					Development	Non-family	47 min
8	H1	RO	100%	Manufacturing	18	CEO	Family	50 min
	H2					Head of product	Non-family	40 min
9	I	RO	100%	Electronics	21	CEO	Non-family	45 min
10	J	RO	100%	Chemicals	47	CEO	Family	60 min
11	K	RO	100%	Vehicle service	36	CEO	Non-family	55 min

4. Results and Discussion

The willingness to work diligently and give oneself totally to an activity demonstrates the presence of motivation within an individual, which results in commitment (Chirico & Salvato, 2008). Not every family member can demonstrate the same level of devotion and interest in the family business, which can create difficulties during the knowledge-sharing process. The family ties are described as strong, with an emphasis on the easygoing and carefree atmosphere that impacts the language utilized. This enables them to openly express their thoughts and feelings, which benefits their process of knowledge sharing. This is accomplished primarily through verbal communication and physical demonstration. The psychological barrier of communication is very low and the incentive for knowledge sharing is high. The following terms, which other respondents shared, best demonstrate the cultural component and openness surrounding family businesses and promoting knowledge transfer:

> *"Everyone should be able to express themselves freely, regardless of whether they are family members or not. Here, regardless of the last name, all employees are treated similarly, and everyone's viewpoint is valued equally."* - Company A1

Despite the fact that all firms rate their knowledge levels as good, it was discovered that a significant portion of existing information and knowledge belongs to individuals, such that their distribution is largely uneven, which decreases the knowledge entropy of the whole organization (Bratianu, 2019). In our interpretation, knowledge entropy does not refer to organizational ignorance (Albrecht, 2003), but to the probability distribution of the organizational knowledge fields. This is a risk that all businesses face, as this type of individual-based knowledge vanishes the day the knowledge carrier leaves the company. As a result, this risk occurs in all businesses, as positions are highly specialized and broad knowledge of the organization is concentrated among family

members. According to one administrator and confirmed by the non-family member interviewed, knowledge distributions are uneven and extremely individual dependent.

It has emerged that there is a large amount of tacit knowledge, while the explicit one is lacking across family businesses. The most prominent procedure for the transfer of knowledge is social interaction and intergenerational learning. This is linked to the culture family companies have, is clearly expressed that the working atmosphere allows ideas and knowledge interaction to occur unconstitutionally. However, this kind of familial feeling invoked may also be present in non-familial companies of the same size. The difference comes from the family members who are unable to separate themselves from the professional role, impacting the knowledge transfer and the places and time this takes form. A prominent source of this transfer is identified as morning coffee meetings where employees exchange experiences, which are said to be a critical component of the socialization process that assists them in their daily tasks and helps set the business's trajectory.

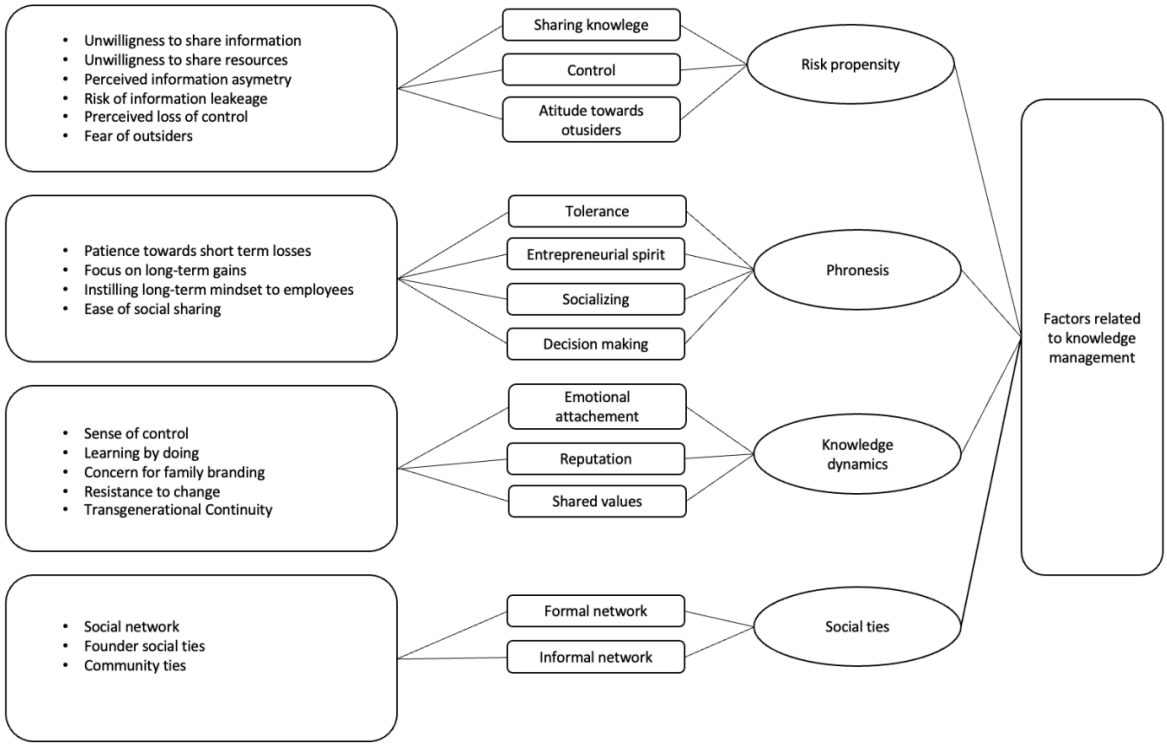


Figure 1: The codification processes

Externalization refers to the process of transforming tacit knowledge into a more concrete and intelligible form (Nonaka & Konno, 1998; Nonaka & Takeuchi, 1995). The results of this process are used in the next stage of knowledge dynamics which is a combination. It contributes directly to the construction of organizational knowledge through its rational component and to the organizational culture through the emotional and spiritual components. The family context stimulates combination and contributes to the knowledge spiral's development.

Despite possessing a long-term orientation, these procedures are mostly absent from the firms interviewed, with no personally developed documented instructions or information addressing various work-related scenarios being present or utilized. Despite the prospect of developing them and understanding of the risk associated with an absence that could have been managed by other employees who could have the knowledge if concretized, still, no efforts in this area are being taken or envisioned. The general argument is that they lack the motivation to codify their knowledge because their size and proximity facilitate knowledge transfer through socializing. Because they have not encountered any case requiring written documentation, this procedure has been usually omitted.

Between the firms analyzed, a prevalent method of incorporating new knowledge into an individual's knowledge base is through learning-by-doing. That shows an increased role played by emotional knowledge, as tacit knowledge. Although the availability of manuals or other forms of codified knowledge is frequent and

advantageous for employees, our interviews indicate their absence in most family businesses analyzed; instead, employees are encouraged to take a more practical approach. Employees are urged to take a more pragmatic approach, with daily duties providing a regular opportunity for exercise and knowledge acquisition. The organizations interviewed do not have any well-documented information that is readily available and quickly accessible to all personnel, who are constantly on hand to supply information. This also varies by industry, as some may require well-documented data. Thus, while the individual level of knowledge is relatively high, the organizational level is relatively low.

> *"We do not store data, and when we want to implement something new, we share it with the appropriate parties, discuss it, and then implement it. We are available to answer and resolve your inquiries and concerns."* - Company F.

> *"While templates and other technical material are available in paper format, we rely on our staff' experience, as they have been with us since the beginning."* - Company C.

The interviewed companies argued for an increased emphasis on action learning, internships, and mentoring, advocating that these are the most suitable processes that prepare the employees or successors for unexpected events at the business. To cultivate and develop practical wisdom, they argue for intensive face-to-face and hands-on interaction, along with a range of experiential activities, and apprenticeship is another way to foster phronesis. *Phronetic* leadership can be learned via experience, and role models that demonstrate this manner of thinking and doing are critical. Despite not being a clearly established and well-documented process, through the nature of a family business, it creates an environment within which people can build mutual trust and empathize with others, which is in line with the creation of Ba (Nonaka & Takeuchi, 1995).

> *"My daughter had learned this since she was a child. She was and is always near me when I'm working."* – Company B1

> *"We believe that the family's history together with the embodied perceptions and subjective factors are just as critical for managing the business as the rational and objective principles of the market."* – Company H1

The assumption that knowledge flows from units with a high degree of knowledge intensity to those with a low level of knowledge intensity is emphasized by discrepancies in the knowledge field of family businesses. Contrary to the common belief that knowledge transfer occurs from the incumbent towards the successor, the empirical data shows that the vice-versa is common and highly impacts how business is conducted. This is attributed to the new technological advancements and digitization, which are considered to be significantly more accessible and understandable to the successors. Additionally, access to a higher level of formal education and job experience in large multinational corporations provides a source of information that many incumbents lack.

Furthermore, by correlating the empirical data with the theoretical aspects and metaphors proposed by Bratianu and Bejinaru (2020), it emerged that emotional and spiritual knowledge transformations occur more frequently. The values and ethical principles governing a family company, together with the common living aspirations and motivation between family members and further transferred to non-family members, have the power to stimulate thinking beyond individual interests and achievements, which shows a high level of *phronesis* (Rocha & Pinheiro, 2021; Rocha et al., 2021). The interviewed family businesses are not making profit maximization their primary objective, family members valuing their common wellbeing and the condition of their employees. These are greatly attached to the family company, becoming an extension of themselves, thus confirming the importance of spiritual knowledge over the family organization. The company's culture governs the dynamics between emotional and spiritual knowledge (Bratianu & Bejinaru, 2020). Understanding this process is very important as it determines the family companies' decision-making processes and the weight emotional and spiritual knowledge have compared to rational knowledge (Bratianu et al., 2021).

5. Conclusions and limitations

Family business distinguishes from the generic business because the work relationships are superposed over family relationships which intensifies knowledge dynamics and creates a specific *phronesis*. The present research aims to reveal some of these properties and their influence on the family business decision-making. For knowledge dynamics we adopted the theory of knowledge fields developed by Bratianu and Bejinaru (2020)

which enlarges the perspective considered by Nonaka and Takeuchi (1995, 2019). The research is based on the grounded theory of Glaser and Strauss (2017). The authors performed and analyzed 13 interviews with members of 11 business families and used the iterative codification process to extract from the initial qualitative data ideas for understanding the phenomena of knowledge dynamics and *phronesis* within the framework of the family business. In Figure 1 we can see how knowledge dynamics and *phronesis* appear in the third phase of analysis, confirming the existence of synergy between work and family relationships. Also, there is a drift from purely rational and economic objectives to practical wisdom where there is a balance between rational, emotional, and spiritual fields of knowledge. These findings can be used in practice to enhance the advantages of the family business over other companies. Also, these findings show the importance of knowledge dynamics and *phronesis* in the family business.

In addition, since the family members have a closer relationship at a personal level, the source's trustworthiness is not disputable and influence substantially the recipient's behaviour in the knowledge transfer process. Even though some employees are not family-related, receive and generate the same level of trust as the family members. Similarly, the availability and desire to transfer knowledge have to be taken into consideration. The researched family business owners' main goal is that their children take over and grow the company therefore they tend to push their siblings into learning faster and accumulate knowledge from within the company at a younger age, later through academic and working outside the company in order to improve the chances of survival on the long term on the family company. In non-family organizations, this may not happen since there are high staff turnover and agency problems. The family acts as a reference system of well-defined values, behaviors, and norms that are unconsciously transmitted from the incumbent towards the successor from birth. These have the role of capitalizing on the traditions acquiring and increasing knowledge to further integrate and apply it in the business. The level of commitment is affecting the effectiveness and quality of the knowledge transfer, accelerating or impeding it.

The research has two main limitations. The first one refers to the relatively small number of interviews, and the second one is created by the exclusive use of online platforms due to the COVID pandemic and many administrative and social restrictions. However, we hope to exit this pandemic crisis and extend our research basis with new face-to-face interviews and a quantitative research component.

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Action Research as a Tool for Project Knowledge Management in the Projectified Public Organization

Kamila Brodzińska
Jagiellonian University, Doctoral School of Social Science, Cracow, Poland
kamila.brodzinska@doctoral.uj.edu.pl

Abstract: The chapter aims to present the results of an action research project carried out in years 2018 – 2019, which concerned project knowledge management. The entity in which the study was conducted is one of the largest museums in Poland. The museum under study is an example of a projectified public organization where most of the activities are being performed in the form of a project. The intention of the undertaken action research was to introduce an organizational change – to improve the process of project knowledge management in the museum. Hence, the aim of the paper is to show how can action research support project knowledge management processes in organisations and in which way action research affects the knowledge retention of project workers. Analysis of the obtained data allow us to conclude that action research, is an effective tool and approach in the improvement of project knowledge management. Thanks to this approach, members of the organizations, dispersed among different project teams, can e.g. jointly work out the rules for better project knowledge management in their workplace and improve the project knowledge management process in general. Hence, action research may positively impact knowledge retention among project team members.

Keywords: knowledge management, project knowledge, projectification, action research

1. 1. Introduction

Project management as a management method helps solve complex problems in different types of organisations (Bredillet, 2004). The popularity of project management leads to development of projectification, defined as an institutionalization of projects in society (Jacobsson & Jałocha, 2018).

Jensen, Thuesen and Geraldi (2016) point out that projectification is not simply the result of current trends or the popularity of the term "project". Projectification is the process of creating temporary forms of project work in an organisation. These forms are future-oriented and purposeful, flexible and adaptable to project conditions. The multiplicity of projectified organisations and the penetration of projectified modes of action into people's private lives contribute to the emergence of the project society (Jensen, 2012).

Projectified organisations attempt to gain an advantage over other organisations also operating in a project-based manner. Factors determining a competitive advantage in projectified organisations include, among others, the way in which the organizations manage project knowledge. In the projectified public organizations, management of knowledge that comes from the projects and programs is especially important. According to research, appropriate management of project knowledge can thus significantly impact the success of organizations implementing an increasing number of projects (Wirick, 2009).

To understand project knowledge management processes in organisations, methodological instrumentation of both qualitative and quantitative nature is needed. It is also crucial to choose engaged research methods that support the development of solutions that are useful from the perspective of practical management of solutions (Coghlan & Shani, 2018). These include action research (AR) – a research approach, a study of the social situation of members of an organisation and the researcher, designed to integrate knowledge creation and practice through collaboration. It aims to work towards improving the quality of activities or solving existing problems. Embedding this research within the organisation contributes to the development of the entity and to its potential to provide knowledge not only to researchers studying management and organisations but more importantly to community members (Coghlan & Shani, 2018).

Therefore, in the presented study, we used Action Research to understand and change the project knowledge management processes in the public museum. The subject of the study was a Polish projectified public institution, the Krakow Museum. In order to present the results of the implemented action research, the paper uses the single case study method. The research problem, concerning project knowledge management processes in a public museum, was explored through two main research questions:
RQ 1. How can action research support project knowledge management processes in organisations?
RQ 2. Does, and if so how, action research affect the knowledge retention of project workers?

This article consists of several parts. After presenting the key issue in the introduction, as well as the research questions, subsection one contains a review of literature dedicated to individuals involved in the project knowledge management process. The second subsection deals with the means by which project knowledge is acquired. Subsection three characterises the use of action research. The result of the study and its conclusions are then presented.

2. Project knowledge management

2.1 Key actors in the project knowledge management process

An important area of project management is the establishment of project teams. Team members, apart from technical competencies, should also be characterised by: commitment to the work, high level of motivation, ability to work in a changing environment – often under time pressure and knowledge of project management methodologies. One of the key elements of the project team should also be the ability to accumulate knowledge, resulting from project experience (Harris, 2016). The focus on the latter very often depends on the type of project, its duration, the stage of the project life cycle and the number of project team members. Project knowledge management is also influenced by how the organisation positions projects in its organisational context (Youker, 2017).

The project manager and those involved in the processes of organising the project, deciding on the ways of carrying out tasks, communication and defining the rules of cooperation, often contribute to the formation of a project subculture. This concept is understood as a kind of subculture that arises in the process of project implementation in a given team involved in its implementation. Such a team is guided by values resulting from the organisational culture, which is complemented by values created in the project management process (Kamiński, 2021). It is worth ensuring that project knowledge management has a special place in such a project subculture.

At the organisational level, the creation of knowledge management systems is supported by so-called knowledge workers. These include senior managers, project managers and technical staff who are specialised in their profession, have experience and ability to solve complex problems. Such people are characterized by unique competences, independence and proactivity (Amoah & Marimon, 2021)

Other people who initiate the collection of project knowledge in an organisation are so-called knowledge seekers (Girard, 2018).

The key actors in the project knowledge management process are therefore employees with above– average knowledge of the organisation and how it implements projects. They are therefore a valuable resource – supporting knowledge management processes with their insights. Sometimes organisations choose to enlist the support of external consultants to plan and improve their project knowledge management process.

2.2 Methods of obtaining project knowledge

Organisations characterised by project management maturity include in their strategies information on the use of knowledge management tools before, after and during project implementation. One of the key challenges in project-oriented organisations is generating project knowledge and engaging employees in the process (Gupta, 2020). However, before an organisation takes action to acquire project knowledge, management should adopt a strategy for gathering this knowledge. In this respect, it is useful to draw on the developed knowledge management models (O'Meara & Kelliher, 2017).

The abovementioned knowledge managers, knowledge workers, knowledge management coordinators or experts, in order to plan project knowledge management processes, should select ways of obtaining project knowledge which will support the timely realisation of project goals in the organisation.

This means that they should be aware of what sources they can obtain project knowledge from and what type of project knowledge is most useful to them (Girard, 2018).The following types of project knowledge are distinguished in literature:

Table 1 Knowledge acquisition methods for specific types of project knowledge

Type of project knowledge	Specific character of the knowledge	Example method of obtaining project knowledge
Process knowledge	involving the knowledge of the project team, concerns the project structure, procedures, tasks and time constraints. Its purpose is for the team member to understand their role in the project and to support the team in implementing the plan.	• Organisation of project launch meeting • Analysis of project documentation, staff notes • Formal and informal discussions among project team members
Domain knowledge	related to the area of specialisation of the organisation, information about the current situation, potential opportunities and difficulties and acceptable solutions.	• Working in task forces • Regular project team meetings • Supporting staff initiatives under project activities
Institutional knowledge	involving the project team's knowledge of organisational and project structures, distribution of power and systematisation of processes within the organisation. This type of knowledge is especially important for management who is not members of the organisation and for external entities involved in the undertaking.	• Analysis of memos, reports, documentation, intranet • Consultation with others involved in the project • E-mail correspondence/ telephone contact
Cultural knowledge	knowledge of the cultural values and artefacts present in the organisation and among stakeholders. It helps understand prevailing norms and accepted behaviour	• Regular meetings with the project team, mentoring, workshops • Maintaining formal and informal contact with employees

Source: (Reich & Wee, 2006), (PMBOK Guide, 2017)

In the case of documentation analysis proposed in the table 1, should be carried out in a transparent way, while selecting relevant information and keeping it in easily accessible repositories. Furthermore, keeping documentation and repositories requires the introduction of a uniform nomenclature for terms and problems. People searching for knowledge that is useful to them need to be informed or be able to verify what phrases to use to find the answer to their question (PMBOK Guide, 2017).The choice of methods of acquiring design knowledge results from the degree of design maturity - i.e. from the assessment of the level of development of project management processes in the organization and verification to which level it aspires (de Souza & Gomes, 2015). Methods recommended by the Project Management Institute (2017) include holding discussion forums, such as setting up focus groups or creating a space for remote communication.

An important aspect is to create events whose purpose is to share knowledge – these can take the form of training or seminars. Another form is workshops devoted to solving problems in order to consolidate the knowledge acquired. As mentioned in Table 1, for project knowledge acquisition, it is important to maintain both formal and informal contacts, which often allow for adaptation of solutions already developed by co-workers (Ekambaram & Jałocha, 2018).

The establishment of an organisational unit supporting the processes taking place within projects – the project management office – may contribute to project knowledge management. The tasks carried out by the project management office as part of this process include creating a portfolio and project programs and gathering knowledge about the profits resulting from the implementation of the task in the form of a project by conducting ex post project controls (Silvius, 2021). Other tasks that help to achieve this goal is include managing the lessons learned from previous projects and developing innovative solutions that can be implemented in subsequent projects (Beste & Klakegg, 2022).

In summary, project knowledge management in projectified organisations is an extremely complex process. This is because it requires a continuous collection of information created in the course of one-off, unique ventures, by teams of varying composition. In addition to setting up knowledge management systems in this type of organisation, it is also important to involve employees who carry out projects on a daily basis, empowering them in the process of collecting and accumulating knowledge. Increasingly, action research is being used for this purpose.

2.3 Action Research - basic assumptions of the method

Action research is a participatory process that aims to develop knowledge that has practical applications for individuals and communities taking up the challenge of change. The research approach is characterised by collaboration with the study subjects by combining knowledge derived from theory and practice observed in the community under study. The aim of the study may also be to identify resources that support the change process or to jointly evaluate processes taking place in the studied entity (Coghlan & Shani, 2018). This study can only be carried out with the participation and consent of members of the given community or organisation. The researcher involved in such a study may come from outside the organisation or be a member of it (Coghlan & Brannick, 2005).

Democratisation of the research process and the involvement of all parties in the dialogue and collaboration enables researchers and the studied community to learn from each other, transfer knowledge and experience. It is important to note that reflection and action are not separated in AR – it is the action that conditions the emergence of reflection – including on one's own practice (MacDonald, 2012).

AR is implemented as a study series. The first step is to diagnose the problem and gain knowledge about its sources. In the next stages, actions are planned and implemented to solve the problem. The results of the change are then subjected to critical reflection. The final cycle is designed to collect data on the results and analyse the effectiveness of the changes made. Importantly, when the results developed are not satisfactory to the group, these cycles are repeated until an optimal solution is achieved (Coghlan & Shani, 2018).

There are many types of AR. These include: participatory action research, critical participatory action research, appreciative inquiry, educational action research and action science. These approaches, despite similar assumptions, are characterised by different ways of collaboration and problem solving. Bearing in mind the types of AR, their specific character and the manner of group involvement in problem solving, an adequate choice of research form should be made (Ollila & Yström, 2020).

3. Project knowledge management at the krakow museum

3.1 Studied organization

The research whose results are discussed in this article was carried out at the Krakow Museum, one of the largest cultural institutions in Poland. The museum has 19 branches located in different parts of the city, with permanent and temporary exhibitions on selected topics of Krakow's history. These exhibitions, as well as educational events, are carried out in the form of projects. The museum also organises scientific projects, carries out investment and partnership projects with the city and other cultural institutions. It is also worth mentioning that as a member of international organisations, the Museum also carries out projects with foreign partners – these take the form of conferences, cultural events and temporary exhibitions. More than 90 projects are undertaken in the institution every year. The multitude of activities conducted by the Museum means that the institution's staff carry out several projects simultaneously, and these projects are at different stages of advancement. Approximately 30% of employees are involved in project implementation. Project management is therefore a key element of management processes.

3.2 Action research and research methods used

To present the research findings, this paper uses a single case study method (Yin, 2009) focusing on issues related to the use of action research as an approach to support project knowledge management. The choice of the analysed case was intentional – the analysed museum is a public institution that organizes a lot of its activities in a project form.

The data presented in this article comes from a wider, completed research project based on the Action Research approach. This study was carried out between March 2018 and March 2019 by two researchers– a student preparing a MA thesis and an employee of the organisation. The researcher from outside the organisation – the student – was responsible for identifying an issue requiring improvement to existing solutions and for involving the organisation's staff in the improvement process by designing a solution jointly. The researcher from the organisation acted as a facilitator – supporting the establishment of contact with staff, sharing data and, through learning about the AR approach, began researching own practices. A thesis supervisor was also involved in the implementation of the study, who was in contact with the researchers and coordinated the process.

The objective of the researchers was to carry out participatory action research. It is an approach based on egalitarian participation of practitioners in the study in order to give them an opportunity to co-determine the design of the study, to control its progress and to share responsibility for the change process (Coghlan & Shani, 2018). Methods such as observations, interviews, analysis of documentation, legal acts and internal procedures, and a survey were used. During the problem diagnosis stage, 21 observations were completed. Information on project knowledge management was obtained by conducting 8 in-depth interviews and analysing project documentation – e.g. project sheets and project procedures. Observations of the work of project teams also took place at this stage. Knowledge was also gained through informal discussions with staff. It was also supplemented by the results of a survey involving 22 employees. We worked with 27 employees of the organisation during the implementation of the study.

3.3 Action research as a method for project knowledge management – study results

3.3.1 Diagnosis of the need to improve project knowledge management processes using action research

Interviews with project team members and project managers were carried out during the action research cycle to gain knowledge about project knowledge management. In order to get a full picture of the issue, the diagnosis stage was extended to include an analysis of project documents and observations. Areas that were identified during the survey as needing improvement included developing a common understanding of project knowledge management strategies, support for sharing knowledge in the organization, collecting project knowledge and functioning of organisational units that support project management processes. The described diagnostic elements in action research allowed the researcher to learn about institutional, cultural, domain and process knowledge. This made it possible to identify issues for improvement. It also made it possible to recognise the rules governing the institution, which is particularly important in case of action research, which is designed to involve members of the organisation. By knowing the problems and the rules of the organisation, it was possible to develop a model of communication that would be acceptable to all participants in the study.

During the interviews to identify issues, there were also discussions about the views of project team members on how changes could be made to the way project knowledge was managed. The reflections and suggestions of the interviewees allowed for their inclusion in the research process. All staff findings were described and presented at the conclusion of the study. This contributed to a higher degree of acceptance of the solutions that were developed in the course of the action research.

Organisational dialogue, which is the basis of action research, presupposes that every interested member of the organisation is given an opportunity to be heard. Therefore, at the stage of designing solutions that would support project knowledge management in the organisation, a survey was carried out. The purpose of the survey was to allow the organisation's staff to articulate their views on the proposed changes and to put forward their own ideas. In this way, everyone who was interested and wanted to participate in the process had the opportunity to put their point of view on the table. Importantly, this action enabled those who wished to remain anonymous and be heard to be included in the action research.

3.3.2 Attitude of project staff during the implementation of action research

Prior to the implementation of the study, the involved staff were informed about its purpose and the assumptions of action research. Involving staff in the research process through regular contact with them and an analysis of project knowledge management needs carried out by them, enabled a partnership to be established between them and the researcher. Without the approval of the members of the organisation, none of the considered ways of introducing changes in project knowledge management would have been proposed. Obtaining detailed information on project knowledge management from the staff would have been impossible without their commitment and time spent reflecting on their own practices. Considering project knowledge management in teams required interviewees to analyse their own knowledge, tools and resources. It was the participatory form of action research that allowed for the creation of a space to start making changes in this area.

In keeping with the project culture, the tasks carried out by project team members were unique in nature, with project staff involved in the action research process carrying out multiple project responsibilities in parallel. Action research allowed the staff to analyse project knowledge management processes from the perspective of each role performed in the project team, and thus to gain an understanding of the current situation of project

knowledge management in the organisation. Employees at different levels and of varying seniority were involved in the research.

Sometimes, during subsequent interviews, the same people signalled other aspects of project management, which was a clear indication that they had taken the time to explore these issues. The repetition of the process, its successive cycles, discussions on project knowledge management complemented with the questionnaire contributed to the project staff's understanding of which of the change efforts could be most supportive. Each person involved in the action research contributed to the improvement of their workplace through collaboration. The result of the action research was to propose an action plan to implement changes in those areas of project knowledge management that need improvement. These changes have been partially implemented in the organisation. These include: organising meetings to integrate project teams, which enables the exchange of knowledge about projects, starting the process of simplifying project documentation and clearly defining the tasks of the unit supporting project management processes.

4. Conclusion

The multiplicity of challenges associated with the management of projectified public organisations results in the search for alternative methods of gaining knowledge about the processes carried out. Research on project knowledge management enjoys unflagging popularity and the results of the completed research project allow us to conclude that action research is an effective tool for improving project knowledge management. This approach allows for the enrichment of the existing knowledge with the organizational context, with particular emphasis on management staff and employees. Action research, by replacing traditional mechanisms of organizational change with forms based on participation, enabled employees to implement changes in project management while respecting their experiences and knowledge.By using this approach, members of the organisation, carrying out their tasks in different project teams, were able to jointly develop principles for better project knowledge management in their workplace and improve the project knowledge management process.

Referring to research question 1 (How can action research support project knowledge management processes in organisations?), with repeated cycles, action research allows members of the organisation to get a better idea of which activities are working well in project management, how to secure ephemeral knowledge and how to select the accumulated project knowledge to gather practices that are most useful from a project management perspective. AR also helps expose certain weaknesses so that the organisation can pinpoint areas for change. Importantly, discussions on management elements in need of improvement, take place in a collaborative atmosphere, with the focus on solving the problem – not evaluating individual team members.

Action research provides a guarantee to members of organisations who are interested in working together for organisational change that their concerns, problems or ideas will be heard. However, when involving the organisation's employees in AR, it is important to warn them of the new responsibilities arising from the study, which include, for example, examining their own practices, analysing the solutions used to date and critically reviewing their effectiveness. Providing such information makes it possible to choose whether employees have the capacity to engage in the process and take co-responsibility for change.

In answering question 2 (Does, and if so how, action research affect the knowledge retention of project workers?) it is worth mentioning at least a few activities that affect knowledge retention in the organisation. The primary task accomplished through the use of action research is to support project team members in becoming aware of the knowledge resources at their disposal. Very often individuals with project knowledge did not realise that it could be useful to other team members, or they struggled to identify their own practices with the terminological definition of the given project management activity. The completed action research illustrated that improving the process depends on sharing project knowledge with other members of the organisation. The action research also allowed the staff involved in the change process to see that the knowledge they revealed served as the basis for developing solutions to improve the process.

In projectified public organization the value of project knowledge management is the basis for its efficient functioning. The use of action research contributed to the acceleration of design knowledge in the organization and made it possible to learn how to manage them. It was action research that initiated many meetings and conversations in the organizational space that, through the very articulation of reflections on employees' own practices, contributed to the preservation of project management knowledge.

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Lifelong learning through knowledge-sharing & digital collaboration

Kay Brouwers[1], Wouter van Lelyveld[2], Emőke Takács[3] and Toon Abcouwer[4]
[1,2,3] Master students, [4,5] Academic staff, University of Amsterdam
kay.brouwers@student.uva.nl
wouter.van.lelyveld@student.uva.nl
e.takacs@uva.nl
A.W.Abcouwer@uva.nl

Abstract. Today, in the age of digital transformation, knowledge management is essential to keep an overview of the endlessly available information. Universities by nature must be leading in generating, sharing, using and managing relevant knowledge and information to equip people to obtain viable employment. It means that the basic assumption is that universities mainly work as the source of knowledge and information. However, in contemporary times knowledge sources are wider spread in society. In a case study, we analysed the current knowledge management initiatives of the University of Amsterdam (UvA). We found that these initiatives insufficiently facilitate the knowledge-sharing behaviour of partners and are too focused on a one-way flow of knowledge to external partners. Consequently, opportunities to learn from knowledge in society, identify societal needs and challenges, and tailor curricula to educate talent with knowledge and skills are not optimally leveraged. This paper suggests a possible way to enhance two-way knowledge sharing in the form of a digital collaboration platform. We based our proposed platform on a thorough scientific literature review on partners, ecosystems, knowledge sharing, incentives, and constructing and maintaining cohesive teams. Such a platform will ultimately facilitate lifelong learning. People can participate in the platform during their lives and bridge the gap between universities and organisations by enabling a constant two-way knowledge-sharing process. Our research mainly focused on identifying the requirements to establish cohesiveness and stimulate knowledge-sharing of the partners and teams of such a platform.

Keywords. Ecosystem, university, knowledge-sharing, lifelong learning, digital collaboration, platform thinking, resilience

1. Introduction

Our current era is characterised by increasingly rapid and dynamic changes. Organizations need to become more resilient to survive and ultimately, thrive. Universities currently face the challenge of bridging the gap between education and the job market. Practice has shown that our educational system provides the job market with graduates whose skills do not sufficiently meet contemporary demands. Abcouwer and Takács (2018), suggest a platform for digital collaboration and lifelong learning (LLL) as a potential remedy to bridge this gap.

To facilitate lifelong learning, one should look at the valorisation task of universities, which is imposed on universities by Dutch law. The definition of valorisation by the Cambridge Dictionary is “the act of making something valuable or useful from an existing substance” (Cambridge University Press, n.d.). This ‘existing substance’ is the knowledge for a university gained from research. In other words, the university has the task to make the gathered knowledge useful for society.

UvA has multiple, ongoing initiatives to fulfil its valorisation task. Innovation Exchange Amsterdam (IXA), UvA ventures holding, MatrixIC, Amsterdam Science Park (ASP) are a couple of examples. IXA aspires to transform academic and practice-based research and knowledge into ground-breaking innovations and applications and assist external parties, such as companies, in navigating the academic landscape to find solutions and opportunities. UvA ventures holding makes scientific innovations and expertise from the UvA available to the market and society by setting up or participating in companies. MatrixIC develops and rents places “in the heart of research”. The goal is to offer an environment where research and companies can meet, and thereby facilitate cooperation and encounters on multiple different levels. UvA currently fulfils its valorisation task through getting their developed knowledge out into the world for the greater good. Valorisation for UvA is a one-way process from the university to society. This blocks the knowledge in society (e.g. in companies) to be valorised by UvA and rules out to learn the society’s needs and wants, and tailor research to this demand. Furthermore, this also likely hinders LLL.

We, therefore, identify a possibility for growth of improvement in the task of university valorisation. Our analysis resulted in the following problem statement:
Problem statement: *Current knowledge-sharing initiatives insufficiently facilitate the knowledge-sharing behaviour of all partners in the ecosystem of UvA and is too much focused on a one-way flow of knowledge from the university to external partners. Consequently, opportunities to learn from knowledge in society, identify*

societal needs and challenges, and tailor curricula to educate talent with knowledge and skills that accurately meet these societal needs are not optimally leveraged.

To address this problem, this paper describes our vision on a solution. We aim to build further upon the platform for digital collaboration and lifelong learning by Abcouwer & Takacs (2018) to bridge the gap between universities and organizations through enabling a constant two-way knowledge-sharing process. Our research particularly focused on identifying the requirements to establish cohesiveness and stimulate knowledge-sharing of the partners and teams of the platform. Furthermore, suggestions will be made for its eventual implementation.

2. Related work

2.1 Partners & Ecosystems

Galan-Muros and Davey (2019) developed a comprehensive framework for establishing university-business cooperation (UBC). The framework describes inputs, activities, outcomes, outputs, impacts, supporting mechanisms, circumstances and context which occur in the UBC ecosystem. The authors emphasize that all participants in the ecosystem can take the mediating, providing or receiving role in the knowledge sharing process.

Financial and physical resources can come from any of the three actors within the triple helix (government, business & higher education), such as government subsidies, industry endowments or other financial or material incentives. The authors also describe barriers and drivers for UBC.

As important barriers, they highlight the limited opportunities for interaction between partners. There is not enough awareness of each other's existence and what they offer. Furthermore, lack of funding, having different goals and time horizons, the need for confidentiality are factors that limit university and business cooperation. In contrast, the opportunity to establish a competitive advantage through shared use of resources, access to the best graduates & scientists, and cutting-edge research are important drivers for cooperation. For universities the opportunity to commercialize research and consulting are relevant reasons to participate in such an ecosystem.

To become a successful platform provider, Berman et al. (2018) defined three steps to take. Firstly, develop a conceptualization and pilot of the virtual or physical platform, and formulate appealing incentives for organizations or partners who might want to participate in it. Secondly, increase the scale and scope of the platform through acquiring users, retaining these users, monetizing interactions, and harvest reputation. Lastly, discover new opportunities during processes and activities. The steps to take are *assessing, innovating, evaluating, creating, and realizing*.

2.2 Knowledge-sharing

Establishing an ecosystem in which all partners feel invited to share information requires a solid understanding of the factors that drive knowledge-sharing. Some important factors affecting positively or negatively knowledge-sharing behaviours are outlined below.

2.2.1 Organizational context

Studies identify the effects of organizational culture and climate. According to De Long and Fahey (2000), organizational values that support knowledge sharing are essential to effect on technology infrastructure. When these values are not supportive, the benefits of a strong architecture are limited. Furthermore, the research found that emphasizing *trust* helps to reduce the perceived costs of knowledge-sharing. Organizational culture with individual competition decreases the chance to share by participants. Whereas a culture that is experienced as cooperative helps to establish trust, which positively influences knowledge-sharing (Schepers & Van den Berg, 2007). Taylor and Wright (2004), also state that the cultural aspect of supporting learning from failure, and sharing new ideas positively affects knowledge sharing behaviours.

Considering management and teams, Lee et al. (2006) identified that both the quality and level of knowledge-sharing increase when top management demonstrates support, positive attitudes, and influences employee commitment. Whereas a lack of incentives forms a barrier (Yao, Kam, & Chan, 2007). Previous research concluded that *incentives* such as recognition and rewards are recommended to facilitate knowledge-sharing,

and promote supportive culture (Liebowitz, 2003). However, research from Fullwood & Rowley (2017) suggests that in the academic context, incentives other than money should be the primary way of stimulating knowledge-sharing behaviour. In a study searching for alternative rewards positively affecting knowledge-sharing, Ferrin and Dirks (2003), say that a cooperative reward system positively, and a competitive system negatively contribute to knowledge share.

Research on the impacts of organizational structure demonstrates that interactions between employees from different departments, with different ranks, positions in the organizational hierarchy should be stimulated, and hierarchy de-emphasized to foster knowledge-sharing (Wang & Noe, 2010).

2.2.2 Social and cultural characteristics

The relationships between individuals, communities of practice or social networks in general, positively influence the amount and quality of knowledge shared (Cross & Cummings, 2004). Web-based platforms seem to play an important role in this matter. According to Chen (2007), an individual expects that improving relationships on a social level through frequently participating in a web-based community positively affects the motivation to continue participating in that network. The overall conclusion is that it is likely that present network connections enhance knowledge-sharing within a particular community of practice (Wang & Noe, 2010).

2.2.3 Motivational factors

Regarding the motivational factor of knowledge ownership, various studies suggest that when people percept that they own the knowledge or information, they are expected to demonstrate more knowledge sharing behaviour (Constant et al., 1994). Fullwood & Rowley (2017) suggest that personal beliefs are the primary motivation to share knowledge with others.

2.3 Incentives within the ecosystem

After the drivers of knowledge-sharing we now focus on the incentives for knowledge-sharing. In an ideal case, knowledge-sharing is an operation both parties can benefit from. To visualize the relation between incentives and knowledge-sharing the following model of Lyu, H., & Zhang, Z. J. (2017) is used, see Figure 1. This model indicates the importance of the incentive to knowledge-sharing.

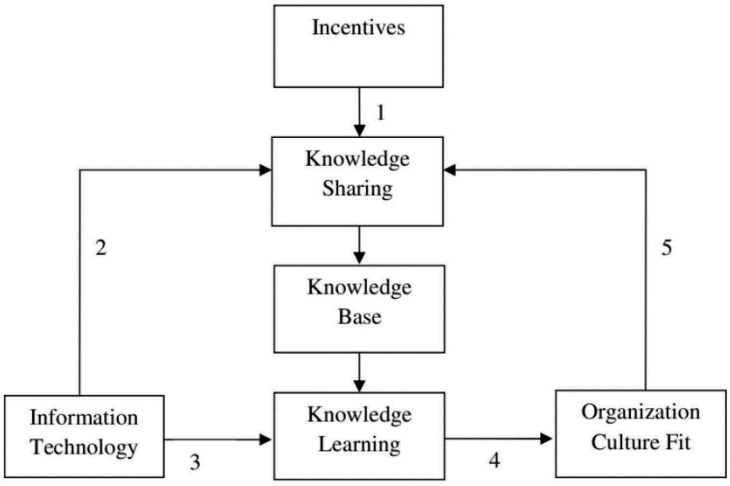


Figure 1: The relation between Incentives and Knowledge-sharing

Within the UvAs ecosystem, different roles have different incentives. The roles we identified in UvA *institutional plan* (2021) are universities, companies, students, teachers and researchers. To realize knowledge-sharing across these roles, we must consider their incentives as described by Koens, L. et al. (2018) and Galan-Muros, V. & Davey, T. (2019). Incentives are essential in developing a culture that favours knowledge-sharing activities, so the roles in the ecosystem need to design and provide incentives to induce them to actively participate in knowledge-sharing and learning. First, we identify the relevant incentives for all the roles, after that we explain the incentives for the specific ones.

2.3.1 Global incentives

The first incentive is *gaining knowledge and skills.* An important driver when no new knowledge or skills are learned. It offers the industry opportunity to gain knowledge from the university and vice versa.

The second incentive is *broadening the network*, with different organizations, researchers, universities etc.

The third one is *reflecting on or thinking about societal problems*. As this affects all the roles within and outside the ecosystem it can be of real benefit for accessing resources. For example, during the COVID-19 pandemic, different roles united to develop solutions for society. This case is a clear example of how beneficial knowledge-sharing can be.

The fourth incentive is to *strengthen your position in the labour market.* The ability to share knowledge around different roles in the ecosystem might bring new possibilities to the labour market. As some research that can be done within a company could be preceded by a student from a university for example.

Lastly, *self-enjoyment* is an important incentive for knowledge-sharing as an individual. It gives the joy to share your knowledge with others and realize one benefits from it.

2.3.2 Universities

For universities, there are different incentives for knowledge-sharing that can play a role. The incentive of *reflecting on our thinking about societal problems* is particularly of interest for universities to have valorisation from society to knowledge.

Higher-quality research is relevant since people outside the ecosystem receive access to knowledge that form the basis of new research. This could be relevant for organizations who want to gain knowledge from someone within the ecosystem.

Higher-quality education: the practitioners from companies could deliver knowledge that is applicable in the labour market and improve the quality of education and academics. It causes another incentive, *better preparation of students for the industry,* as it bridges the gap between education and the labour market. Another incentive is *the valorisation of knowledge*. Their well-valued knowledge is used which can be positive considering the university as it shows they are not creating useless knowledge. Furthermore, universities are obliged to include valorisation.

The last incentive is the *provision of sources of income and funding* as the university can turn the knowledge-sharing initiatives into funding and income for themselves. This can be of benefit for funding research and education.

2.3.3 Researchers/Teachers

Researchers and teachers have similar incentives; therefore, we formulate the incentives for both. Similar to universities, researchers and teachers can be incentivised through *being able to conduct high-quality research.* Particularly, since researchers and teachers need the ability to acquire the right knowledge.

The ability to *work in an environment with high quality and inspiring people.* The one that shares knowledge is most certainly inspired by the subject as this is where they have knowledge and want to share it. So, for their field of expertise, it is inspiring to share and for the receiver to gain.

The third incentive is *earning a good salary, fringe benefits and pension*. It is an incentive to receive money for work.

The ability to *uncover knowledge gaps* from working with researchers outside of the ecosystem could also lead to tailored knowledge gaps, beneficial for universities and companies.

It is stimulating to *discover the practical application of research results.* Researchers/teachers work on various topics however they cannot always apply them in practice.

The last one for the researcher is *building status, known as a respected researcher in the field.* As knowledge-sharing broadens your network it can be an incentive to use knowledge-sharing to receive more respect as a researcher.

2.3.4 Companies

To be more specific about the general incentive to gain knowledge and skills in a company, it is the staff who acquires new skills and knowledge.

Within companies, an incentive is to *add value to the business* since new knowledge can be brought into the organization from outside. This results in three sub incentives. Firstly, *accessing new knowledge discoveries* from people outside the organization can add value through knowledge-sharing. Secondly, the ability to gain *insights into emerging technologies* by making use of, for example, students that are aware of these emerging technologies and can share their knowledge with the company in question. Thirdly, *stimulating innovation* in relation to the previous can be of benefit to get someone from outside the organization to look at a product/problem from another perspective with their knowledge. The latter could in return lead to the stimulation of innovation.

Another incentive to share knowledge for companies and businesses is *money* since new knowledge could lead to new business value or competitive advantage and thereby lead to more revenue.

Next, another incentive is to *receive access to qualified graduates* which can be for the future of the company since acquiring new knowledge, skills and talent is always an ongoing process. Furthermore, it adds up *contributions to product and service development* when knowledge is acquired from outside your business and as stated earlier look at it from another perspective.

2.3.5 Students

For students, a wide variety of incentives are applicable, and these highly depend on the individual. One of the incentives for knowledge-sharing is to *work on your future.* This incentive contains sub incentives which are defined as the *increase of practical skills, the increase of soft skills* and *the increase of personal networks.*

Next to that, students receive the *opportunity to apply theoretical knowledge in the real world* which they acquired as a student. This hands-on experience is where the real benefit is gained as this prepares the individual for the labour market.

2.4 Cohesive teams

UvA needs to have (de)centralized teams to achieve its set goals with divisions with good understanding of their tasks. A study conducted by Guilfoyle et al. (2012) showed that universities often struggle with heavy workloads due to imbalanced teams or non-efficient use of resources. In this study, multiple universities were researched. Close to all universities experienced difficulties in facilitating knowledge-sharing (for international students). Creating and maintaining several teams to increase the effective use of UvA resources and make teams balanced is based on aspects of the dissertation from Shaw (2019). We also cover the building and maintaining teams along with the role of leaders to facilitate cohesive team collaboration.

Shaw (2019) makes the distinction between two types of cohesion. Task-Oriented is about the degree to which teammates unite as a group to achieve a shared goal. Here every member is expected to carry out tasks within a group. The focus is on the task instead of relationships, bringing us to the Social-Oriented Cohesion. This type is about the bond within groups, members of this group thrive on social situations and are more relational oriented. In these groups, conflicts are reduced to a minimum (or extinct) and strong bonds are present. Now we discuss further the aspects of task-oriented and social-oriented cohesion methods as educational organizations consist of both perspectives.

2.4.1 Building teams

Universities should aim to create teams that can collaborate cohesively. It should look at several factors before any teams will get implemented in the first place. Constructing teams that will have a shared purpose is the first hurdle that UvA has to overcome. Goal setting is a mechanic that instructs team members on set goals (short and long-term), specific targets and timetables. The research conducted by Salas et al. (1999) provides a recommendation on how to approach this goal-setting procedure. It describes an *environment* where team

members need to be involved in the goal-setting procedure to get a better overview of how to achieve set goals. Having timely interventions where performance is assessed have been proven to work.

The second cornerstone of building cohesive teams lies in group size. For a group to be successful, a group size of five to seven members is preferred. However, depending on the type of group and goals, the group size has some freedom to differ from the set size. The reason why larger teams often fail to succeed can be explained due to members being overlooked. When there are tasks available to carry out, members with low confidence can more easily hide and walk away from their responsibilities. A common argument as to why members are neglecting their work is to avoid conflicts within the team. Thus, meaning that a member is acting conflict-avoidant to preserve team cohesion. In turn, the total team performance will be reduced drastically (Shaw, 2019). UvA, therefore, has to assess whether this phenomenon is occurring currently and decide if the current group size leads to optimal output.

2.4.2 Maintaining teams

Rigopoulou et al. (2012) describe that having a minimum clarity of roles will lead to negative results. To facilitate growth within a team, every individual member of the team must have a clear understanding of what their role is. According to Carbonell and Rodriguez-Escudero (2011) cohesion in teams can only be improved or maintained when every member of the team has a clear understanding of its tasks and responsibilities. To avoid members feeling undervalued it is important to pinpoint the rewards and outcome of a specific task for every member. To improve role clarity, there are several measures that an organization could undertake to improve the expectations of roles. Here, a continuous process of feedback is a possible way to improve clarity in tasks and responsibility (Nhundu, 1992).

2.4.3 Sense of belonging

The second way of maintaining teams is to give every member a sense of belonging. Members understand their strengths, weaknesses and believes and other teammates accept and adapt to the (lack of) competencies (von Treuer et al., 2013). It is necessary in the building phase of creating teams, that managers place people with non-clashing personalities together. However, sometimes it is impossible to have a clear understanding of the personality of every single person. Therefore, a manager could facilitate an *environment* that makes it easy for members to pay respect and gratitude for a team's variety and skills (von Treuer et al., 2013). A possible way to do this is to build trust or introduce feedback and clarity (Senécal et al., 2008).

2.4.4 Communication

The third part of maintaining a cohesive team is to improve cohesion. The leader must offer the resources necessary for communication. Enabling communication between members or manager to members will lead to better understanding. A better understanding will eventually lead to greater cohesion within teams or help with identifying possible issues early on. A way to improve communication is to meet. A team meeting will make communication between members more accessible and give every member the feeling of security (Smith et al., 2013).

2.4.5 Rewards

The last cornerstone of maintaining a cohesive team is rewards, to keep a team motivated. When a team achieves a result, the leader's responsible to award and thanks (Podsakoff et al., 1984), using intrinsic or extrinsic rewards.

3. Platform requirements

Since the platform for digital collaboration by Abcouwer and Takacs (2018) does not elaborate on the deeper system requirements necessary to establish team cohesiveness and knowledge sharing behaviour of all partners and teams within such a platform, this research focuses on bringing these to light. We aim that future work can build upon these suggestions, test them in practice, and validate their effectiveness.

Our research led to findings of five key requirements which a platform for lifelong learning and digital collaboration should meet to establish knowledge sharing behaviour and cohesive teams. These requirements and their sub-requirements are processed in table 1. To clarify the nature of each requirement, they will be explained using the proposed implementation of the system.

Table 1: Requirements of the lifelong learning and digital collaboration platform

ID	System requirements	Literature
R1	Goal setting	
R1a	Partners can formulate and share challenges requiring new knowledge	Koens, L. et al., 2018 Galan-Muros, V. & Davey, T., 2019
R1b	Shared formulation of short- and long-term goals (targets and timetables)	Salas et al., 1999
R1c	Clear division of the roles and responsibilities of every team member	Rigopoulou et al., 2012 Carbonell & Rodriguez-Escudero, 2011
R2	Construct cohesive teams	
R2a	Teams can be composed based on individual profiles	von Treuer et al., 2013
R2b	Every team member has a clear understanding of their role, tasks, and responsibilities at any given moment	Rigopoulou et al., 2012 Carbonell & Rodriguez-Escudero, 2011
R2c	de-emphasize hierarchy	Wang & Noe, 2010
R3	Personal & group development	
R3a	Feedback between team members.	Nhundu, 1992
R3b	Share and gain knowledge between networks with varying access rights	Galan-Muros, V. & Davey, T., 2019
R4	Effective communication	
R4a	Facilitate an environment where team members can pay respect and gratitude for a team's variety	von Treuer et al., 2013
R4b	Facilitate resources for team members to communicate with each other	Senécal et al., 2008 Smith et al., 2013
R4c	Share new ideas and facilitate learning from failure to enhance knowledge sharing	Taylor and Wright, 2004
R4d	Establish relationships between individuals, practice communities or social networks	Cross & Cummings, 2004; Chen, 2007; Wang & Noe, 2010; Galan-Muros, V. & Davey, T., 2019)
R5	Honest value distribution	
R5a	Possibilities to reward team members in return for shared knowledge, project efforts, tailored to individual needs.	Podsakoff et al., 1984
R5b	Honest value distribution based on input while preventing a competitive climate	Carbonell & Rodriguez-Escudero, 2011 Schepers & Van den Berg, 2007; Ferrin and Dirks, 2003; Constant et al., 1994)

3.1 Suggested system

The system should allow any participant of the ecosystem to share challenges that require new knowledge. It should make these challenges become visible to other participants (R1a) and allow the person who adds the challenge to formulate the knowledge, skills and resources required (if these are known) so that others can estimate whether or not it suits their profile (R2).

Second, the system should allow other members of the ecosystem to browse easily through challenges, based on their interests (R2). If participants want to join a project, they apply through elaborating on their profiles (R2a). What motivates someone to join the project? What knowledge and skills they bring to the table? What strengths and weaknesses they have? Other team members can estimate their inputs and competencies, enabling the team to stay balanced. Furthermore, this will give the applicant the feeling others accept them and will adapt to their competencies, which is essential for establishing a sense of belonging and dedication to the project (R2).

Third, if the team is formed, the system should facilitate that all team members are involved in setting goals such as timetables and overall objectives on both team and personal levels (R1b). The system should allow members insight into their personal tasks and responsibilities (R2b). The latter establishes cohesion and motivation. Furthermore, it should de-emphasize hierarchy, and consider every team member equally important in the group process (R2c).

Fourth is agreeing on an honest value distribution. The system must facilitate and document an honest value distribution in return for any shared knowledge or project efforts (R5b). Rewards can take various forms but are essential to agree on upfront. Possibilities are receiving knowledge in return or asking for knowledge at another time, receiving money in return where the amount is based on the knowledge and the time consumed for the sharing of knowledge, receiving back credits to be used later for the gain of knowledge at peers, and a cooperative reward system based on team effort. A considerable challenge is that the system needs to find balance between rewarding participants relative to their efforts while preventing a competitive climate (R5b). Consequently, the system should include a reward functionality that allows balance between the team and individual rewards.

During the goal-setting phase, it is also essential to agree upon knowledge ownership. Those receiving knowledge should always handle it correctly. The system should prevent knowledge share with third parties without arrangement with the knowledge owner (R5b). The perception that one owns knowledge enhances the likeability participants also share knowledge. Knowledge ownership therefore is a primary facilitating feature. Everything that is agreed upon has to be documented by the system and monitored by all members.

Fifth, the system should stimulate the development of trust, and feelings of belonging through offering possibilities to pay gratitude and respect for certain accomplishments, a team's variety, or an individual's skills (R4a). Developing effective channels for communication (R4b), sharing ideas or knowledge (R4c), and building relationships in the ecosystem and sharing relevant knowledge with partners (R4d). Besides, team members could give each other feedback to help professional development (R3a).

Lastly, the system should allow all participants in the system to learn by doing research and sharing new knowledge (R3b). The developments around these challenges could potentially lead to new courses, services or products that accurately address relevant challenges in society. The role of the system in sharing this knowledge and fostering the development of relationships between partners and communities of knowledge can be considered in multiple ways. The system could be used as storage for all knowledge and register for all professional relationships. However, existing frameworks or architectures can also be used to provide these functionalities. In the latter case, the system would solely refer to the location of certain knowledge or information.

4. Limitations & future work

This research should be considered an exploratory study. Given the sheer size of the research domain, relevant concepts may have been overlooked. This could mean other focus areas apart from, knowledge-sharing incentives and constructing cohesive teams can lead to additional requirements for knowledge-sharing initiatives. Future research could focus on including more topics and encompassing them in a single framework.

Our presented results should be looked at as a basis, and framework with insights, suggestions and critical questions to consider when designing a knowledge-sharing ecosystem. This research proposes a possible way to encompass this in a knowledge-sharing platform, but other, more feasible ways might exist which are not considered in this paper. Future research could identify and test other ways of facilitating knowledge-sharing in a digital platform for collaboration and lifelong learning.

Furthermore, the research does not come with a final design of a platform but merely provides suggestions of what a possible platform could look like, this suggestion can function as the basis for future research and it should be tested to validate its effectiveness in light of lifelong learning.

5. Conclusion

This research focused on identifying incentives and requirements for potential partners in the UvA's ecosystem to participate in a platform for digital collaboration and lifelong learning. To provide an answer to the formulated problem statement, this research provides potential members, incentives of these members, identified system requirements, and suggestions for the development of such an ecosystem.

We advise the university to initiate the development of such an ecosystem or incorporate the presented insights and elements into existing initiatives. Furthermore, since previous literature highlighted the relevance of showing support, and encouraging staff to participate in knowledge sharing, and lifelong learning initiatives, we advise to stimulate employees to participate in such initiatives and include their insights into current curricula, or new courses. This would not only benefit the professional development of the employees, but it would also allow the institute to better fulfil its valorisation responsibility. Besides, the university would contribute to educating a workforce that is resilient, and adaptive to future developments in society.

Finally, this research raised some important questions that should be considered while developing a platform for digital collaboration and lifelong learning. First and foremost, consider the balance between dividing value based on effort, and the necessity to prevent creating a competitive climate. Second, how to ensure an honest value distribution in such an environment. Third, who owns the knowledge in a situation with varying efforts or input of resources. Fourth, where to keep knowledge and one gain access to the knowledge. Fifth, how to keep the platform alive and members engaged. We believe that to receive answer to these challenges, one first needs to accept that such a platform will never be perfect upfront. We encourage our university to accept it, start shaping a minimum viable product and perform iterations to come to the desired outcome.

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Does the level of Intellectual Capital Affect Meeting the Information Needs of Social Media Users in the Field of Sustainability? The case of the World's Largest Energy Industry Companies

Łukasz Bryl[1], Justyna Fijałkowska[2] and Dominika Hadro[3]
[1]Poznan University of Economics and Business, Poznań, Poland
[2]University of Social Sciences, Łodz, Poland
[3]Wrocław University of Economics and Business, Wrocław, Poland
lukasz.bryl@ue.poznan.pl
dominika.hadro@ue.wroc.pl
jfilalkowska@san.edu.pl

Abstract: It is increasingly essential for companies to communicate appropriately about sustainability. In today's world, with the massive spread of social media's popularity as a critical communication channel, sustainability is also present in the Internet disclosure practices of many enterprises. It is also presumed that firms' intellectual capital (IC) plays a vital role in the quality of corporate disclosure. Our paper aims to explore to what extent disclosure practices of firms via social media fulfill the needs of stakeholders for information related to sustainability. We also test how IC impacts this disclosure. We analyze tweets of the world's largest energy industry companies to assess if this disclosure meets the stakeholders' expectations regarding sustainability topics. Using a common measure of IC, we also check whether its level determines sustainability disclosure. This study provides several contributions to the literature. The findings may help understand companies' responsiveness to sustainability information needs. The chief contribution also lies in its focus on how the IC level influences the sustainability disclosure practices via social media. The findings may have implications for organizations in creating and using social media channels when developing a dialogue with stakeholders on topics regarding sustainability. Conclusions also provide new insight on IC's importance in corporate disclosure practices on sustainability.

Keywords: sustainability, disclosure, intellectual capital, social media, Twitter

1. Introduction

The public has never been more engaged in the current debate about the growing importance of sustainability concerning the society, the economy, and the environment. Consequently, the corporate disclosure of sustainability has steadily increased its relevance and perception by stakeholders over the last years. Additionally, in today's world, the communication of companies with their stakeholders has changed significantly. The rapid transformation in technologies and forces of mass communication, together with digitization, provide challenges and opportunities for companies concerning information disclosure and dialogue with stakeholders (Bryl, et al., 2021). Evolutions in technology and the way society communicates are shifting reporting practices from traditional media to online channels, such as websites, Facebook, and Twitter (Lombardi & Dumay 2017). Also, sustainability disclosure is continuously more present in the dynamic social media sphere.

We aim to understand what the companies disclose on sustainability via social media and if the information published is appropriately adjusted to the information needs of its recipients. We assess the content of tweets of energy industry companies to compare it with the stakeholders' expectations regarding sustainability in this specific industry. The stakeholders' needs were determined with the help of the GRI Report (2013), addressing the sustainability reporting needs of the given industry. We base our study on the legitimacy theory, stakeholders' theory, and signaling theory. We also indicate the intellectual capital (IC) as the relevant variable for sustainability disclosure. Drawing on resource-based theory (Penrose 1959), we consider the companies with high IC as those that possess knowledge and awareness together with capabilities that prone them towards better communication with their stakeholders in the sphere of social, environmental, and governance goals. Therefore, the second aim of this paper is to check how the level of IC impacts sustainability disclosure.

The energy sector has been chosen as it devours an inherent responsibility to realize a sustainable world. On the one hand, energy utilities have long played a vital role in the energy transition by contributing to a secure energy supply and decarbonization; this sector is expected to secure the affordable, reliable, and sustainable energy supply to end extreme poverty and promote shared prosperity. On the other hand, practices of some actors in the energy sector, together with the over-reliance on greenhouse gas-intensive fossil fuels, undermine global

efforts to mitigate climate change and maintain healthy ecosystems and populations, which can exacerbate worldwide conflict and inequality. Therefore, the chosen sector is particularly significant in the discourse of sustainability.

This study makes several inputs to the literature. It contributes to enriching the theory with sectoral-sensitive analysis concerning sustainability disclosure. The findings may help to understand what components of sustainability disclosure are perceived by companies as the most important to be communicated to stakeholders and if they match the information needs of their addresses. The results have implications for organizations in creating and using communication channels when developing a dialogue with stakeholders on topics regarding sustainability. They might also be of interest to the regulators of non-financial information.

Despite the increasing importance of sustainability reporting worldwide, to the best of our knowledge, there is currently just one study by Bananuka et al. (2021) that has linked IC and its components to sustainability reporting. Our research extends this analysis to the disclosure in social media. Studies on whether the information needs of the recipients of information disclosed by companies on sustainability are also scarce. Given the lack of prior research in these two fields, our study aims at covering this niche.

The article is structured as follows: the first section presents a background and literature review, allowing the formulation of research questions. The second section describes the sample, data collection, and methodology. The third part shows the results and discussion, followed by conclusions.

2. Background and literature review

2.1 Sustainability disclosure and social media

Sustainability disclosure gives way to the organization to convey the organization's short-term and long-term vision and strategies to the stakeholders. Consequently, it has the potential to show how the value is created. By realizing economic, environmental, and social information, the organization may communicate with various potential parties, including suppliers, creditors, activist groups, the government, the media, customers, and the general public (Saxton et al., 2019). Sustainability disclosure, therefore, reduces information asymmetry and helps gain a competitive advantage and reputation that lead to value maximization (Bae et al., 2018). During the last decade, the transformation brought by digital and technological advances has made organizations undergo a thorough overhaul of communication with their stakeholders. Traditionally, corporate annual reports were considered the primary source for communicating the organizational performance to their stakeholders (Hadro et al., 2021). However, in the last decades, social media has disrupted the firms' reporting field by providing a more dynamic and interactive public space (Neu et al., 2020). Social media can be a powerful communication resource for sustainability and may provide potentially efficient means for sharing sustainability-related information and engaging stakeholders in sustainability discussions. The appropriate communication of sustainability activities is necessary for companies to achieve credibility and legitimize their actions. Social media has created new possibilities for organizations to engage in conversations with their stakeholders and receive real-time feedback on organizational announcements (Manetti et al., 2017).

Consequently, companies are increasingly using the internet to disseminate sustainability information as it enables them to engage with a broader range of stakeholders on a timely basis (Lodhia 2018). Social media have given a chance to organizations to disseminate reliable and consistent information, meet the public's expectations, and earn public trust. However, the information released should be adjusted to the information needs of their uses specific to the industries to which the company belongs.

2.2 Stakeholders' information needs

Business stakeholders such as suppliers, customers, and investors are the main drivers for communicating sustainability credentials (Thijssens et al. 2016). Companies face increasing pressure from stakeholders to adopt sustainable behavior and provide an adequate representation of sustainability practices (Raimo et al., 2021). Most existing sustainability disclosure is voluntary, which means that individual issuers choose which information to disclose. The resulting lack of standardization means that disclosures vary substantially, which raises the issue of to which extent this disclosure meets the information needs of its recipients. The increasing importance placed on sustainability worldwide has contributed to focusing attention on the specific shareholders' information needs. It is essential to underline that the stakeholders are not a homogeneous group. Therefore, the information needs of investors and other stakeholders differ in their focus on different aspects

of an organization's activities and on different types of information (de Villiers & Sharma 2020). Different stakeholder groups typically have other objectives in seeking corporate information (Adhariani & de Villiers 2019). Companies are expected to report extensively on all critical aspects of sustainability while ensuring that they do not subordinate the interests of groups that have specific expectations and information needs (Naynar 2016). Identifying potentially material topics by sector or industry is fundamental for high-quality sustainability reporting, both for organizations that report and for users of the reports, and aids other management activities that aim to evaluate companies' sustainability performance (GRI 2013). To meet the information expectations, it is necessary to get acquainted with them. The report prepared by the Global Reporting Initiative (GRI) (2013) can provide companies with the essential help. GRI is a not-for-profit organization that promotes the use of sustainability reporting as a way for organizations to become more sustainable and contribute to a sustainable global economy. The report of GRI (2013) provides an international reference list of relevant sustainability topics, considering the different stakeholders' perspectives of particular sectors. Based on the previous, we formulate the following two research questions:

RQ1: What sustainability topics disclose companies from the energy industry on Twitter?
RQ2: To what extent do corporate disclosure practices in the energy industry meet the information needs of their stakeholders?

2.3 IC and sustainability disclosure

Even though there is no generally accepted definition of intellectual capital (IC), there is a consensus concerning the fact that IC is important as a factor in the achievement of organizational objectives (Striukova, Unerman & Guthrie 2008). In this paper, we refer to the understanding of IC as the "intellectual material, knowledge, experience, intellectual property and information that can be put to use to create value" Dumay (2016). IC can be utilized by management to take a longer-term perspective of organizational strategy and provide information to financial stakeholders (De Villiers and Sharma 2020). Intellectual capital is one of the prominent features in the current era, the era of the knowledge revolution and the revolution of smart technologies. The use of data and technology requires specific knowledge and skills embedded in intellectual capital (Juric, 2020). This is the first motive that makes us assume the relation between a high level of IC and social media disclosure on sustainability. The relationship between the IC and the idea of sustainability and their mutual influence was underlined from the theoretical perspective in the existing literature (e.g. Sułkowski & Fijałkowska 2013). Empirical research usually tries to verify how much of intellectual capital is disclosed through sustainability disclosure (e.g., Bronzetti et al., 2013). Other studies document the determinants of sustainability disclosure. Still, these are limited to company characteristics such as firm size and age, firm nationality, industry type, ownership structure, corporate governance, reporting language, auditor type, profitability, growth, media visibility, and GRI usage (e.g. Manetti and Bellucci, 2016; Dienes et al., 2016).

In this paper, we take a different approach. We follow Bananuka et al. (2021), indicating that in a situation where the firm's total intangible and knowledge-related resources useful for value creation are low, it is likely that sustainability reporting practices will also be low. Firms with low levels of IC continue to exert meager and simple disclosure, usually exclusively obligatory, because of a lack of competencies, recognition of the need, and resources required to prepare more sophisticated sustainability disclosure. To prepare disclosure on sustainability, the company needs knowledgeable, skilled, and motivated employees, appropriate systems and databases as well as relationships between firm workers and other stakeholders capable of smooth information acquisition, elaboration, and sharing. All these are crucial elements of IC. Therefore, IC may be treated as an important moderator of sustainability disclosure. Consequently, de Villiers and Sharma (2020) underline that IC is an essential element in preparing sustainability reports. Also, Massaro et al. (2018) provide evidence of the interconnection between IC and sustainability and suggest it is hard to separate the two.

Considering the above, we expect that the level of IC may determine the sustainability disclosure. This topic is a research niche. The only existing studies indicate some components of IC influence sustainability reporting. The latest survey by Bananuka et al. (2021) based on a questionnaire investigates whether IC elements (human, structural and relational capital) affect sustainability reporting practices of financial services in Uganda. They find that human capital and relational capital elements are the resources that can better explain the variances in sustainability reporting practices. With this research, we add to the previous analysis of Bananuka et al. (2021), which is believed to be the first study examining how IC affects sustainability reporting practices. We extend their research to sustainability disclosure in social media. We also place our study in the international context and other sectors. Our study also applies a different methodology that focuses on analyzing the text disclosed.

With this research, we add to the previous analysis of Bananuka et al. (2021). Considering theoretical premises, we formulate the third research question:

RQ3: How does intellectual capital impact the extent of sustainability disclosure on Twitter?

3. Sample, data collection, and methodology

3.1 Sample and data collection

To analyze the main topics related to sustainability that companies disclose on social media, we focused our research on the top 32 companies from the Fortune 500 ranking in the energy industry for the year 2021. We decided to investigate the world's largest business corporations in this sector based on their revenue in descending order. Hence, we followed Xiong *et al*. (2019), who found that company size affects how companies adopt Twitter in their communication. Generally, smaller companies with limited resources tend to use Twitter less and, if so, mainly for one-way communication. We also decided to exclude Chinese companies from our research since studies suggest Chinese companies barely use English profiles on Twitter for corporate purposes (Bryl 2021). The main features of our sample are presented in the table below.

Table 1: Descriptive statistics of the studied sample

No. of companies	32
National context	US (10), Germany (2), Brazil (2), India (2), UK (2), Italy (2), Spain (2), France (2), Saudi Arabia (1), Norway (1), Finland (1), Switzerland (1), Russia (1), Malaysia (1), Austria (1), Australia (1)
Tweets	
Total	17 876
Mean	558,6
Median	329,5
Min.	22
Max.	2 521

Source: Own elaboration

To collect data on tweets, we used a dedicated R script (Rtweet) that employed the official Twitter API to download tweets from corporate profiles for the entire year 2021. We concentrated only on the official English language profiles of the companies. The Twitter accounts of each company were identified and manually validated to eliminate false corporate profiles. We excluded brands and sub-brands profiles of the studied company. Finally, we gathered 17 876 tweets, an average of almost 559 tweets per company.

3.2 Methodology

To determine the disclosure on sustainability (to answer RQ1 and RQ3), we adopted the keywords/keyphrases approach. Keywords/keyphrases were defined as either a separate word (leakages), an abbreviation (HR), or a phrase (emission to air) multiplied by various verbal expression forms.

With the help of Kripendorff's (2004) rules for content analysis, a single tweet containing only text was defined as the unit of our research. Because a single tweet could potentially encompass more than one item referring to sustainability, we developed a concept of sustainability mention that was depicted as any information related to sustainability within a separate tweet. Consequently, we managed to identify several sustainability mentions in various categories in a single tweet. As a result, we anticipated that the total number of sustainability mentions would outnumber the total number of tweets related to sustainability topics. We erased pictures, videos, and/or external links from tweets to concentrate only on the textual content. To identify the sustainability keywords, we applied the Global Reporting Initiative (GRI) report: "Sustainability Topics for Sectors: What do stakeholders want to know?" which defines the most important topics for stakeholders in the given industries. We follow the research of GRI (2013), in which this institution conducted a questionnaire among 94 organizations related to the different stakeholder groups. This research generated 2812 topics that were related to 52 business activity groups. As a result, the 1612 unique topics have been identified through this process. A special section was dedicated to the energy sector. It lists all the material issues that the users of information concerning this sector expect about sustainability disclosure. The table below shows the most relevant topics for stakeholders in the energy industry companies based on GRI (2013).

Table 2: Sustainability topics most desired in the energy industry according to GRI

Category	Topic
Economic	Carbon abatement and offsetting
	Payments to government
	Strategy to address risks and opportunities from climate change
	Tendering processes
	Indirect economic impacts
	Local employment
	Local supply chain
Environment	Energy efficiency of end products & Energy efficiency of operations
	Water management
	Water withdrawal
	Water pollution
	Biodiversity and ecosystem services (BES) impact management
	Emissions to air
	Leakages
	Oil/gas spills
	Tailings waste
	Fires and explosions
	Remediation, reclamation and decommissioning
Social	Employment practices
	Labor management
	Occupational health and safety management
	Employment practices
	Migrant workers
	Impacts on local communities
	Local community resettlement
	Public policy positions and lobbying
	Corruption
	Risks and conflicts with local communities and indigenous peoples
	Human rights impacts
	Security practices in sensitive and/or conflict-affected areas
	Water use rights
	Fuel quality
	Eco-efficient technological innovation
	Emergency preparedness
	Process safety and asset integrity
Other	Renewable energy technology
	Corporate governance
	Oil and gas reserves
	Biofuel production
	Emergency management system
	Near accidents management
	Political accountability
	Unconventional and hard-to-access oil/gas reserves exploitation

Source: GRI, 2013

Based on the GRI report (2013), we developed a set of 86 keywords related to sustainability divided into four main categories (Environment, Economic, Social, and Others), which are most relevant for energy industry companies. We created an Excel spreadsheet that included a set of tweets for a given company. With the help of Excel formulas, we automated the process of searching tweets for keywords. A random manual double-check was performed to avoid any potential research mistakes.

To overcome the limitation of a small sample and to find the answer for our RQ3, we employed a QCA method, which has been lately more widely used in management and finance studies (Mastrangelo et al., 2019). QCA is a set-theoretic method that uses sets and searches for set relations to form concepts and formulate casual relations between social phenomena applying Boolean algebra rules (Schneider & Wagemann 2012). QCA is based on configuration analyses (also referring to conjunctural causation in set theory) (Schneider & Wagemann 2012), assuming that different conditions can cause the occurrence and absence of an outcome (Greckhamer et al. 2018). We use fs/QCA software to run QCA analysis. Fs/QCA uses the Quine-McCluskey algorithm with the simplification rules of Boolean expressions to determine configurations that are sufficient or necessary conditions for specific levels of an outcome (Fiss 2007; Schneider & Wagemann 2012). Finally, the QCA analysis results for each outcome are presented as models with the degree of consistency and coverage. Consistency is defined as the degree to which empirical evidence is consistent with the set-theoretic relation in question (Rihoux & Ragin 2008). At the same time, coverage can be interpreted as a numeric expression for the empirical importance (sufficiency) and relevance (necessity) of a given condition (or a combination) for producing an outcome (Schneider & Wagemann 2012). The formulas expressing consistency and coverage are as follows (Rihoux & Ragin 2008):

$$Consistency\ (X_i \leq Y_i) = \frac{\sum(\min(X_i, Y_i))}{\sum(X_i)} \quad (1)$$

$$Coverage\ (X_i \leq Y_i) = \frac{\sum(\min(X_i, Y_i))}{\sum(Y_i)} \quad (2)$$

Where min indicates the selection of the lower out of two values, X_i represents membership scores in a combination of conditions, and Y_i represents membership scores in the outcome.
To apply QCA analysis with our data, we used models described by the following equation:

$$y = f(x_1, x_2, x_3, x_4) \quad (3)$$

We run five models with the same four conditions (x_1, …, x_4). As outcomes (y), we defined five dependent variables representing the ratio of sustainability intensity and five sustainability topics in the companies' tweets (Tweets sustainability intensity, Environment, Economic, Social, Other mentions intensity). As a condition, there is an explanatory variable in each model - Intellectual Capital (IC) measured as market value to book value (MV/BV). Based on the literature review, we also added three control variables: company profitability (EBIT/equity), company size (value of assets), and leverage (debt/assets).

4. Results and discussion

To answer RQ 1, we first investigated the intensity of tweets containing the sustainability items and the division into the four sustainability categories. In 2021, a total of 7 669 sustainability tweets were published, which made an average of 239 sustainability tweets per company. Hence, we argue that sustainability is an important theme in corporate disclosure practices on social media since almost half of the published tweets referred to sustainability (mean score of 0.47) (Table 3).

Table 3: Sustainability topics' intensity in tweets

	Tweets			Mentions				
	Total	Sustainability	Sustainability intensity	Environment	Economic	Social	Other	Total
AngloAmerican	458	147	0,32	56	48	91	18	213
Aramco	201	98	0,49	79	20	30	7	136
BHP	410	134	0,33	68	34	79	16	197
BPC Limited	1800	356	0,20	206	21	186	64	477
Centricapls	276	139	0,50	106	47	36	29	218
Chevron	524	145	0,28	83	72	40	31	226
Enbridge	695	317	0,46	162	54	182	63	461
Enel group	703	425	0,60	220	128	106	200	654
Energy Transfer	603	419	0,69	335	64	138	44	581
Engie	1053	553	0,53	292	313	144	167	916
Eni	835	263	0,31	141	103	104	68	416
Eprod	126	52	0,41	43	2	7	1	53
Equinoir	115	72	0,63	57	26	10	25	118
Exelon	509	305	0,60	162	48	223	24	457
ExxonMobil	116	83	0,72	72	34	17	5	128
Flameoftruth	2521	389	0,15	118	46	370	71	605
Fortum	91	61	0,67	47	26	13	16	102
Gazprom	248	40	0,16	16	5	8	18	47
Glencore	526	252	0,48	92	140	159	33	424
Iberdrola	1198	793	0,66	582	118	207	652	1559
Marathon Petroleum	346	151	0,44	31	22	132	19	204
Petrobras	22	12	0,55	11	4	3	1	19
Petronas	101	28	0,28	18	4	15	4	41
Philips	246	141	0,57	84	24	83	21	212
Repsol	224	129	0,58	107	40	28	46	221
RioTinto	185	96	0,52	40	42	40	16	138
Shell	162	94	0,58	80	28	9	34	151
Siemens Energy	313	159	0,51	115	34	49	39	237
Total Energies	1267	409	0,32	269	144	123	183	719
Uniper	1689	1284	0,76	1132	288	264	217	1901
Vale	192	80	0,42	17	18	60	14	109
Valero	121	43	0,36	9	8	43	12	72
Total	**17 876**	**7 669**	**0,47***	**4 850**	**2 005**	**2 999**	**2 158**	**12 012**

*mean value
Source: Own elaboration

We observed that tweets containing topics related to sustainability (tweets sustainability intensity) are relatively numerous. On average, 47% of all tweets of the world's largest energy companies include at least one sustainability topic. Although the tweets' sustainability intensity performed a visible variance, we did not identify a company that does not disclose anything on sustainability via tweets. In addition, the lowest tweets' sustainability intensity amounted to 0,15, which still suggests that sustainability topics are not entirely neglected even in the case of that single company (Flame of Truth). Considering the sustainability categories breakdown, the most often disclosed themes related to the environment (40%), followed by the social topics (27,9%). Details are presented in the table below.

Table 4: Summary of the sustainability disclosure in tweets

	Total	Share (%)	Mean	Median	Min	Max
Environment	4 850	40	151,6	83,5	9	1 132
Economic	2 005	17,4	62,7	37,0	2	313
Social	2 999	27,9	93,7	69,5	3	370
Other	2 158	14,6	67,4	27,0	1	652
Total	12 012	100	375,4	215,5	19	1 901

Source: Own elaboration

Concerning RQ2, first, we identified the sustainability topics of the most significant interest expressed by the stakeholders of the energy industry outlined in the GRI report (Table 2). Secondly, we identified the most frequently disclosed topics based on the set of previously developed keywords, and finally, we compared these two sets of data. The results are presented in the figure below.

The three most often topics disclosed via Twitter were not classified into one main sustainability category. In fact, these topics belonged to the Environment (Energy efficiency of end products & Energy efficiency of operations), the Other (Renewable energy technology), and the Social (Carbon abatement and offsetting) category, respectively. Comparing the broad spectrum of topics expected by the stakeholders, we state that, on average, companies address the needs for sustainability information relatively well; however, there is still a great potential for improvement. We observed that the companies entirely neglected some topics, i.e., none of the studied companies disclosed on Twitter topics related to oil/gas exploitation, political accountability, fuel quality, water use rights, local community resettlement, fires, explosions, leakages, local supply chain and tendering processes. In general, these topics have rather negative content, and therefore disclosing them may put companies in a negative light. Consequently, we conclude that disclosing sustainability on Twitter is not free of greenwashing corporate practices.

To answer RQ3, we use Qualitative Comparative Analysis to find casual relations in our sample. Results of five logical models confirm that Intellectual Capital is relevant for sustainability disclosure on Twitter for energy industry companies. We look at five models for the Sustainability intensity, Environment, Economic, Social, and Other topics intensity outcomes. We obtain equifinality (alternative factors that can produce the same outcome) in our models, thanks to QCA, which indicates that more than one set of variables explains a specific outcome (Fainshmidt et al. 2020). The results of the QCA method are presented in Table 5.



Figure 1: Sustainability posts on Twitter in 2021 (sustainability topics - keywords counts)

Source: Own elaboration

In each model, IC is a relevant driver for the level of sustainable topics disclosure on Twitter. The study results align with the resource-based view theory, which suggests that organizations with resources like IC that are not imitable, substitutable, and rare have a competitive advantage over those without. This result also goes in line with legitimacy theory, stakeholders' theory, and signaling theory. Moreover, it is also consistent with a few existing empirical studies in this field (Bananuka, 2021, Yusoff et al., 2019). Our study, however, goes further. We find that IC does not constantly influence positively dependent variables. For models with Sustainability intensity and Environment dependent variables, solutions without IC are also present. Sustainability intensity and Environment models solutions' paths include similar sets of conditions. IC influenced disclosure of sustainability and environmental topics on Twitter positively if companies are both large and with low leverage. Disclosure related to sustainable topics, in general, is more frequent for companies with a lower level of IC if they are smaller or in the worst financial situation, less profitable, and with higher leverage. Likewise, when the

value of IC is lower, separately as two solutions, small companies and those highly in debt tend to communicate more about environmental issues. There are two solution paths for the Economic disclosure model that include IC as a relevant variable. Companies with higher IC tweet more about Economic topics if they are greater, less profitable, and have lower leverage.

In contrast, the group of companies that disclose less about that topic is characterized by a lower level of IC and profitability but is larger. There is only one solution regarding Social disclosure, where there are more tweets of companies with higher IC but smaller in size and with lower leverage. In the model, in reference to topics classified as Other, our research confirms that the companies that are more active on Twitter are the ones with a lower level of IC but, at the same time larger and less profitable.

Table 5: QCA results

Sustainabilityintensity = f(IC, Profitability, Size, Leverage)			
	raw coverage	unique coverage	consistency
~IC*~Size	0.703617	0.0565928	0.799735
~Size*Leverage	0.62077	0.021587	0.819723
~IC*~Profitability*Leverage	0.576429	0.042007	0.859131
IC*Size*~Leverage	0.348891	0.0484248	0.811398
solution coverage: 0.831972			
solution consistency: 0.726439			
Environment = f(IC, Profitability, Size, Leverage)			
	raw coverage	unique coverage	consistency
~IC*~Size	0.750477	0.0528326	0.78183
~IC*~Profitability	0.711012	0.0171865	0.771409
~Size*Leverage	0.651178	0.0337365	0.788135
IC*Size*~Leverage	0.401655	0.0401018	0.856174
~Profitability*~Leverage	0.582432	0.00190961	0.793582
solution coverage: 0.931891			
solution consistency: 0.71345			
Economic = f(IC, Profitability, Size, Leverage)			
IC*~Profitability*Size*~Leverage	0.380703	0.0882573	0.804107
~IC*~Profitability*Size*Leverage	0.468212	0.175767	0.865837
solution coverage: 0.55647			
solution consistency: 0.835955			
Social = f(IC, Profitability, Size, Leverage)			
IC*~Size*~Leverage	0.604106	0.604106	0.826479
solution coverage: 0.604106			
solution consistency: 0.826479			
Other = f(IC, Profitability, Size, Leverage)			
~IC*~Profitability*Size	0.573964	0.573964	0.827292
solution coverage: 0.573964			
solution consistency: 0.827292			

Where: ~ indicates the absence of a condition, no variable means that a condition is not relevant for the particular solution

Source: own elaboration based on fs/QCA software

5. Conclusion

The universe of social media is vast and growing. Social media platforms have created an impressive field for interactive communication among all actors taking part in sustainability activities. The first central thesis of this article is that the non-financial disclosure should satisfy the information needs of its stakeholders. The second states that intellectual capital determines this disclosure. The analysis results indicate that sustainability is an important topic in social media disclosure practices. All the companies in our sample tweet about sustainability issues. Out of all tweets on any possible topic, almost half of them include sustainability topics. Certain topics

are pmore relevant among tweeters' preparers. These include environmental and social issues. Analyzing in-depth the information needs of the addressees of the information disclosed by the company concerning a particular industry, we notice that these needs are not entirely fulfilled in many areas. This is especially true in those areas where there is stakeholder interest, but disclosure of information might not be beneficial to the company. This allows us to conclude that companies opportunistically select information to present to their users in such a way as to create a positive image of themselves and do not necessarily care about preserving the principle of delivering relevant and material information. This situation disturbs the principle of transparency and accountability. It also raises suspicion of greenwashing practices.

Regarding intellectual capital and its role as a determinant of sustainability disclosure, we can partially conclude similarly to the work of Bananuka et al. (2021). Intellectual capital is relevant for sustainability disclosure on Twitter for energy industry companies, that was confirmed by five logical models of QCA. However, its influence is not always positive; it depends on companies' financial characteristics and sustainability topics. Social media provide opportunities for dynamic engagement online. They also contribute to creating a sustainable world where each voice will be heard and acknowledged. Undoubtedly, online and mobile communication channels are expanding and should not be ignored by companies on any topic, including the one referring to sustainability.

The only concern is that the information disclosed through the use of these modern and attractive communication methods presents information tailored to the needs of its users rather than selectively and opportunistically tailored to the needs of the company that publishes it. The results of this research imply that to improve sustainability disclosure practices, emphasis should be put on understanding the information needs of addresses and better use of social media as they offer a unique platform for communication exchange and dialogue. The IC is also an important moderator of the disclosure; therefore, in order to take advantage of the social media potential and create and use an appropriate communication platform and thus keep stakeholders informed, it is vital to develop corporate IC. This study contributes to and extends the existing literature on sustainability disclosure practices, but it is limited to the world's largest energy industry companies. Future research may involve other sectors with larger samples to validate our results.

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Role of Managers in Stimulating Innovativeness of Employees in Enterprises

Felicjan Bylok
Czestochowa University of Technology, Czestochowa, Poland
felicjan.bylok@pcz.pl

Abstract. The process of creating knowledge and innovation is becoming a significant challenge for enterprises operating on both international and domestic markets. A key factor that has an impact on this process refers to the actions of managers on behalf of creating an environment that is favourable towards the innovativeness of employees. A significant task for managers is to initiate, support and control the innovative activities of employees. By assuming that managers have a significant impact on the process of creating knowledge and innovation in enterprises, this facilitated the formulation of the research objective, which was to search for the answers to the following two research questions: What relationships exist between manager traits and employee innovativeness in enterprises? To what extent do leadership attributes influence creating an innovative organizational climate in enterprises? The assumed goal was executed due to the application of the method of critical analysis of literary sources and the survey method. The empirical research conducted among 179 enterprises from the list of 500 largest enterprises in Poland was conducted in 2019 with the aid of a standardized survey questionnaire using the techniques of CATI and CAWI. As a result of the research, statistically significant relations were discovered between the features of managers and the level of innovation and knowledge in the analysed enterprises. Their positive impact on the innovative environment was illustrated. The research findings acquired provide knowledge about the role of managers in terms of stimulating the innovative behaviour of employees.

Keywords: Leadership, innovativeness, Innovative organizational climate, enterprise.

1. Introduction

Contemporary enterprises, operating in a competitive environment characterized by globalization, short product life cycles, and rapid technological changes, are forced to adapt quickly and effectively to market requirements. Innovation is a key enabler for companies to face the complexity and uncertainty of economic reality. As an attribute of an enterprise, innovativeness indicates the ability of a company to generate and market new organizational, marketing, and product solutions. By innovating, an enterprise can create and meet new customer needs, and develop business models, operating strategies, and business processes. Organizations capable of creating innovation-friendly work environment can achieve a sustainable competitive advantage in innovation (Bammens 2016). Given that innovativeness is crucial for businesses, it is important to identify the factors that can stimulate innovation. One of the important determinants of innovativeness is leadership focused on employees' innovative behavior. It requires managers to develop new competencies to support innovation.

This paper develops new theoretical and empirical insights on the impact of leadership on employee innovativeness. The study sought to make two major contributions to the understanding of the role of managers in building an innovation climate. First, the study contributed to highlighting the role of manager traits in stimulating organizational processes focused on knowledge creation and innovation. Second, the study identified the impact of leadership attributes at the individual, group, and organizational levels on an innovation climate and business growth.

2. Theoretical Background

The development of enterprises and their competitive position on the market depends increasingly on their innovative activity. Among many definitions of innovation, the broad definition of " Innovation in general terms is the creation and adoption of new knowledge to improve the value of products, processes, and services" (Ozorhon et al., 2010, p.1) seems to be the most accurate. Therefore, innovation is a complex and multidimensional process of improving products and services, new methods of production, supply, distribution, and new organizational and work forms and practices. Innovation is an essential means to business success (Evanschitzky et al., 2012). Many factors have an effect on the innovative activity of enterprises, including R&D expenditures, company size, a form of ownership, level of competition, etc. (Kurpayanidi 2018). Important determinants of organizational innovation include the climate within the organization, which can have a constructive effect on innovation at individual and organizational levels (Shanker et al., 2017).

In a company focused on creating innovation, a climate of innovation (Wang et al. 2022) or creativity (Van Esch et al., 2016) can be built. An innovative organizational climate (IOC) can be defined as the subjective perceptions of staff regarding the work environment that encourages the generation of new thoughts, concepts, methods, and procedures (Reichers and Schneider 1990). IOC supports the initiation and development of new ideas. If employees perceive a conducive climate for knowledge creation in the workplace, they soon become more engaged, which results in better performance and business success for the entire organization (Macey and Schneider, 2008). This influences the innovative behavior of employees viewed as behavior related to generating ideas, new technologies, processes, techniques or products, and their promotion and implementation (Qi et al. 2019). The innovative behavior of employees is primarily focused on the innovation process (i.e., engaging in innovative activities) rather than the innovation outcome (i.e., new products) (Montag et al. 2012). Employee innovativeness is affected by many determinants. In numerous studies, researchers have sought to identify the most important ones, such as impact of knowledge sharing (Montani, Stagliano 2021), practices of human resource management (Krammer 2022), an innovation climate (Jaiswal and Dhar 2015), and leadership (Qi et al., 2019).

Among all these determinants of innovation, leadership can be considered as one of the most important factors. Jiang et al. (2014) defined leadership as the process of a leader guiding the organizational members to practice the plans for changes and moving toward the objective of changes. The leader first establishes directions consistent with their vision and then communicates and encourages employees to overcome obstacles and work together to create innovation (Duffy et al., 2012). Several leadership styles can be distinguished in the process of driving innovation, transformational leadership, ethical leadership, paternalistic leadership, and inclusive leadership. Ethical leadership is based on moral and ethical practices. An ethical leader is a role model and inspires positive attitudes and behavior in employees. The ethical leader also encourages employees to channel their energy and skills into innovative behavior and being innovative. They emphasize activities that inspire employees to be innovative in achieving common goals (Iqbal et al. 2020).

Paternalistic leadership includes three dimensions: authoritarianism, benevolence, and moral character. A leader's authoritarianism is characterized by hierarchical relationships between the control, power, and authority of leaders and the obedience, submission, and respect of subordinates. A leader's benevolence involves investing in social relationships with subordinates, providing individual and holistic care when subordinates encounter personal and family problems. The moral dimension requires the leader to act as a role model (Cheng et al. 2013). The research by Tian and Sanchez (2017) demonstrated the relationship between the interaction of benevolent and authoritarian leadership and employee trust, innovative behavior, and knowledge sharing. This style is most commonly found in the Chinese culture.

Transformational leadership promotes a drive among employees to accumulate tacit knowledge and use it productively, which is only possible if the enterprise develops the capacity to learn. This style encourages employees to go beyond their job requirements to be innovative of their own accord. Therefore, it requires visionary thinking and openness to ideas. It also includes the type of behavior needed to make improvements that will improve business performance (Majumdar and Ray 2011). Therefore, transformational leadership is an effective leadership style for enterprises that wish to stimulate the processes of sharing knowledge and improve the innovativeness of employees (Lei et al. 2021).

Inclusive leadership emphasizes accepting employees as they are, allowing them to contribute their unique abilities and views, and encouraging their involvement in organizational activities. Inclusive leadership supports employee innovation by creating a work context in which employees feel supported to create, promote, and execute innovative solutions (Qi et al. 2019). Inclusive leadership is a predictor of innovative work behavior (Javed et al. 2017). Inclusive leaders, by intellectually stimulating their subordinates, promoting innovation, and tolerating mistakes, create a climate in which employees are stimulated to seek innovative approaches in their work. Providing organizational support toward employee innovation behavior by an inclusive leader is an important source of innovation (Scott, Bruce 1994). A study by Rosing et. al. (2011) found that different leadership styles are effective at different stages of the innovation process. Therefore, the choice of a leadership style depends on the stage of innovation. Basically, there should be a balance between exploration i.e., the search for new ideas, and exploitation of the innovation i.e., goal-oriented, performance-oriented, and routine implementation of the idea. Therefore, an effective innovation leader should support both exploration and exploitation by providing flexible connections between the two.

3. Methods

The research on the impact of leadership on employee innovativeness was conducted in selected major enterprises in Poland. They aimed to answer the two research questions: What relationships exist between manager traits and employee innovativeness in enterprises? To what extent do leadership attributes influence the creation of an innovative organizational climate in enterprises? In order to response to the research questions, the empirical research was carried out, in which the method of a single-purpose survey on an unweighted sample was applied. It is the most appropriate method to determine the characteristics of the surveyed population of enterprises at a specific time. The research tool was the standardized survey questionnaire. For the purposes of studying the enterprises, mixed techniques were used: CATI (Computer Assisted Telephone Interview) and CAWI (Computer Assisted Web Interview). CATI is a technique based on a computer supported telephone interview. An interviewer conducts a survey following the script drawn up. On the other hand, CAWI is a technique of the Internet survey. Acquiring data from respondents is ensured by electronic questionnaires available via web browsers, whereas supervision over their completion is provided by dedicated research software. The combination of two quantitative methods is a commonly applied method increasing the response rate.

The survey frame was the database of 500 largest enterprises (according to the ranking of the Rzeczpospolita portal site). Based on the method of random selection, the research sample of 179 companies was constructed. As a result of sampling, the survey was carried out on a representative sample, according to the following parameters: general population size – 500, estimation error 6%, confidence level: 95%. The research was participated in by 74 manufacturing enterprises, 35 trading enterprises, 25 service enterprises, 20 manufacturing-service enterprises and 25 manufacturing-trading enterprises. The respondents were representatives of these enterprises, e.g., personnel directors, HR department heads, while also specialists of the field of HR. For the purposes of selecting enterprises for research, the method of random selection was applied.

For the purposes of the analysis, the responses to the following questions were used: How do you assess the processes in your company? The respondents evaluated 6 processes affecting the innovativeness of employees. To determine the impact of managers' characteristics on the processes conductive to building innovativeness, the question was asked: Please, assess to what extent do the managers in your company …? The respondents evaluated 16 characteristics of the manager (Tab.1). In order to identify an organizational innovation climate, the question was formulated: To what extent do you agree with the statements? 19 statements were adopted allowing for the determination of organizational innovation capital (Tab. 2). The statements were selected based on the questionnaire constructed by Kot and Lewicka (2016). In order to specify leadership attributes in the surveyed enterprises, the question was asked: To what extent do you agree with the statements? 15 statements were adopted allowing for the determination of attributes related to managing the organization, managing human resources and the leader's own construction. The question was developed based on the tool constructed by Paliszkiewicz et al. (2015).

To analyze the responses to the questions, the statistical methods were applied, i.e., arithmetic mean, median and Spearman's rank correlation coefficient. The arithmetic mean is a measure of location, i.e., any change in any element of the analyzed set entails a change in in the mean value and, at the same time, a measure of the central trend. The median is "the middle value" of the characteristic in the ordered series, above and below which there is an equal number of observations. It is the measure of the average (or location measures), and it allows for the determination of the location of the highest concentration of results. The median value indicates that half of the results are below the median value and the other half are above the median value. Spearman's rank correlation coefficient evaluates the monotonic nature between random variables. This coefficient is used to describe the strength of the correlation of two characteristics when they are measurable, the tested group is small, and they are qualitative and can be ordered.

4. Results

Creating innovation is a complex process. One of its elements is developing innovativeness among employees. The author of the present study decided to examine the impact of leadership on employee innovativeness in large companies in Poland. As a first step, intra-organizational processes that foster knowledge creation and innovation were assessed. Among the processes studied, the highest ratings were found for the quality of task performance in collaboration with employees from other teams and departments (3.32, SD = 1.243 on a scale

of: 1- very low, 2- low, 3- medium, 4- high, 5- very high), information flow between employee teams and departments (3.28, SD = 1.330), cooperation between employee teams and departments in the enterprise (3.22, SD = 1.265), and creation of innovation in the enterprise (3.16, SD = 1.274). The lowest ratings were given to the speed of performing tasks requiring cooperation with employees of other teams and departments in the enterprise (2.97, SD = 1.273) and the flow and creation of knowledge in the enterprise (2.95, SD=1.360). In conclusion, in the process of creating innovation in large enterprises in Poland, the most important factor is the cooperation with other teams, which is based on the mutual flow of information. However, this process is limited by the relatively small flow of knowledge.

Managers are important actors in creating innovation-friendly attitudes. The innovation process depends on their level of commitment to the organization and trust in other employees. In the enterprises surveyed, the most important features of managers that foster employee innovation is keeping secrets, keeping their word, the belief that trust is an important source of innovativeness, the interest of subordinates in improving their skills, and the belief that most people are open-minded. These are trust-related traits, and, therefore, it can be concluded that the key to creating innovation is the trust of managers. (Table 1).

Table 1: Degree of the features of managers (FM) of the enterprises surveyed

Specification	Mean	Median	Standard deviation
(FM1) They self-develop their knowledge	3.13	3	1.316
(FM2) They keep secrets	3.24	3	1.428
(FM3) They reduce protections for long-time employees	3.17	3	1.331
(FM4) They have a strong tendency to trust others	2.95	3	1.295
(FM5) They keep their word	3.20	3	1.379
(FM6) They think that most people are open-minded	3.19	3	1.276
(FM7) They have respect for norms and values	3.15	3	1.356
(FM8) They believe that trust is an important source of competitive advantage	3.12	3	1.347
(FM9) They believe that trust is an important source of innovation	3.20	3	1.376
(FM10) They enter into informal relationships with employees	3.12	3	1.285
(FM11) They limit contacts to immediate associates	3.08	3	1.205
(MC12) They are interested in the improvement of qualifications by their subordinates	3.18	3	1.327
(FM13) They are guided by ethical values in their relations with subordinates	3.11	3	1.319
(FM14) They help break down barriers to the implementation of innovation	3.12	3	1.365
(FM15) They are mentors for their subordinates	3.10	3	1.384
(FM16) They have the traits of a leader who supports innovation	2.99	3	1.317

Source: own research

Grading 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

One of the objectives of the study was to identify the impact of manager traits on processes that foster building innovation. Spearman's rank correlation coefficient r_s was used to examine the effect size. Its magnitude illustrates the strength of the impact of manager traits on organizational processes. The process related to the flow of information between work teams and departments is affected by manager traits such as FM4 ($r_{s=}$ 0.160, p=0.326) and FM13 ($r_{s=}$ 0.152, p=0.438). The creation of innovation in a company is affected by FM3 ($r_{s=}$ 0.226, p=0.002), FM14 ($r_{s=}$ 0.325, p=0.002), and FM16 ($r_{s=}$ 0.213, p=0.004). The flow and creation of knowledge within the enterprise is affected by FM7 ($r_{s=}$ 0.204, p=0.006), FM6 ($r_{s=}$ 0.218, p=0.003) and FM9 ($r_{s=}$ 0.240, p=0.001). Collaboration between work teams and departments in the enterprise is affected by manager traits such as FM15 ($r_{s=}$ 0.219, p=0.003), FM16 ($r_{s=}$ 0.272, p=0.000), FM8 ($r_{s=}$ 0.208, p=0.005), FM7 ($r_{s=}$ 0.186, p=0.125), and FM13 ($r_{s=}$ 0.180, p=0.158). The speed of performing tasks that require collaboration with employees from other teams and departments is primarily determined by FM16 ($r_{s=}$ 0.319, p=0.000), FM7 ($r_{s=}$ 0.243, p=0.001), FM15 ($r_{s=}$ 0.188, p=0.011), FM1 ($r_{s=}$ 0.187, p=0.012), FM2 ($r_{s=}$ 0.172, p=0.020), and FM14 ($r_{s=}$ 0.167, p=0.024).

One of the determinants of innovation in enterprises is organizational culture focused on stimulating employee innovation. Employees show more interest in innovative activities if they perceive the presence of an organizational climate that supports innovation (Bos-Nehles 2019). This indicates the need to create an innovative organizational climate (IOC) in the enterprise. The study identified the degree of occurrence of IOC in the enterprise studied. A questionnaire containing 19 statements was adopted to measure the IOC construct

in the enterprises studied (Krot and Lewicka 2016). The analysis of Table 2 shows that the generalized level of IOC in the enterprises surveyed is at a medium level (mean 4.14). The detailed analysis of its indicators reveals that the most important feature is a belief among employees that innovation is much more likely to succeed if employees can suggest unusual and unique solutions in their everyday work. Other important characteristics of IOC are recognition of innovation as a core value in the organization, employee knowledge of consistent goals for the development of innovative ventures, and knowledge of the employee's contribution to innovative ventures. The extent to which employees engage in innovative activities depends on the belief that innovation processes carry high risk and therefore errors may occur. An important component of IOC is managerial support, which manifests itself in managers helping break down barriers to the innovation process, supporting employees who want to seek innovative solutions from managers, and encouraging risk-taking and seizing opportunities. Furthermore, IOC is influenced by the expectations placed on employees to improve their skills and knowledge, which can serve to foster innovative ventures and expect employees to be creative and think and act in innovative and original ways.

Table 2: Assessment of an innovative organizational climate (IOC) in enterprises

Specification	**Mean**	**Median**	**Standard deviation**
(IOC1) There are consistent goals for developing innovative ventures known to employees	4.27	4	2.057
(IOC2) Innovation is a key value in the enterprise	4.32	4	1.844
(IOC3) Ability to turn ideas into profitable ventures	4.23	4	1.904
(IOC4) The belief that innovation processes pose a high risk and therefore errors may occur	4.35	5	2.042
(IOC5) Quickly using customer or competitor suggestions to improve products	4.04	4	1.824
(IOC6) The project manager has a high degree of autonomy to accelerate, slow down, or completely abandon the innovation project	4.03	4	1.913
(IOC7) Creating free access to information and knowledge	4.13	4	2.033
(IOC8) Creating optimal conditions for cooperation between departments/divisions	4.22	5	2.056
(IOC9) Each employee involved in innovative ventures knows their contribution	4.37	5	1.847
(IOC10) Expectations of employees to improve their skills and increase their knowledge, which may support innovative ventures	4.26	4	1.943
(IOC11) Innovation is much more likely to succeed if employees can express unusual and unique solutions in their everyday work	4.60	5	1.906
(IOC12) Using employees' creativity for profit, which means using it well	4.09	4	2.032
(IOC13) Taking a risk is accepted	4.05	4	1.930
(IOC14) Expecting employees to be creative, think, and act in innovative and original ways	4.14	4	1.993
(IOC15) With the creation of a new solution, there is an increase in recognition within the enterprise	4.08	4	1.864
(IOC16) Expecting employees to be flexible and adapt quickly to change	3.98	4	1.947
(IOC17) Employees are too busy solving everyday problems to spend time thinking about the future	4.21	4	1.909
(IOC18) Helping managers break down barriers in the innovation process	4.23	4	1.883
(IOC19) Encouraging managers to take a risk and seize opportunities to develop the company by enterprises' managers	4.07	4	1.863

Source: own research

Grading 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.

Managers play an important role in IOC management by encouraging employees to seek new solutions to old problems without fear of blaming each other in case of a negative outcome and building positive attitudes towards innovation (Gumusluoglu and Ilsev, 2009). A tool consisting of three dimensions; organizational management, human resource management, and self-management (self-development) proposed by Paliszkiewicz et al. (2015) was used to measure leadership attributes in enterprises. The results contained in Table 3 reveal that in leading an organization, the most important attribute of leaders is the ability to positively shape the organization, people, and themselves by establishing a vision and translating it into business strategies and expected outcomes. The ability to make a change in the organization is also important. Furthermore, in managing people, it is important to build and maintain good relationships with subordinates and use

interpersonal communication to stimulate employees to work effectively. Empowering employees to perform their assigned tasks is also an important attribute of leadership. Self-awareness (knowing one's strengths and weaknesses and being willing to improve weaknesses), seeking opportunities for continuous learning, and seeking and using feedback from others at work are important in managers' self-construction.

Table 3: Leadership attributes (LA) in the enterprises surveyed

Specification	Mean	Median	Standard deviation
Leading the organization			
LA1 Managers make changes in the enterprises	4.49	5	1.882
LA2 It is necessary for the manager to lead/manage innovation in the organization	4.40	5	1.980
LA3 Managers in the enterprise can positively shape the organization, people, and themselves by setting a vision and translating it into business strategies and expected outcomes	4.59	5	1.918
LA4 Managers respect values and respect diversity by including them in the organization. This inclusion ensures proper conditions for everyone to develop and work together to increase organizational effectiveness.	4.44	5	1.878
Total	4.48	5	1.985
Managing people			
LA5 Managers motivate employees to work more effectively and bring out the best in them	4.25	4	2.052
LA6 Managers empower/strengthen employees to perform their assigned tasks	4.51	5	1.867
LA7 Managers are good listeners and can calm others	4.44	5	1.878
LA8 The manager's interpersonal communication is essential to stimulate employees to work effectively	4.54	5	2.050
LA9 Managers can build and maintain good relationships with subordinates	4.59	5	1.938
LA10 Managers are not afraid of conflict: a manager's attitude should be to see conflict as something good and therefore should not avoid conflict	4.09	4	1.902
Total	4.40	5	1.953
Leader's self-construction			
LA11 Managers are based on principles and values when making decisions	4.48	5	1.906
LA12 The manager should be self-aware (know his or her strengths and weaknesses and be willing to improve the weaknesses)	4.58	5	2.030
LA13 Managers seek and use feedback from others	4.51	5	1.941
LA14 Managers know how to manage their time effectively	4.42	5	1.959
LA15 Managers seek opportunities for continuous learning	4.54	5	1.920
Total	4.51	5	1.948

Source: own research

Grading: 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.

Another research objective was to identify the impact of leadership attributes on IOC. The analysis of the study shows that the strength of the effect of each attribute on the IOC indices varied (Table 4). The leadership attribute - LA13 had an impact on the largest number of innovation climate indicators (9 indicators), whereas the strongest impact was for the statements: IOC12 ($r_{s=}$ 0.261), IOC19 ($r_{s=}$ 0.254) and KI14 ($r_{s=}$ 0.231). The leadership attribute - LA5 had an impact on 8 indicators, including the strongest impact on IOC18 (0.281), IOC ($r_{s=}$ 0.264) and IOC11 ($r_{s=}$ 0.240). In turn, the LA8 attribute, above all, had a positive impact on 7 indicators, among others on IOC17 ($r_{s=}$ 0.256, p=0.000) and IOC16 ($r_{s=}$ 0.227). The LA15 attribute also had an impact on 7 indicators, including primarily IOC11 ($r_{s=}$ 0.235), IOC17 ($r_{s=}$ 0.231) and IOC16 ($r_{s=}$ 0.228). The leadership attributes: LA1, LA2, LA6, LA7, LA11 and LA14 had an impact on 6 IOC indicators, whereas the strongest impact was observed in the case of LA1 on ICO 16 ($r_{s=}$0.264), LA2 on IOC1 (rs=0.287), LA6 on IOC 14 ($r_{s=}$0.295), LA7 on IOC15 ($r_{s=}$0.274), LA11 on IOC 19 ($r_{s=}$0.306) and LA14 on IOC9 ($r_{s=}$0.286). To sum up, the largest impact on IOC is exerted by attributes related to managing human resources, particularly, communication between managers and employees, which is essential to stimulate employees to work effectively, and which allows managers to search for and use feedback from subordinates. The leadership attribute related to motivating employees to work more effectively and bringing out what is the best in them also has a significant impact on IOC.

Table 4: Spearman's rank correlation between an innovative organizational climate (IOC) and leadership attributes (LA)

	LA1	LA2	LA3	LA4	LA5	LA6	LA7	LA8	LA9	LA10	LA11	LA12	LA13	LA14	LA15
IOC1		0,287 p=00			0,153 p=040					0,215 p=003		0,177 p=017	0,178 p=016	0,172 p=021	
IOC2													0,158 p=033		
IOC3		0,179 p=016							0,251 p=000			0,202 p=006			
IOC4						,-156 p=042									
IOC5		0,216 p=003													
IOC6											0,158 p=034				
IOC7							0,155 p=037								
IOC8		0,223 p=002		0,249 p=00	0,240 p=001	0,236 p=002	0,176 p=018				00,255 p=00	0,177 p=022		0,157 p=034	
IOC9						0,172 p=021		0,171 p=022			0,217 p=003	0,227 p=002	00,208 p=006	0,286 p=00	
IOC10											0,150 p=044				
IOC11	0,193 p=009		0,202 p=006		0,264 p=000			0,213 p=004						0,151 p=043	0,235 p=0001
IOC12					0,164 p=027	0,278 p=000	0,165 p=026	0,174 p=019	0,160 p=032				0,261 p=00	0,267 p=001	
IOC13	0,170 p=023		0,153 p=041		0,181 p=015			0,147 p=049		0,206 p=005				0,197 p=008	0,217 p=003
IOC14	0,151 p=043	0,188 p=011				0,295 p=000		0,223 p=002	0,222 p=002		0,169 p=024	0,149 p=046	0,231 p=001		0,154 P=040
IOC15			0,178 p=017				0,274 p=00		0,155 p=038				0,149 p=046		0,164 028
IOC16	0,193 p=009		0,161 p=030		0,153 p=041			0,227 p=002	0,190 p=010	0,203 p=006			0,190 p=010		0,228 p=003
IOC17	0,162 p=030				0,187 p=012		0,206 p=005	0,256 p=00		0,151 p=043		0,171 p=021	0,169 p=023		0,231 p=002
IOC18	0,264 p=000	0,168 p=024			0,281 p=00										
IOC19				0,227 p=002		0,169 p=023	0,216 p=003				0,306 p=000		0,254 p=00		0,164 p=027

Source: own research

5. Conclusions and Discussion

The results of the present research provided the answers to the formulated research questions. Organizational processes related to innovation are important in the enterprise. To answer the first research question (What relationships exist between manager traits and knowledge creation and innovation processes in enterprises?), it should be stated that in large enterprises in Poland, the main emphasis is on cooperation with other teams in the organization, which is based on the mutual flow of information. These processes occur primarily in service-providing and commercial enterprises. There is a limited knowledge flow and creation within enterprises, which

limits the creation of innovation. These processes are influenced to a large extent by managers who have diverse traits. Manager traits such as respect for norms and values, being mentors to their subordinates, having leader traits that support innovation, having respect for norms and values, and believing that most people are open-minded are most conducive to creating innovation in enterprises.

One of essential factors affecting the level of innovation in enterprises is organizational culture based on an innovation climate. The generalized innovative organizational climate index is at a medium level in the enterprises surveyed. When answering the second research question (To what extent do leadership attributes influence creating an innovative organizational climate in enterprises?), it should be concluded that they had an impact on most innovation climate indicators, with varied strength of impact. Leadership attributes such as encouraging employees to take risks and seize opportunities to develop the enterprise by managers, managers' use of employees' creativity for profit, knowledge of personal contributions of employees to innovative ventures, and the creation of optimal conditions for collaboration between departments/divisions significantly influenced an organizational climate. Therefore, by providing support, making resources available, and providing autonomy, managers have a significant impact on the perception of work environment as the one conducive to innovation, thus building a climate for innovation (Shalley and Gilson, 2004). The research on the impact of leader attributes on organizational processes that support innovation and an innovative organizational climate revealed close relationships with inclusive leadership. In particular, this concerns leadership dimensions such as tolerating the views and failure of employees and supporting them if they make mistakes, focusing on training employees and praising achievements rather than showing jealousy, treating them fairly, and taking into account their needs and interests (Qi et al. 2019). Being role models, inclusive leaders reinforce employee innovation behavior, influence employee team member feelings, psychological empowerment, and behavioral outcomes (e.g., creativity, job performance, reduced turnover) (Randel et al. 2018).

The obtained results significantly confirm the previous findings of numerous researchers. Tang (2017), among others, established that leadership behavior has a positive and considerable impact on the innovativeness of employees. Kesting et al. (2015) also confirmed a positive relationship between leadership and innovative behavior as well as Jia et al. (2018) identified a positive influence of leadership on organizational innovation.

Some limitations of using the research results on the role of managers and stimulating innovation in enterprises in Poland should be indicated. The present survey research was conducted to outline the complex problems of the impact of leadership on an innovative organizational climate and to provide a starting point for broader research on its role in creating such a climate in modern enterprises. Future research on the impact of leadership on employee innovation should employ a longitudinal design.

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Organizational Conditions associated with the sharing of Tacit and Explicit Knowledge in the financial sector in Colombia

Delio Ignacio Castaneda and Camilo Andrés Ramírez
Pontificia Universidad Javeriana, Bogotá, Colombia
delio.castaneda@javeriana.edu.co
ramirezcamilo@javeriana.edu.co

Abstract: Knowledge sharing is understood as the social interaction through which individuals exchange their tacit and explicit knowledge with others. Tacit knowledge is difficult to formalize, transfer and communicate to other individuals, and it is a result of experience, talent, and reflections of individuals. Conversely, explicit knowledge is formalized, codified, and easier to transmit. The focus of this study was on four organizational conditions associated with knowledge sharing: culture, training, strategic clarity, and information technology support. Although the relationship between organizational conditions and knowledge sharing has been investigated, there are few studies about whether organizational conditions impact tacit and explicit knowledge sharing differently. In this research, 270 participants were surveyed, belonging to companies in the financial sector in Colombia. It was found that explicit knowledge had a significant positive relationship with strategic clarity, organizational culture, training, and information technology support. On the other hand, tacit knowledge correlated significantly only with organizational culture, and it was not related to strategic clarity, training, and information technology support. Additional research on information and communication technologies that facilitate the sharing of tacit knowledge is recommended, as well as exploration of other types of administrative support besides technology. Studies are also suggested on which elements of the strategy can be considered explicit and which are tacit, and the mechanisms to facilitate their successful sharing.

Keywords: Knowledge sharing, tacit knowledge, explicit knowledge, organizational conditions

1. Introduction

Knowledge sharing is understood as the social interaction through which individuals exchange their tacit and explicit knowledge with others (Nonaka and Takeuchi, 1995). This is the way how individual knowledge becomes organizational (Foss, Husted and Michailova, 2010) to achieve objectives and obtain results.

Knowledge sharing is a central process of knowledge management because this is the collective mechanism by which organizational knowledge is created and applied. The lack of knowledge sharing is a major obstacle to effective knowledge management (Davenport and Prusak, 1998). There is evidence of the influence of knowledge sharing on different organizational processes and results, for example, innovation (Sigala and Chalkiti, 2005), and performance (Navimipour and Charband, 2016).

There are multiple publications about the relationship between personal and organizational conditions and knowledge sharing behavior. For example, Arif, Qaisar, and Kanwal (2022) in Pakistan found that perceived reciprocal benefits, technological support, and the ability to share knowledge facilitated the knowledge sharing behavior. Henttonen, et al. (2016) identified some knowledge sharing enablers: organizational culture, technology, and rewards. In the opposite direction, some authors have studied blockers of knowledge sharing like abusive supervision style, and lack of management support (Kim and Yun, 2015).

The focus of this study was on four organizational conditions associated with knowledge sharing: culture, training, strategic clarity, and information technology support. Some authors have reinforced the hypothesis that organizational culture impacts knowledge sharing (Kucharska, 2017; McDermott and O'dell, 2001). In addition, some studies link training and knowledge sharing (Al Saifi, et al., 2016). There is also a connection between knowing the organizational strategy and the quality of shared knowledge. It is also known that technology infrastructure, which is part of information technology support, is a facilitator of knowledge sharing (King and Marks, 2008). In the same direction, information technology systems support organizational knowledge sharing (Del Giudice and Della Peruta, 2016).

Although the relationship between organizational conditions and knowledge sharing has been investigated, there are few studies about whether organizational conditions impact tacit and explicit knowledge sharing differently. In a systematic review, Ahmad and Karim (2019) found that research on the differential impacts of sharing various types of knowledge is scarce and contradictory and proposed further research on this topic. This research contributes to reducing the gap, investigating if the chosen organizational conditions equally influence the tacit and explicit knowledge that individuals share.

2. Literature Review

2.1 Knowledge sharing

In today´s information age, knowledge is the most valuable asset for achieving organizational goals. It is an interactive activity, which involves exchanging information and know-how to help individuals work together to solve problems and develop new ideas (Cummings, 2004). In the same direction, Camelo-Ordaz et al. (2011) described knowledge sharing as the act of making individual knowledge available to others within an organization, so that it can be assimilated and used. Whitherspoon et al. (2013) defined knowledge sharing as a process of knowledge management used to create, harvest, and sustain business processes. Knowledge sharing has been conceptualized as converting an individual´s knowledge to a form understandable and usable by others (Mishra and Pandey, 2018).

2.2 Tacit and explicit knowledge sharing

Polanyi (1962) defined two types of knowledge: tacit and explicit. The first one is difficult to formalize, transfer and communicate to other individuals (Nonaka, 1991). This knowledge is a result of experience, talent, and the reflection of individuals (Haldin-Herrgard, 2000). It is also part of tacit knowledge values, individuals´ beliefs, and perspectives (Nonaka and Takeuchi, 1995), hunches, intuitions, and insights that are hard to express (Becerra and Sabherwal, 2001). This knowledge is easy to lose in organizational turnover (Nonaka and Van Krogh, 2009). Conversely, explicit knowledge is codified and easier to transmit. Explicit knowledge is organized information adjusted to tangible forms such as databases or documents (Thomas and Gupta, 2021).

Knowledge sharing is fundamental in the exchange of tacit and explicit knowledge. Van den Hooff and de Ridder (2004) defined knowledge sharing as the exchange of tacit and explicit knowledge. According to Nguyen (2021), transferring explicit knowledge does not lead to the loss of privileged status in an organization, but transferring tacit knowledge may do. Therefore, employees seem to be more willing to share explicit than tacit knowledge. Humphreys et al. (2008) found that explicit knowledge was positively associated with online knowledge sharing, whereas the relationship with tacit knowledge was negative. Malik (2021) stated that emotional intelligence has a stronger positive effect on tacit knowledge sharing compared to explicit knowledge sharing. Wang et al. (2022) showed that virtual rewards have a significantly positive linear relationship with explicit knowledge sharing and an inverse U-shape relationship with tacit knowledge sharing.

2.3 Organizational conditions and knowledge sharing

Literature on the direct link between organizational culture and tacit and explicit knowledge is still lacking (Le et al., 2020; Yang et al., 2018). This statement is also valid for other organizational conditions like training and strategic clarity.

Organizational culture is one of the foundations of organizational life (Castaneda, 2015). Values, beliefs, and practices form culture. In this framework, reciprocity and interaction are crucial determinants of knowledge sharing (Nguyen, 2021). Another value that impacts knowledge sharing positively is trust (Andrews and Delahaye, 2000). De Long and Fahey (2000) expressed that trust and cooperation contribute to employees´ willingness to share knowledge as part of the organizational culture. Kucharska and Kowalczyk (2016) pointed out the relationship between collaborative culture and knowledge sharing. Based on the above, the following hypothesis is proposed:

H1: Organizational culture significantly influences the tacit and explicit knowledge that individuals share.

Investment in training enhances individuals´ capital (Malik, 2018), which facilitates sharing knowledge and not ignorance. A learning environment is required for effective knowledge sharing (Dong, et al., 2016). Training equips workers with new knowledge, improved levels of skills, and positive attitudes to sharing knowledge. Training in organizations occurs not only through courses but also via work activities (Watkins and Kim, 2017). Individuals who engage in knowledge sharing expect to attain learning and expertise (Zaqout and Abbas (2012). In a complementary way, training enables individuals to share up-to-date knowledge. However, following the line of related studies, where there is a greater commitment to share explicit knowledge than tacit (Humphreys et al., 2008), the following hypothesis is proposed:
H2: Organizational training significantly influences the explicit knowledge that individuals share, but not the tacit knowledge.

Critical knowledge is only valuable to the organization if the employees know it (Ling et al., 2009). Strategical clarity means that workers know the mission, vision, and objectives, especially the strategic ones, which are types of explicit knowledge. Mohammed and Ismael (2021) defined organizational clarity as the comprehension an employee has of the strategy, challenges, and priorities of the organization. To the extent that workers have strategic clarity, the probability of sharing valuable knowledge increases, which not only facilitates completing tasks successfully but also contributes to the achievement of the first-level organizational objectives. Organizational knowledge resides in the interactions between individuals, and it forms the basis of competitive advantage (Argot and Ingram, 2000). Riege (2005) found that one of the main barriers to sharing knowledge is unclear integration between knowledge management initiatives and organizational goals. Bakonyi (2018) found an interrelation between knowledge-sharing failures and organizational ignorance. Israilidis et al. (2021) defined organizational ignorance as the lack of employees´ awareness of organizational characteristics. This factor affects the type and quality of knowledge that workers share. Based on the previous literature it is hypothesized:
H3: Organizational clarity significantly influences the explicit knowledge that individuals share, but not the tacit knowledge.

Perceived organizational support is an antecedent for knowledge sharing (Ali et al., 2019). One of the main organizational tools to support knowledge sharing is information technology. Information technology has been considered a way to increase knowledge sharing among employees (Leonardi, et al., 2013). However, knowledge needs to be codified to be shared, and technology helps to share mainly explicit knowledge (Vuksic, et al, 2015). Crugh (2019) found a lack of use of technologies of information to transfer tacit knowledge. Social media technologies impact knowledge sharing, especially tacit knowledge, which is shared through social interactions (Ali et al., 2019). Perceived ease of use is also a facilitator in applying information technology in knowledge sharing (Chang et al., 2013). Castaneda and Toulson (2021) found that not all information and communication technologies let tacit knowledge be shared, but those that facilitate dialogue, for example, text messaging and video conferences. From the above it is hypothesized:
H4: information technology support significantly influences the tacit and explicit knowledge that individuals share.

3. Methodology

3.1 Participants

In total, 297 participants were surveyed, belonging to companies in the financial sector in Colombia. Twenty-seven of the participants did not answer all the questions, for which they were excluded from the sample. The final number of participants for this research was 270. Table 1 shows their demographic characteristics.

Table 1: Demographic characteristics of the participants

Characteristics	Number	Percentage (%)
Gender		
Male	152	56,30%
Female	118	43,70%
Position		
Director	55	20,37%

Characteristics	Number	Percentage (%)
Adviser	105	38,89%
Professional	84	31,11%
Administrative	26	9,63%
Educational level		
Graduate	94	34,81%
Undergraduate	110	40,74%
Technical	66	24,44%
Time of experience in the company in months		
0-12	134	49,6%
13-24	42	15,6%
25-36	24	8,9%
37-54	20	7,4%
Over 54	50	18,5%
Time of experience in the position in months		
0-12	159	58,9%
13-24	39	14,4%
25-36	25	9,3%
37-54	24	8,9%
Over 54	23	8,5%

3.2 Instruments

The instrument used in this study for measuring tacit and explicit knowledge that workers share was the one designed by Castaneda et al. (2015). The instrument uses 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. The instrument used to evaluate organizational conditions was published by Castaneda (2015). The instrument consists of 16 items, of which four measure organizational culture, four training, four strategic clarity, and four information technology support. The instrument uses a Likert scale with five levels of response. The validation of this instrument obtained a Cronbach's alpha reliability score of 0.92.

4. Results

To assess whether the type of knowledge that is shared is related to the organizational conditions of this study, a Pearson correlation was run. As shown in table 2, tacit knowledge correlated significantly only with organizational culture (r=0.342, p=0.000). This knowledge was not related to strategic clarity (r=-0.102, p=0.080), training (r=-0.079, p=0.175) or information technology support (r=-0.025, p=0.667).

Explicit knowledge had a significant positive relationship with strategic clarity (r=0.208, p=0.000), organizational culture (r=0.278, p=0.000), training (r=0.119, p=0.04), and information technology support (r=0.156, p=0.007).

Based on the results, there is full support for hypotheses 1, 2, and 3, and partial support for hypothesis 4.

Table 2: Correlations between types of shared knowledge and organizational conditions

Organizational Conditions	Type of knowledge: tacit	Type of knowledge: explicit
Strategic clarity	-0.102	0.208**
Organizational culture	0.342**	0.278**
Training	-0.079	0.119*
Information technology support	-0.025	0.156**

Note: * significant correlation p<0.05 (bilateral). ** significant correlation p<0.01 (bilateral).

5. Discussion

According to the results, explicit knowledge had a significant positive relationship with strategic clarity, organizational culture, training, and information technology support, while tacit knowledge correlated significantly only with organizational culture, and it was not related to strategic clarity, training, and information technology support.

Based on Nguyen (2021), a possible explanation for results in the case of culture, this is hypothesis 1, is that sharing explicit knowledge does not lead to the loss of privileged status in an organization but transferring tacit knowledge may do. In this sense, employees seem to be more willing to share explicit than tacit knowledge. Therefore, an organizational culture that strongly promotes values and practices aimed at exchanging knowledge, will facilitate workers to share tacit and explicit knowledge without fear of losing privileges, competitiveness, or job stability. There is evidence of the positive influence of trust in knowledge sharing (Andrews and Delahaye, 2000). Trust as a core value of the culture reinforces beliefs in workers that sharing tacit and explicit knowledge is considered valuable and desirable in the organization.

Training is often related to improving performance measured through processes, procedures, protocols, and other types of explicit knowledge. In contrast, training in tacit knowledge is minimal. Rather, it is acquired through dialogue and observation. In addition, there is evidence that there is a greater commitment to sharing explicit knowledge than tacit (Humphreys et al., 2008). As proposed by hypothesis 2, these are possible explanations why there is a relationship between training and explicit knowledge, but not with tacit knowledge.

One of the least studied variables concerning explicit and tacit knowledge is strategic clarity. The strategy is mainly explicit knowledge embodied in the vision and strategic objectives. This is why in this research, it was hypothesized that strategy is shared as explicit knowledge, while tacit knowledge associated with the strategy is not shared. Examples of tacit knowledge associated with the organizational strategy are expertise, intuitions, and hunches. Results confirmed hypothesis 3.

Finally, It was raised as hypothesis 4 that information technology support, constituted mainly by information and communication technologies, could be associated with both types of knowledge: tacit and explicit. Results supported the second type of knowledge, but not the first. The above agrees with the findings of Vuksic et al., (2015) who stated that to be shared, knowledge needs to be codified, and technology helps to share mainly explicit knowledge (Vuksic et al, 2015). Castaneda and Toulson (2021) formulated an exception, who found that not all information and communication technologies let tacit knowledge be shared, but those that facilitate dialogue, for example, text messaging and video conferences.

6. Conclusion and Recommendations

It can be concluded that culture, training, strategic clarity, and information technology support are organizational conditions that influence the explicit knowledge that is shared. Likewise, that culture is an organizational condition that influences the tacit knowledge that is shared.

Additional research on information and communication technologies that facilitate the sharing of tacit knowledge is recommended, as well as exploration of other types of administrative support besides technology. New studies are also suggested about which elements of the strategy can be considered explicit and tacit, and the mechanisms to facilitate their successful sharing.

A limitation of this study is it used only a sample of workers from the financial sector in a Latin American country, therefore the scope of findings is restricted.

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The Impact of Ethical Leadership on Knowledge Management Processes: An Empirical Study on Healthcare Professionals in Turkey during the Pandemic Period

Ömer Çelik and Mustafa Sağsan
Cyprus International University, Nicosia, North Cyprus
afyon1453@gmail.com.tr
msagsan@ciu.edu.tr

Abstract: Given an increased call for examining ethics in the healthcare sector, this study examines how ethical leadership influences employees' knowledge creation and development, knowledge codification and storage, knowledge sharing and knowledge usage and utilizing in the healthcare sector. Healthcare professionals in Turkey were added to the study to observe the effect of ethical leadership on knowledge management. The questionnaire was sent to 414 healthcare professionals randomly selected from healthcare facilities operating in Turkey via Google Forms. All the response rates were 100%. Results indicate that healthcare professionals' views of their supervisor's use of ethical leadership behaviors are related to knowledge creation and development, knowledge codification and storage and knowledge usage and utilizing. Contrary to other studies, it has been observed that ethical leadership does not affect knowledge sharing, which is a process of knowledge management. It is considered that this situation is the result of the increased workload and intense overtime of healthcare professionals during the pandemic period, and that different achievements will be obtained from the studies to be carried out after the pandemic period. In this study, ethical leadership is positively associated with knowledge creation and development and knowledge usage and utilizing, which is negatively associated with knowledge codification and storage. Perceived ethical leadership behaviors positively influence knowledge management. Based on the findings, implications are provided for both theory and management, and directions for future research are offered.

Keywords: ethical leadership, knowledge management, healthcare sector, pandemic period in Turkey

1. Introduction

In today's world, every institution is constantly faced with chaos due to the COVID-19 pandemic. In this chaotic environment, the characteristics of institutions can have a significant impact on the way they function and the way services are delivered. Therefore, knowledge management is of great importance for institutions. In times of chaos, information is often asymmetrically distributed. Managing the pandemic process based on ethical codes in such an environment largely depends on knowledge management skills. Because knowledge management is one of the most important processes of creating, developing, codifying, storing, sharing and utilizing the knowledge experience of employees within a public organization. Therefore, as companies evolve, they acquire significant institutional knowledge. This knowledge obtained is important for the further development of organizations by contributing to the public life of newcomers and less-experienced staff. For that reason, the most essential aim of knowledge management, which encompasses knowledge creating, codifying, sharing and utilizing is to create the connection of staff looking for information, or institutional knowledge, with the people who have it. This is achieved by sharing knowledge. Because there is a close link between knowledge management and employee motivation and willingness to play an active role in knowledge sharing. However, when there is no knowledge sharing among employees, it is difficult to achieve knowledge management (Wu and Lee, 2017). In addition to this, knowledge may not be sufficient to help leaders to make reasonable decisions and take competitive advantages as expected. So, public organizations need employees who can eagerly share knowledge to others even if they have well-established knowledge management systems.

However, although previous research have stated a strong connection between ethical leadership and knowledge management, the effect of ethical leadership on knowledge management processes except knowledge sharing is yet to be explored. This study aims to strengthen relationship between ethical leadership and knowledge management processes and examine why and how ethical leadership has an impact on knowledge management in the context of healthcare sector in Turkey during the COVID-19 Pandemic Period.

2. Literature on the Relationship between Ethical Leadership and Knowledge Management Process

Ethics is concerned with the kinds of values and morals an individual or a society finds desirable or appropriate. Furthermore, ethics is concerned with the virtuousness of individuals and their motives. A leader's choices are also influenced by their moral development (Northouse, Peter G., 2016).

2.1 Ethical Leadership

Ethical leadership defined Brown et al. (2005) as 'the demonstration of normatively appropriate conduct through personal actions and interpersonal relationships, and the promotion of such conduct to followers through two-way communication, reinforcement and decision-making'. Beauchamp and Bowie (1988) revealed that ethical leadership originated from the principles of justice, respect, community, service, and honesty. Ethical leadership is characterized by fairness, honesty, openness, values, and trustworthiness (Brown and Trevino, 2006). It also can be defined as "the demonstration of normatively appropriate behavior in both personal and interpersonal contexts and the active promotion of socially responsible behavior at all levels in the organization reinforcing a moral ethos through communication and ethical decision making" (Tourigny et al., 2019. Based on the ethical leadership theory, ethical leadership results from situational and individual characteristics that incorporate a moral context and reasoning (Babalola et al., 2019; Bedi et al., 2016; Ciulla, 2005). Johnson (2005) explains four components of ethical leadership: goal, information, authority and trust as the following;

- "goal" means being determined to reach ethical goals.
- "Information" refers searching and justifying the knowledge close and distant environment of the organization.
- "authority "is the power of making decision and acting in accordance with what the decision requires.
- "trust" which is a bridge among the others is the most essential component of all.

Ethical leaders can generate trust among employees and become a role model for his/her organization so that they can prosper and increase their creativity and productivity. Reliable leaders don't hesitate to use their authority; they gather and use the necessary information.

Being ethical requires not only behaving by taking "right" and "good" into account but thinking about others and being just as well. In this sense, ethical leaders should be a valuable source for the employees, who are keen on ethics, by exhibiting ethical behaviors (Mihelic et al., 2010). In ethical leadership, being a moral person and ethical management are the most crucial factors that make a person reliable and a good leader. As a trait, being a moral person encompasses rightfulness, honesty, and reliability while doing the right thing, being open-minded and open to criticism, just and objective and obedient to ethical codes are of critical importance in terms of behavioral aspect.

2.2 Knowledge Management (KM) and its Processes

Knowledge has been defined as "information possessed in the minds of individuals" (Alavi and Leidner, 2001), or as "individual's experience and understanding" (Marwick, 2001), or as "a high value form of information that is ready to apply to decisions and actions" (Davenport and Prusak, 1998). Given the growing perception of importance of intellectual resources, it is not surprising that firms have begun to engage in a wide range of strategies to create, store, transfer and apply knowledge within their organizational contexts (Kayworth and Leidner, 2003). In light of this, the KM process can be defined as "the process of capturing, storing, sharing, and using knowledge" (Davenport and Prusak, 1998; Leidner and Kayworth, 2006) or as "a systemic and organizationally specified process for acquiring, organizing, and communicating both tacit and explicit knowledge of employees that other employees may make use of to be more effective and productive in their work" (Alavi et al., 2005). Thus, the KM process is the generation, representation, storage, transfer, transformation, application, embedding and protection of organization knowledge (Schultze and Leidner, 2002; Massey and Montoya-Weiss, 2006). Kankanhalli et al. (2005) have mentioned that the strategic management of organizational knowledge is a key factor in helping organizations to sustain competitive advantage in volatile environments. Organizations are turning to KM initiatives and technologies to leverage their knowledge resources (Kankanhalli et al., 2005). Therefore, the goal of KM is for an organization to become aware of its knowledge, individually and collectively, and to shape itself, so that it makes the most effective and efficient use of the knowledge it has or can obtain (Bennet and Bennet, 2003; Newell et al., 2003; Alavi et al., 2005-2006). To date, the scientific understanding of knowledge in organizations is still in its infancy, in spite of a large and

growing body of literature focused on organizational culture, KM processes and knowledge (Griffith et al., 2003; Alavi et al., 2005-2006; Pawlowski and Bick, 2012).

Kayworth and Leidner (2003) suggested that there are four elements in the KM process: knowledge creation, knowledge storage, knowledge transfer, knowledge application.

However, Sağsan (2006) defines 5 basic steps of Knowledge Life Cycle (KLC) in hierarchical order: creating, sharing, structuring, using, and auditing knowledge.

Previous research have demonstrated that ethical leadership of leaders can change followers' moral cognition, concerns, or values (Zhu et al., 2011; Sosik et al., 2014), which in turn stimulate employees to engage in behaviors that abide by moral standards (Mayer et al., 2009; Steinbauer et al., 2014). As Ali and Sağsan (2021) indicated that there is a positive relationship between psychological ownership of knowledge and knowledge hiding and this connection is moderated by ethical leadership. Kim and Yun (2015) argued that knowledge sharing is regarded as generous or ethical "donating" behaviors especially in workplaces, which can raise other colleagues' knowledge level and even improve organizational performance. Even though KM, as an indispensable aspect of organization's success, is highly emphasized by many companies, few have achieved a sustainable knowledge-based competence for competitive advantage. Team members must make a collaborative engagement for acquiring knowledge as well as provide creative ideas and improve team performance. What is more, it is essential to accumulate knowledge and integrate it into the objective of a company with the help of peer collaboration. In order to achieve these goals, leaders are looking for ways in which they can enhance their organization's creation and dissemination of knowledge. According to this research, organizational leaders have the capability of creating financial gains and inspiring employees. Leaders who pivot around ethics and morality are fair to taking into consideration of their employees' rights and freedoms, thus giving them will to complete their duties and work. Taking care of employees has the most crucial importance in organizational structure.

With the current research, it is aim to investigate whether apart from other leadership types, how effective is ethical leadership in the management of asymmetrically distributed knowledge, creating, developing, codifying, storing, sharing and utilizing the knowledge in the healthcare sector.

However, although previous researchers have stated a strong connection between ethical leadership and KM, the effect of ethical leadership on KM processes except knowledge sharing is yet to be explored. This study aims to strengthen relationship between ethical leadership and KM processes and examine why and how ethical leadership impact on KM in the context of healthcare sector in Turkey during the COVID-19 Pandemic Period.

3. Research Methodology and Data Analysis

This paper focuses on the influences of ethical leadership behavior on KM to evaluate all aspects of the healthcare sector in Turkey through the opinions of healthcare professionals. These surveys can also help organize the sector and provide input on a healthcare sector's strengths and weaknesses.

The study answered four main questions:
How do the KM processes play in sustaining the ethical leadership behavior of healthcare professionals during the pandemic period? For Example, Is the ethical leadership effect on the creation and development of health-related knowledge? In the same way, the study answered also how ethical leadership has an impact on health-related knowledge creation and development, health-related knowledge sharing and health-related knowledge usage and utilizing.

The study proposed the following hypotheses:

1. H_1: Ethical leadership has an impact on knowledge creation and development.
2. H_2: Ethical leadership has an impact on knowledge codification and storage.
3. H_3: Ethical leadership has an impact on knowledge sharing.
4. H_4: Ethical leadership has an impact on knowledge usage and utilizing.

3.1 Population and Sampling

The research universe consists of healthcare professionals that are working in Turkey. Republic of Turkey Ministry of Health announced that the number of healthcare professionals in 2020 was 1.6 million. Appropriate sample size determined the following formula by Yamane (1967).

$$n = \frac{N}{1+N*(e)^2}$$

$$n = \frac{1.601.635}{1+1.601.635*(0.05)^2} = 400$$

n = sample size
N = total number in population
e = the acceptable error is equal to (0.05)
The sampling method of the study formuled by Yamane (1967) consists of 414 healthcare workers with a simple, disproportionate sampling method. This study measured the influence of ethical leadership behavior on KM as a health sector in Turkey during pandemic period is scrutinized from the viewpoint of its workers (non-executive staff and managerial staff).

3.2 Data Collection

In this research, the influence of ethical leadership behavior on KM in Turkish healthcare sector during pandemic period is scrutinized. The questionnaire was sent to 414 healthcare professionals randomly selected from healthcare facilities operating in Turkey and conducted from 8 September 2021 to 17 November 2021. The questionnaire was understandable for all the healthcare professionals, because in this study we derived not only from Ethical Leadership Scale items but also from Knowledge Management Processes (KMP) Scale items. The literature was reviewed in detail with respect to content of each construct. Then the item pool was sent to the academicians from related fields. Based on the feedback received from the academicians, the survey form was adjusted and became ready for the pilot study. The questionnaire was prepared in English and translated into Turkish. Then the Turkish version was back-translated into English until the experts agreed that the two versions were almost identical. Then the survey was fine tuned to confirm the terms of the wording, format and sequence of the subscales and the items.

The survey conducted in the research is made up of three sections. The survey includes 55 questions and Likert Type Scale is applied to the questions in the sections except for the first one. All the response rates were 100%. Participation in online survey followed the principle of voluntariness to ensure the confidentiality and anonymity of respondents' answers.

Ethical Leadership Scale (ELS), developed by Brown, Trevino and Harrison (2005), is a ten-item instrument used to measure perceptions of ethical leadership. It is listed as follows:

1. Listens to what employees have to say.
2. Disciplines employees who violate ethical standards.
3. conducts his/her personal life in an ethical manner.
4. Has the best interests of employees in mind.
5. Makes fair and balanced decisions.
6. Can be trusted.
7. Discusses business ethics or values with employees.
8. Sets an example of how to do things the right way in terms of ethics.
9. Defines success not just by results but also the way that they are obtained.
10. When making decisions, asks "what is the right thing to do?".

KMP Scale was taken from Delen et al. (2013). Original items in this scale were developed by Demirbağ et al. (2006).The original scale comprised of four factors is shown below.

Knowledge Creation and Development

1. Our corporate conducts enough number of R&D activities.
2. All employees of our corporate are encouraged continuous learning.
3. I have access to new and updated information on the Web.
4. Highly qualified and featured individuals are tried to be attracted to work in our corporate.
5. Our corporate supports innovative thinking and encourages creating innovative ideas.
6. Our corporate successfully implements a suggestion system.
7. Brainstorming sessions are conducted for creating alternative solutions to problems and for system development (i.e. improving the current service and production systems)

8. Employees of our corporate actively contribute to the process of knowledge creation
9. Our corporate is systematically devoted to create and develop knowledge

Knowledge Codification and Storage

1. All information about my job is regularly classified, filed, and stored in an electronic environment.
2. I can quickly and easily obtain the information that I need.
3. We have an effective record-storing system in which the related information about the employees and patients.
4. We have data storage and archiving system through which we can get rapid access to accurate information.
5. All personnel of our corporate record the data and the information which is revealed by their operations.
6. Information about services, employees, and patients is updated on a regular basis.
7. Our duties and operations are well-identified and recorded.
8. All technological information and inventions related to health all over the world are up to date and saved.

Knowledge Sharing

1. We pay special attention to share the accumulated knowledge with our colleagues.
2. We improve our work processes by sharing our knowledge and experience with our colleagues.
3. We efficiently make use of e-mailing and the Internet to share knowledge.
4. We efficiently make use of EBYS (Electronic Document Management System).
5. Teamwork is very helpful in sharing knowledge.
6. We conduct meetings with the other departments to coordinate knowledge-sharing.
7. To achieve informal knowledge-sharing, we organize picnics, soccer games, and family visits with our friends and try to get together apart from the work environment.
8. There is strong communication between the employees and the managers.

Knowledge Utilization

1. I effectively make use of my knowledge and experience in the work environment.
2. Our decision-making processes are working efficiently.
3. Our corporate effectively makes use of its knowledge potential.
4. Our corporate has a management style which is convenient to practically make use of accumulated knowledge.
5. The knowledge obtained through training is implemented in a short while.
6. Corporate knowledge is reflected in our health service systems.
7. Corporate knowledge is reflected in patients' relationship processes,
8. Our corporate has adopted the philosophy of "continuous learning" and practicing the lessons learned.

3.3 Data Analysis

The research model was applied to determine the effect of ethical leadership on KM. In this study, ethical leadership was performed as the dependent variable and KM processes as the independent variables for the testing of hypotheses. In order to address the hypotheses stated above, demographic analysis, reliability analysis, correlation analysis and regression analysis were performed.



Figure 1: Research Model

3.3.1 Demographic Analysis

Table (1) shows the gender, marital status, age, organization, years of experience, position, graduation degree and extra income of the respondents.

Table 1: Demographical Statistics

Variable	Description	Responses	Percentage
Gender	Male	204	49.3
	Female	205	49.5
	Agender	5	1.2
	Total	**414**	**100.0**
Marital Status	Single	155	37.4
	Married	259	62.6
	Total	**414**	**100.0**
Age	Less than 30 Years	164	39.6
	31-39 Years	109	26.3
	40-49 Years	120	29.0
	50+ Years	21	5.1
	Total	**414**	**100.0**
Organisation	State-oriented	261	63.0
	Private/Other	153	37.0
	Total	**414**	**100.0**
Years of work Experience	5 years	203	49.0
	6-9 Years	53	12.8

Variable	Description	Responses	Percentage
	10-14 Years	62	15.0
	15+	96	23.2
	Total	**414**	**100.0**
Position	Manager/Chief /Executive	30	7.2
	The Other	384	92.8
	Total	**414**	**100.0**
Graduation Degree	Secondary School	3	0.7
	High School	47	11.4
	Associate	112	27.1
	Bachelor	193	46.6
	Master	43	10.4
	PhD	16	3.9
	Total	**414**	**100.0**
Extra Income	Yes	49	11.8
	No	365	88.2
	Total	**414**	**100.0**

The result presents that 49.5% of healthcare professionals were female, 49.3 % were male and 1.2% were agender. Similarly, the total number of married respondents was 62,6%, while single respondents accounted for 37.4%. The sample is made of relatively young, 65.9% of who are under the age of 40. About 63% of respondents were working in state-healthcare facilities, while 37.0% of them were working in private or other healthcare facilities. About 49% of respondents have worked for their current healthcare facilities for 5 years or less, while 41% of respondents have spent over 5 years for them. While the total number of non-executive staff respondents were 92.8%, the other was 7.8%, The healthcare professionals' graduation degree are also presented, the highest rate of the respondents (46.6%), were those with the qualification of bachelor. However, the rest of the other groups, Secondary Education, High School, Associate Degree, Master's Degree and PhD., were only (0.7%), (11.4%), (27.1%), (10.4%), (3.9%) respectively. A great majority (88.2%) of the respondents had no extra income. This study was approved by Institute of Graduate Studies and Research, Cyprus International University and the healthcare professionals were informed of the processes and objectives driving the research.

3.3.2 Reliability Analysis

The Cronbach's alpha reliability was checked prior to data collection using SPSS, the coefficient normally extends between 0 and 1, while there is no lower limit to the coefficient, the closer the Cronbach's alpha coefficient is to 1.0, the greater the internal coherence of the items in the scale. Values above 0.8 are defined as good reliability (Hair, Ringle, Sarstedt, 2011). So the values of Cronbach's alpha coefficient are statistically significant.

Table 2: Reliability Statistics

Scales	Processes	Cronbach's Alpha	N of Items	Total Cronbach's Alpha
Ethical Leadership	Ethical Leadership	.936	10	.936
Knowledge Management	Knowledge Creation and Development	.959	9	.931

Scales	Processes	Cronbach's Alpha	N of Items	Total Cronbach's Alpha
	Knowledge Codification and Storage	.928	9	
	Knowledge Sharing	.886	7	
	Knowledge Usage and Utilizing	.951	8	

In this study the Cronbach's alpha coefficients, ethical leadership, knowledge creation and development, knowledge codification and storage, knowledge sharing and knowledge usage and utilizing were (0.959), (0.928), (0.886) (0.951) respectively for the scale ratings.

3.3.3 Correlations Analysis

Table (3) presents the relationship between ethical leadership and knowledge creation and development, knowledge codification and storage, knowledge sharing, knowledge usage and utilizing processes of KM.

Table 3: Pearson Inter-Correlations between the variables

Correlations		Ethical Leadership	Knowledge Creation and Development	Knowledge Codification and Storage	Knowledge Sharing	Knowledge Usage and Utilizing
Ethical Leadership	Pearson Correlation	**1**				
	Sig. (2-tailed)					
	N	**414**				
Knowledge Creation and Development	Pearson Correlation	**,772****	**1**			
	Sig. (2-tailed)	**,000**				
	N	**414**	**414**			
Knowledge Codification and Storage	Pearson Correlation	**,574****	**,675****	**1**		
	Sig. (2-tailed)	**,000**	**,000**			
	N	**414**	**414**	**414**		
Knowledge Sharing	Pearson Correlation	**,715****	**,794****	**,777****	**1**	
	Sig. (2-tailed)	**,000**	**,000**	**,000**		
	N	**414**	**414**	**414**	**414**	
Knowledge Usage and Utilizing	Pearson Correlation	**,775****	**,842****	**,743****	**,859****	**1**
	Sig. (2-tailed)	**,000**	**,000**	**,000**	**,000**	
	N	**414**	**414**	**414**	**414**	**414**

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

It clarifies that there is a positive significant relationship between ethical leadership and knowledge creation and development as reflected by the 77.2%. The results show that there is a significant and positive relationship between ethical leadership and knowledge codification and storage as reflected by 57.4%. And it shows that

there is a positive relationship between ethical leadership and knowledge sharing as reflected in the 71.5%. It also shows that there is a positive relationship between ethical leadership and knowledge usage and utilizing as reflected in the 77.5%. The major finding of this test is: there is a significant correlation between independent and dependent variables

3.3.4 Hypothesis Test

The regression results in terms of standardized regression coefficients (with significance levels), ANOVA test and tolerance values are presented in Table 4. The regression results in terms of standardized regression coefficients (with significance levels) and tolerance values are presented in Table 4.

Table 4 : Regression Model

	Dependent Variable	Independent Variables	Significant Level in ANOVA	Adjusted Rsquare	Standart Coefficient (Beta)	Sig.
Regression Model	Ethical Leadership	Knowledge Creation and Development	0,000	0,672	0,435	0,000
		Knowledge Codification and Storage			-0,113	0,019
		Knowledge Sharing			0,093	0,148
		Knowledge Usage and Utilizing			0,348	0,000

The representation ratio of the model is 67.2% (adjusted R^2). The model was statistically significant. (ANOVA significance level was 0.00 p<0.01).

Table 4 shows both the direct and indirect effects of ethical leadership on employees' knowledge creation and development, knowledge codification and storage and knowledge usage and utilizing behavior. First, ethical leadership has a significant and positive relationship with employees' knowledge creation and development behavior ($\beta = 0.435$, $p < .005$) and knowledge usage and utilizing behavior ($\beta = 0.348$, $p < .005$). Second, ethical leadership has a significant and negative relationship with employees' knowledge codification and storage behavior ($\beta = -0.113$, $p < .005$).

But, Table 4 also shows that the relationship between ethical leadership and knowledgement sharing is insignificant ($\beta = 0{,}093$, $p > .005$).

Table 5: Hypothesis Test

	HYPOTHESES	**Accepted/ Rejected**
H_1	Ethical leadership has an impact on knowledge creation and development.	Accepted.
H_2	Ethical leadership has an impact on knowledge codification and storage.	Accepted.
H_3	Ethical leadership has an impact on knowledge sharing.	Rejected.
H_4	Ethical leadership has an impact on knowledge usage and utilizing.	Accepted.

The significance levels of ethical leadership on employees' knowledge creation and development, knowledge codification and storage and knowledge usage and utilizing were less than 0,05. Therefore, Hypothesis 1, 2 and 4 is accepted. But the significance level of ethical leadership on employees' knowledge sharing was 0,148, which is more than 0, 05. Therefore, Hypothesis 3 is rejected.

4. Conclusion, Recommendations and Directions for Further Research

4.1 Conclusion

Although there are findings confirming the assumed relationship between ethical leadership and knowledge sharing in the theoretical and empirical discussions, this study has not found a relationship between ethical

leadership and knowledge sharing probably due to the hard workload on the healthcare workers during the pandemic period. It has been observed in the study that the COVID-19 pandemic not only affects human health and life, but also negatively affects the knowledge sharing of employees. Therefore, it is evaluated that different findings can be obtained in the studies to be carried out after the pandemic period.

This study is among the first to examine the effects of ethical leadership on employees' knowledge creation and development, knowledge codification and storage and knowledge usage and utilizing behavior at healthcare sector. The results of this study indicate that ethical leadership is a critical and highly effective tool for enhancing creativity and increasing efficiency of KM. Providing the employees with appropriate Internet access and library facilities allows them to fulfill their academic requirements; it also provides appropriate skills and knowledge. This also encourages their job participation and enables them to use their initiative to make the right decisions. Overall, it gives employees the freedom and confidence to perform their job in their own way without direct intervention, while also strengthening, promoting, or training them to support the infrastructure of the organization. It provides technical resources and promotes independence, responsibility, and self-focuses on workers in the organization, and the formation of trust between the leadership and employees, which leads to empowering employees. Furthermore, it can reduce absenteeism and turnover work, enabling employees to achieve a privileged position, increase competitiveness, increase cooperation in solving problems, giving them a high innovative capacity and high individual resistance to the pressures of work. Finally, the analysis process has proven the significant role of ethical leadership in enhancing KM.

4.2 Recommendation

The ethical status and behavior of managers in the managerial process is of critical importance for the performance of organizations. Therefore, managers, who have acquired ethical leadership, can contribute to the achievement of the goals of their organizations by bringing a different dimension to the attitudes of employees through well-managed KM processes.

Health organizations should work to support continuous learning of their employees also after the pandemic period, expand backgrounds, and explore approaches to coordinate knowledge and past encounters with new learning. In order to educate them more about the practice of organizational creativity and the dissemination of knowledge, holding internal dialogues between all working groups will be good for the organization's overall success. Health institutions and their managers must have the skills to solve problems in creative ways.

In order to have a positive and meaningful relationship between ethical leadership and KM, healthcare managers who have ethical leadership can organize weekly or monthly meetings where employees will freely express their ideas and opinions, exchange mutual ideas, and reward employees who contribute to the development of the organization. Health managers will contribute to the in-house bonding of managers and employees and strengthening corporate belonging by organizing activities such as matches, picnics, sightseeing tours, dance and folk dances.

4.3 Directions for Further Research

Although the study tested the impact of ethical leadership style on KM during the COVID-19 pandemic in the healthcare industry, the future studies could be designed by adding some variables into the model apart from the KM processes like employee loyalty, employee durability, job satisfaction, organizational citizenship behavior, organizational changing processes and resistance to change, and etc. at the same sector.

The new study, which could be designed from the result of this study, can be done after the COVID-19 process whether there could be the different results between the COVID-19 process and after the COVID-19 pandemic period. So, whether there could be the difference during and after the pandemic or not, the results would be very interesting to understand the flow of knowledge. Additionally, the effects of ethical leadership on knowledge creation and development, knowledge codification and storage, knowledge sharing and knowledge usage and utilizing conducted in this study will contribute to the literature in different institutions and after the pandemic period in future research.

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Innovation for Banking in the Covid-19 Era: The Role of Transformational Leadership and Knowledge Sharing

Sherine Al-Ahmad Chaar[1] and Nasser Fathi Easa[2]
[1]University of Kurdistan Hewler, Kurdistan, Erbil
[2]American University in the Emirates- UAE and Alexandria University,Egypt
Sherine.khaled@ukh.edu.krd
nasser.easa@aue.ae

Abstract: The consequences of the Covid-19 pandemic have brought many challenges for the financial sector. Banks are strongly required to introduce stimulus financial, business, and operational implications to prove their value to society. Therefore, this paper aims to discuss the role of transformational leadership and knowledge sharing in boosting banking on innovation in the Covid-19 era. Thirty-two in-depth interviews were conducted with bankers working in 15 leading banks in Lebanon. Content analysis was used to investigate the research aims. The findings highlight that developing a knowledge-sharing culture by leaders exhibiting transformational behavior have a powerful and reinforcing influence on generating new ideas, products, and processes. Leaders allow knowledge sharing on improving and expanding online and digital banking services to further streamline banking operations during the pandemic. Research implications and directions for future research are presented.

Keywords, *Innovation, Transformational leadership, Knowledge sharing, Covid-19 pandemic, Banking*

1. Introduction

The Covid-19 pandemic has become one of the crucial threats to the global economy (Brem et al., 2020). It has embarked the world into recession and made economic recoveries a difficult task (Baicu et al., 2020). According to the International Monetary Fund report (2020b), the global economy activity falls 4.4% in 2020. Most governments across the globe have taken immediate measures to mitigate the impact on their economies and businesses (Wakode, 2020).

While the pandemic has severely affected various sectors around the world (Marcu, 2020), it unpredictably brings opportunities for the banking sector (Baicu et al., 2020). Covid-19 crisis has induced rise in online banking activity and a decline in traditional banking services (Demirgüç-Kunt et al., 2021). Similarly, Marcu (2020) noticed that banks' consumers shift towards digital or electronic banking during the pandemic times. Globally, Statista in 2020 reported that the global growth in finance app usage during Covid-19 rise by 49%.

In developing countries such as Lebanon, the banking sector also witnessed significant transformation from traditional face-to-face transactions to digital transactions during the pandemic (Association of Banks in Lebanon, 2018). Since 2014, the Lebanese banking sector had embarked on a digital transformation. The initial objective of launching new digital services is to be competitive in this market (Sarji, 2017). However, the Covid-19 crisis becomes the game changer, forcing banks to re-evaluate how digital channels can be used to support business sustainability through the crisis and beyond (Abdo and Edgar, 2021).

Although, the Lebanese banks experienced continual digital service transformation (Association of Banks in Lebanon, 2018); however, delivering the services in an effective manner is still challenging, particularly in facilitating collaborative climate needed for innovation during the Covid-19 crisis (Duan et al., 2021; Berger and Demirgüç-Kunt, 2021).Transformational leadership (TL) and Knowledge sharing (KS) holds great importance in collaborative and innovation environments (Alnesr and Ramzani, 2019; Jia et al., 2018). In pandemic situation, this innovation importance amplifies significantly as they play a key role in handling the crisis (Acharya and Steffen, 2021), by accelerating digital innovation that guarantees business continuity and meet customers' changing needs (Brem et al., 2020).

Transformational leadership style develops a team attitude and spirit among members, which enhances the generation of new ideas (Zheng et al., 2016). Additionally, knowledge sharing has been widely recommended to sustain innovation. Encouraging collaboration and mutual interaction between employee-customer prompt the sharing of more valuable knowledge and continuously improves innovative capacity (Singh et al., 2016).

With the ongoing Covid-19 crisis, both new knowledge and leaders' insights are required to enable banks to reassess their relationship with customers and come up with innovative solutions (Abdo and Edgar, 2020). Despite this fact, a lack of research on the role of knowledge sharing and transformational leadership on innovation has been identified (Foumany, et al., 2015; Ramezani et al., 2017), and scant studies have assessed these relationships in the banking sector under a pandemic situation (Marcu, 2021). Additionally, most of the literature that highlights the potential Covid-19 implication for banks had focused on developed countries (Brem, Viardot and Nylund, 2020; Baicu et al., 2020). However, there is a recognized lack of research regarding exploring the role of TL and KS in facing the challenges posed by the Covid- 19 pandemic in developing countries. Therefore, this study aims to explore the link between knowledge sharing (KS), transformational leadership (TL) and innovation in banking sector and its role in cultivating collaborative climate needed to accelerate creation of innovative ideas during the Covid-19 pandemic and beyond, using Lebanon as the case study.

2. Literature Review

2.1 Transformational leadership and innovation

Transformational Leaders raise individuals and groups above self-interests through mainly four different behaviors: idealized influence (ID), inspirational motivation (IM), intellectual stimulation (IM),, and individualized consideration(IC) emphasizes that transformational leaders behave as role models for their subordinates (Bass and Riggio, 2012; Yukl, 2013).

Plessis (2007) clarified innovation as the creation of new knowledge and ideas to facilitate new business outcomes. Similarly, Andreeva and Kianto (2011) claimed that innovation is the uncovering of novel thoughts, processes and products. Previous studies have highlighted different forms of innovation. For instance, Tidd and Bessant (2011) distinguished between incremental and radical innovations. Damanpour and Aravind (2012) focused on product and process innovations. Schilling (2010) embraced technical and administrative innovation. Despite the various forms of innovations, however, each type of innovation is commonly related to a process or product (Chaar and Easa, 2020). Accordingly, this research will focus on products and processes innovations that are commonly recommended and studied empirically in the innovation literature (Liao and Wu, 2010). Product innovation within the banking environment is defined as accepting, developing, and implementing new products. It is referred to the degree to which employees seek advanced solutions; develop new service and adopt latest technologies to meet clients need (Liao et al., 2017). Regarding process innovation, Gunday et al. (2011) considered it as the application of new, considerably changed production methods and distribution means by making technical, equipment or software changes. It focused on the adopt of novel ways of service, achieved by developing and using latest technology, and introducing changes in management structures, practices and techniques (Obeidat et al., 2016).

Regarding investigating the relationship between TL and innovation, several studies have reported that TL is a critical enabler for product and process innovations. In particular, the relationships between the four components of TL, namely, ID, IM, IS and IC in relation to innovation have been investigated.

Regarding ID, leaders determine high standards for moral and spiritual behavior. Suifan and Al-Janini (2017) found that emphasizing the prominence of having a collective sense of the organization's mission may encourage subordinates to generate new ideas. Providing employees with a purpose that transcends their self-interest may increase their desire to generate innovative ideas (Jia et al., 2018).

By practicing IM, leaders inspire their followers through motivation so as a shared vision insight is facilitated (Frazier and Bowler, 2015). Nusair et al. (2012) indicated that articulating a shared vision plays an important role in enhancing initiation and implementation of new ideas. Meanwhile, Overstreet et al.'s (2013) findings suggested that giving encouragement and recognition to staff inspires them to be highly competent and innovative. Similarly, Zheng et al. (2016) claimed that developing a team attitude and spirit among team members enhances the generation of new ideas.

By providing IS, transformational leaders stimulate followers to find out new solutions and rethink about solving organizational problems in an innovative way (Yukl, 2013). In this aspect, the leaders arouse their followers through precise questions and re-explaining the problems with new ones. Transformational leaders with IS motivate their followers to rethink traditional practices in a creative way (Weib and Sub, 2016). Through the behavior of IS, leaders can promote employees' creativity by questioning their assumptions and the status quo

(Slatten et al., 2011). According to Suifan and Al-Janini (2017), leaders who prevent their employees from thinking outside the box can hinder their employees' capability to create innovations.

2.2 Knowledge Sharing and Transformational Leadership-Innovation Relationship

Various scholars have reported various kinds of knowledge sharing processes such as knowledge seeking and knowledge contribution (Wei et al., 2013); knowledge transmission and knowledge absorption (Ipe, 2003). Because of the variety of diverse kinds of KS, this research will adopt Hooff and Weenen's (2004) definition, who classified KS processes as involving two main dimensions: knowledge donation and knowledge collection. This definition is supported and is the most widely adopted by several scholars (Ritala et al., 2015).

Transformational leadership received increased attention from scholars and practitioners in terms of its relationship with innovation and knowledge sharing (Tellis et al., 2009). The relationship between the three concepts has been examined. Leaders who encouraged employees to integrate new knowledge with existing knowledge and supported them to utilize this combined knowledge into internal processes enabled them to implement changes that significantly influenced product and process innovation (Birasnav et al., 2013). According to Ratih et al. (2016), establishing a knowledge supportive culture can increase the willingness of colleagues to donate and collect knowledge, which in turn influences the speed and quality of a company's innovation capability. Besides, imparting skills, expertise, and knowledge to the organizational members, enables them to employ it to obtain, apply, convert and adopt a novel practice (García -Morales et al., 2012).

The collaborative and empowering approaches of leaders help to integrate the tacit knowledge in all the members, resulting in the addition of newness into products and processes (Foumany et al., 2015). Providing knowledge management paths to reach organizational goals are essential for an innovative climate (Ramezani et al., 2017). Similarly, inspiring the creativity of staffs through communicating the vision will boost KS among them (Haase et al., 2015). Leaders, through its support, may encourage the alliance and creation of cohesive work teams that stimulate KS for further organizational innovation (Bettis-Outland, 2012). These studies have underlined the influence of the mediating role of KS in the TL to innovation relationship.

To explore the theme being highlighted in this research, the following research questions are proposed.

RQ1 How Transformational leaders could enhance innovation process during Covid-19?

RQ2 What role knowledge sharing plays in boosting the influence of transformational leadership on innovation during Covid-19.

3. Methodology

A qualitative method was used to elicit bankers' experiences regarding of TL and KS in enhancing innovation. This research used semi-structured face-to-face interviews. A total of 32 interviews with bankers from 15 Lebanese banks.

The sample population in the interviews were non-managerial employees from different departments and positions who work in banks branches and headquarters, such as: Credit, Treasury, Cards Service, IT, Marketing, Product Development, Operations, and Customer Service departments (Table 1). These employees were selected through purposive sampling technique as they can provide in depth information regarding the product and process innovation, TL and KS process. A total of 32 interviewees (17 men and 15 women) participated in this research. Their experiences in banking were diverse. Twenty-three of the interviewees (72%) had a minimum five years of banking experience while nine of them (28%) had less than five years. The interviewees current positions reflected this diversity; the largest group being senior bankers (fifteen), followed by junior bankers (eleven) and then heads of units (six).

Table 1: Interviewees' Attributes

Banks Name	No. of interviewees	Position	Gender	Years of Experience	Code
Al-Mawared Bank	3	Senior*	Male	10	AMB2
		Junior	Female	8	AMB3
		Junior	Female	5	AMB4
Bank Audi	3	Head of Unit*	Female	16	AUD1
		Senior*	Female	12	AUD2
		Junior	Male	4	AUD3

Banks Name	No. of interviewees	Position	Gender	Years of Experience	Code
Saradar Bank	2	Head of Unit*	Female	11	SB1
		Senior	Male	8	SB2
BLOM Bank	2	Senior Branch	Male	13	BB1
		Junior	Male	4	BB2
Credit Libanais	2	Senior Branch	Male	9	CR1
		Junior*	Female	4	CR2
Intercontinental Bank	1	Head of Unit*	Male	8	IBL1
Societe General Bank	1	Junior	Male	2	SGBL1
Banque de Mediteranne	2	Senior Branch	Male	6	MED1
		Senior	Male	3	MED2
Fransabank	2	Head of Unit*	Male	13	FSB1
		Junior	Male	3	FSB3
Lebanese Swiss Bank	3	Senior Branch	Female	8	LSB1
		Senior	Male	7	LSB2
		Junior	Female	3	LSB3
Bank Libano Francaise	2	Senior Branch	Male	9	BLF1
		Senior	Female	7	BLF2
Bank of Beirut	2	Senior	Female	9	BOB1
		Senior	Female	8	BOB2
Lebanon and Gulf Bank	2	Senior	Male	7	LGB1
		Junior	Female	3	LGB2
Byblos Bank	2	Head of Unit*	Female	12	BYB1
		Senior	Male	9	BYB2
First National Bank	3	Head of Unit*	Female	16	FNB1
		Junior	Female	10	FNB2
		Junior	Male	4	FNB3
Total	32	* Staff working in Headquarters			

Content analysis is employed to evaluate the selected aspects of meaning that are related to TL, innovation, and KS (Sekaran and Bougie, 2016). Prior to the qualitative analysis process, validity and reliability was checked. The validity was established during the interviews using several validation tools such as rephrasing questions and repeating what the interviewees said to verify the answers. On the other hand, in qualitative research, reliability related to whether alternative researchers could present similar information (Sekaran and Bougie, 2016). Therefore, to enhance the reliability of the interviews, in this research, the researcher asked similar respondents, according to their years of experience and current job positions about the same subjects of TL practice, innovation and KS activities to examine the reliability and consistency of the responses provided through the interviews.

Content analysis is an interpretive method that is employed to evaluate the symbolic content of all forms of recorded communication (Sekaran and Bougie, 2016). This technique helps to focus on selected aspects of meaning that are related to TL, innovation, and KS. The 32 interviews were analyzed by searching for phrases/sentences and words that could be connected to different dimensions: idealized influence, individualized consideration, inspirational motivation, intellectual stimulation, process and product innovation, and knowledge donation and collection. Based on an extensive review of the literature, each of these dimensions was pre-identified to related aspects such as idealized influence referred to values, respect, and pride; intellectual stimulation referred to suggesting new ways, rethinking ideas; product innovation referred to new ideas and new solutions; process innovation is concerned with the use of novel approaches to services and production; knowledge collection referred to shared training, experience, skills, and work topics.

4. Findings and Discussion

4.1 Transformational Leadership and Innovation

The interviewees have highlighted the role played by idealized influence leaders in promoting innovation during Covid-19 crisis. Interviewees declared that respecting their opinions allowed them to provide further inputs, comments and suggestions to generate digital friendly use services that suits customer needs. “My supervisor shows respect and values our opinion about how to digitalize services and tarin customers to be familiar with them” (SGBL2). Interviewees highlighted that sustaining standard during Covid-19 pandemic motivated them to

work hard and try new things: "the main concern as a developer in research and development department, is not just to provide digital services that meets customers' needs but also to benefits from these novel digital services to face any coming challenges" (LSB3).

In the context of Covid-19 crisis, interviewees considered that specifying the scope of the bank's vison Inspirational motivational leaders allowed them to suggest innovative and non-traditional banking practices: "I feel amazed, tireless, and always upbeat about my work and my career future prospects. Since my supervisor always motivated me to adopt new methods and ideas and this was accelerated during pandemic" (CR2).

Intellectual stimulation leadership generate a positive climate for individual innovation. In term of the 'stimulating to rethink ideas' aspect, interviewees suggested that allowing limitless critical thinking and participating in decision-making processes enable them to apply new methods: "My supervisor is limitless in his thinking; he lets us …… use our brain to think out of the box. I find myself goes beyond procedures and think of remotely digital services especially during complex crisis like Covid-19" (IBL1).

During Covid-19 pandemic context, the interviewees highlighted that individualized consideration exhibited by the leaders are vital for product and process innovation. As to one interviewee explained that being reminded about their objectives and goals, being guided and their work progress monitored to reach their maximum potential, helped them to come up with novel ideas: "……. spends time with us develop our negotiation skills to persuade customers and win a deal. Thus, this support strengthens our capabilities, to absorb Covid-19 shock to come up with novel ideas for advanced online payments and transfers systems" (CR1).

4.2 Knowledge Sharing and the Transformational Leadership-Innovation Relationship

Innovation is considered one of the important sources for modernisation and sustainability (Nguyen and Khanh, 2021). Hence, the interviewees in this research have highlighted the role of leaders and KS as a powerful tool in stimulating innovation during complexity and uncertainty, especially Covid-19 crisis. In this context, pointed out that, due to Covid-19 and the resource scarcity, they have to develop new plans that triggers employee's creativity to respond to the crisis since relying on old plan is no longer efficient: "the preventive measures taken by the government during Covid-19 crisis, restricted us to operate with a capacity 50% workforce, also restricted the working office hours, and limited the cash withdraws per day, while at the same time our clients were highly in need to perform their financial transactions. Therefore, we started to think beyond our predetermined plans to come up with novel ideas, and creative solutions" (BYB1).

Abdo and Edgar (2021) had pointed out that leaders, through developing a climate supportive to creativity a will enable sharing of new knowledge. To establish how leaders can contribute to KS and innovation during Covid-19 pandemic, interviewees' opinions were sought. Some of the respondents mentioned that shortage in workforce manpower forced them to utilize the available know-how, knowledge and experience gained by employees to implement the needed changes effectively: "In response to employees' shortage due to Covid-19 restrictions, my supervisor set a new strategic plan to benefit from the limited number of employees attending work" (LGB2). Other respondents stressed that sharing experience and skills helped them to respond quickly and with agility to Covid-19 crisis by innovating remotely banking services that simplify banking operations: "My supervisor shares with us his ideas to innovate new remotely banking services that fulfil client's needs and simplify banking operations" (AUD2).

Interviewees' observations on innovation and financial services during Covid-19 crisis indicated that leaders fuel KS by challenge employees to find innovative solutions. According to one of the interviewees, working in a collaborating climate during Covid-19 crisis encouraged them to come up with new ways of doing tasks such as increase cash withdraw from ATM to achieve sustainability: "The Lebanese central bank provided new guidelines for banks to apply during Covid-19, as banking industry based on competitive advantage, my supervisor stimulates us to generates creative and innovative idea to serve clients' needs. By sharing ideas, he motivated us to practice new ways of doing tasks, for instance, a free transfers fees are permitted, amount of money holds in ATMs (automated teller machines) are increased, to achieve sustainability and competitive advantage." (BLF1)

To overcome the challenge of social distancing due to Covid-19, it was suggested that digital communication application be used as a mean of KS activities in banks. According to an interviewee, having a digital communication platform with the help of quality support team had assisted in communicating knowledge effectively among them, which in turn assisted in generating ideas that cope with Covid-19 crisis in term of

facilitating online shopping: "…. My supervisor motivates us to look outside the box due to Covid-19, as a result, we established advanced digital communication platform to facilitate sharing knowledge and we added a new service for the existing debt/credit cards to perform online shopping with open cash limit and free of charge" (MED2). Some interviewees also stressed that sharing experience through digital communication application enabled them to learn from them and develop new financial market services: "My supervisor believes that without creativity business cannot survive especially during crisis. Working at treasury department, this triggers us to build on his experience and learn more about financial market fluctuation in order to develop creative services. We offer our clients a new service, to withdraw cash against their assets to increase their benefits and have liquidity in hand to manage the impact of Covid-19 crisis" (FSB2).

As a suggestion on how transformational leader and KS boost the innovation process during Covid-19 pandemic, some interviewees explained that leaders' support assisted them in converting challenges to innovation which helped them generate new way of providing innovative digital services and products continuously to clients: "In facing the challenges brought by Covid-19, my supervisor motivated us to convert constrains into innovation, we started to gather information on services provided by our competitors and try to outperform them by applying new knowledge and provide them with innovative digital services and products continuously" (FNB1)." During Covid-19 pandemic, we are encouraged to learn new things from our clients, colleagues, and competitors, to remain cautious with our services to achieve sustainability and avoid market outperformed" (AUD3).

Given the need to seek out the role of KS plays in enhancing innovation and sustaining banking operation during the pandemic, some interviewees mentioned that to overcome employee shortage caused by Covid-19 pandemic, existing employees need to share their know-how and perform multi-tasks to serve clients' transactions: "To overcome the manpower shortage caused by Covid-19 crisis, by sharing his know-how and skills my supervisor emphasizes the need to allocate our potentials and capabilities to carry on diverse tasks and to be ready to act in many job positions to meet our clients' financial transactions and liquidity in hand" (AMB2). Moreover, the interviewees also believed that Covid-19 pandemic triggers knowledge-sharing practices by stimulating our thoughts to offer clients an electronic wallet on their mobile phones to pay for goods and services: During pandemic two days' workshop were held for 6 hours a day, to discuss various digital model for effective adaptation of electronic wallet on customers mobile phones in order to carry out P2P (peer-to-peer) payments and pay for goods and services, while enabling withdrawals and cash feeds for electronic wallets all at the same time" (FNB1).

The financial sector, particularly banks, played a vital role in absorbing Covid-19 shock, by supplying funds to the corporate sector and households (Acharya and Steffen, 2020). To establish how banker can contribute to innovative services under pandemic circumstances, interviewees' opinions were pursued. Some of the respondents mentioned that measure taken by central bank forced us to offer a package of new services to clients: "In response to central bank measures, our bank established online community of practice platform which enable us to receive updates, comments, address problems, and provide solutions that best serve our clients for instance, our bank offers package of financial facilities to their clients such interest-free loans, simplified programs for non-performing loans, liquidity support for domestic and foreign currency based on swap agreements" (BYB1). Another respondent stressed that to contribute to the resilience of individuals and organizations, we allowed delay settlement of the loans: "…. to adapt to the challenges brought by the Covid-19 pandemic, our bank permit delay payments of loans for individual and organizations alike, this rescheduling process come up from the suggestions and feedback of our customers" (FSB1).

5. Theoretical and practical implications

This research adds to the extant literature regarding the role of KS on TL– innovation relationship within the Covid-19 setting. The findings of this research empirically strengthen the role KS plays in boosting the TL influence on innovation in Lebanese banks during the pandemic of Covid-19. Foremost, the findings of this research provide better understanding how the 4I's within TL influence on innovation. Moreover, the use of KS in the context of TL, along with product and process innovations, represents another contribution, since this research provides a better understanding of how KS during the pandemic of Covid-19 impacts the relationship between TL styles and product and process innovations. This research also confirms the universality of the effects of KS across cultures. By confirming the relationship between TL, KS and innovation in Lebanon, the findings indicate that, regardless of whether the context is Western or Eastern, TL plays a vital role in stimulating a KS culture and strengthening both product and process innovations in the banking sector. From a

methodological view, the reliability and validity of TL, innovation and KS constructs are evaluated in a new geographical setting. This provides researchers and academics with a model to track the effects of TL and KS on innovation in another similarly research.

In Covid-19 period, in a highly complicated environment, innovation in banking sector becomes very challenging. This research makes a significant contribution to the practice of KS to tackle difficulties of innovation in banking sector. The result indicates KS practices is crucial for banks' ability to generate new processes and products during the pandemic of Covid-19. Therefore, management at banks should develop knowledge-sharing platform that encourage their experienced staffs to communicate their expertise to deliver innovative digital services that serves their customers' needs. Moreover, promoting online meetings and digital blogs can build virtual communities for optimal KS among bankers during Covid-19 crisis. Additionally, management should motivate employees to enhance their knowledge about digital-technological change through workshops, in the contest of Covid crisis, banks can adapt online course to educate their employees.

In this research, knowledge sharing has influence on TL–innovation relationship among bankers during Covid-19. It was found that sharing new knowledge among employees is vital for innovation. Therefore, to enhance the knowledge-sharing culture among bankers, bank leaders should create a knowledge-friendly environment to take advantage of sharing experiences and knowledge, such as encouraging and facilitating virtual teamwork, communities of practice and videoconferencing. Besides, this research found that TL is the critical enabler for a KS mechanism among the staff in the Lebanese banking sector during the pandemic of Covid-19. This shows that building successful KS climate depends on the presence of TL. Therefore, for sustainability, bank leaders should utilize new technologies to develop value-added customer relationship that cannot be effectively provided with their current infrastructure. New technologies such as biometry, video, chatbots or artificial intelligence may help banks to create sophisticated capacities for maintaining a value-added remote customer relationship, while securing transactions and mitigating fraud and risks. Banks may also be prone to offer partially or totally automated robo-advisor services, digital wealth management tools for customers with the intention of maintaining a competitive position in the banking market and sustain business operations.

6. Research limitations and further research

Although this research provides several insights regarding the role of KS on TL–innovation relationships in the banking sector in Lebanon, it has its own limitations that should be identified. The sample of this research is constrained to the banking sector; hence, the findings drawn from it cannot be generalized to other sectors. Thus, it is recommended to replicate this research in other sectors, e.g. industrial, educational and health and also conduct comparative studies between the industrial and service sectors, as industrialized firms could pursue various phases of innovation than their service counterparts. This research is limited to developing countries, specifically Lebanon, as one of the smallest Arab countries; therefore, it is recommended to replicate and extend this research to other Arab countries to confirm the results, since it is acknowledged that cultural differences may reach dissimilar results. Another limitation is that this research investigates qualitatively the impact of KS on TL–innovation relationship among non-managerial employees. Considering different managerial levels may provide a better understanding of the research topic. A comparative study can thus be drawn from interviews with employees and leaders which might provide a greater understanding in regard to which TL practices foster KS and innovation. Finally, the study was restricted by focusing on KS variable in the TL-innovation relationship. It is suggested that future studies incorporate other potential variables that could influence this relationship.

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The Intellectual Potential of Employees in Hospital Crisis Management During a Pandemic

Jolanta Chluska
Częstochowa University of Technology, Częstochowa, Poland
jolanta.chluska@pcz.pl

Abstract: Hospitals are medical entities that provide health care services to patients. The specialized medical staff does not only provide medical services, but also educates future medical professionals, conducts clinical research, and supports the development of medical technology. The important role of employees in hospital operations is evidenced by the dominant percentage of labour costs in the cost structure of the health care entity. The article aims to analyse the changes in remuneration of teaching hospital employees as a factor stimulating the increase in the intellectual potential of hospital employees, including medical staff as the main resource of knowledge workers, in hospital crisis management during a pandemic. The inference was made based on the available financial data on the formation and growth of labour costs of hospital employees as a factor in stimulating the development of intellectual potential. The following research questions were posed: Is the level of remuneration of hospital employees during a pandemic an expression of building the intellectual potential of hospital employees and do current legal regulations on financing the operations of teaching hospitals in Poland, including the financing of salaries and other labour costs of medical staff, support crisis management during a pandemic? The research was conducted based on the reporting data for 2018-2020 in selected teaching hospitals as primary entities employing high-level medical professionals. The research was empirical by nature and was based on quantitative and qualitative data. The analyses were of an expert nature from the perspective of a certified auditor and a long-term researcher of the problems of the functioning of hospitals as medical entities. The investigations presented in the paper help identify the conditions for the development of the intellectual potential of hospital employees as actors involved in solving health problems of an international scope. The effects of the analyses are mainly addressed to the bodies establishing medical entities, bodies influencing the form of the health care system and hospital management staff.

Keywords: intellectual potential of hospital employees, salaries of physicians, hospital crisis management, knowledge workers in hospitals

1. Introduction

The COVID-19 pandemic in the European Union began at the turn of March 2020. In Poland, pandemic containment measures were taken as early as mid-March, just 11 days after the first case of COVID-19 was detected. According to the European Centre for Disease Prevention and Control (ECDC), as of 30 October 2020, Poland was 11th in Europe in terms of cumulative 14-day incidence per 100,000 inhabitants.

The dynamic increase in the number of new infections observed in the fall of 2020 forced a new model of hospital bed organization. Level 1 hospitals (hospitals within the hospital network) were tasked with:

1. increasing the number of places to admit a patient with suspected disease pending receipt of a COVID-19 test result,
2. implementing life-saving procedures if necessary,
3. organizationally increasing access to COVID-19 diagnostics by increasing the number of laboratories.

Starting in October 2020, the payer (the National Health Fund) accepted applications from hospitals to extend the settlement period of contracts for the provision of medical services. Applications could be submitted by service providers who were unable to fully deliver contracted services during the COVID-19 restriction period. The settlement period was extended to 2021.

Crisis management in Poland is regulated by legal regulation in the form of a legislative act. The Act of 26 April 2007 on crisis management defines the types and tasks of authorities competent in crisis management, and the principles and financing of activities in the field of crisis management.

Crisis management is defined as the activity of public administration bodies being an element of national security management, consisting of the prevention of crisis situations, preparation to take control over them through planned activities, reacting in case of crisis situations, elimination of their effects, and reimplementation of resources and critical infrastructure. An important concept defined in the Act is that of a crisis situation. A crisis situation should be viewed as "a situation that adversely affects the level of security of people, property of significant size, or the environment, which cause significant limitations in the operation of the relevant public

administration bodies due to the inadequacy of their resources". In the case of the COVID-19 pandemic, this situation has been observed since 2020.

The Act relates to public administration. Its findings, however, can be applied to entities on the front line of pandemic control, such as hospitals. The health care system is the area of interest for crisis management (Act of April 26, 2007, art. 3).

Important systemic solutions of crisis management in health care in Poland in the fight against COVID-19 affecting the tasks performed by hospitals included:

1. creating hospital wards that specialize in admitting patients with COVID-19,
2. creating temporary hospitals,
3. providing hospitals with specialized equipment,
4. COVID-19 treatment task funding,
5. fixed rates for remaining on standby for medical services for people infected with the virus,
6. immunization of medical and other staff members,
7. a nationwide COVID-19 vaccination program,
8. coronavirus testing system,
9. payment of additional cash benefits for medical personnel involved in the fight against COVID-19,
10. simplifying access to selected health professions.

Crisis management tasks are performed directly in healthcare entities.

Hospitals and other health care providers are characterized by high levels of intellectual capital in all areas of its occurrence. A specific element of these important resources is high-quality specialists, i.e. medical professionals. Therefore, teaching hospitals provide a knowledge management environment for intellectual capital (Bose, 2003). Developing the intellectual potential of employees is a long-term process and is part of the hospital's strategic management system.

The article aims to analyse the changes in remuneration of teaching hospital employees as a factor stimulating the increase in the intellectual potential of hospital employees, including medical staff as the main resource of knowledge workers, in hospital crisis management during a pandemic.

2. Hospital as an object of crisis management. Literature review.

The occurrence of a crisis situation requires taking quick measures while remaining calm. An entity operates in a complex and changing environment, and the degree of its dependence on the various elements of this environment is becoming greater (Huczek, 2015).

Subject-related literature shows that during a pandemic, health care facilities face many difficulties in terms of operations. These primarily include the following:

1. the need to admit a disproportionate number of patients compared to the capacity of the health care system,
2. shortages of personnel, medicine, vaccines, or medical equipment,
3. absenteeism among medical professionals,
4. problems resulting from the high number of deaths,
5. logistical problems associated with transporting patients or running out of supplies, such as medication,
6. financial problems of individual health care facilities (Buchelt, Kowalska-Bobko, 2020).

Crisis is an umbrella term referring to different spheres of activity. A. Zelek argues that a crisis should be viewed as a consequence of disturbances in the existence or realization of one or more factors determining the existence and development of an entity, both those of external and internal impact, which are dependent on the efficiency of management (Zelek, 2003). Crisis management tasks faced by hospitals to combat COVID-19 include as follows:

1. developing plans for hospital operations while taking consideration of nationwide pandemic control system solutions,
2. preparing structures and resources to perform tasks,
3. preparing a crisis management information system,

4. preparing solutions in the event of significant disruptions to task performance.

These tasks had to be included in the budgeting (planning) of hospital activities. Although planned admissions of patients with diseases other than COVID-19 were kept to a minimum, some hospitalizations could not be excluded (for example, in gynecology, oncology wards). Coordination of pandemic activity planning areas is the responsibility of the hospital manager.

Hospital employees are an important link in the operation of the hospital during emergencies. They are assigned to three main areas of evaluation:

1. crisis management (hospital administrator, deputy directors, hospital office, head nurse, IT staff, pharmacy staff),
2. logistics (maintenance and operations personnel, IT specialists, engineers),
3. providing medical assistance (physicians, nurses, support staff).

Task forces are especially important during triage, infection control, lifesaving, and intensive care (Davoli, 2007). The pandemic has brought medical personnel to the forefront as the most important group in pandemic control and strategic efforts to contain the spread of the pandemic. It is therefore important not only to provide medical assistance, but also to identify the causes of the pandemic, modify the factors that cause the disease, create vaccines and new medicine, while also analyse the determinants of the course of the pandemic. Hospital employees with their intellectual capital are therefore the most important resource in the fight against a pandemic.

Models of human capital measurement are a function of multiple variables and are based on the capitalized cost of living, cost of education, growth in experience over years of work, creativity, and the minimum fair wage. The measurement of intellectual capital has also been linked to the value of salaries (Renkas, 2016; Dobija, 2003, 2015; Dobija, Kurek, 2013). Remuneration affects the motivation and morale of knowledge workers (Smith, Rupp, 2003; Orzano et al., 2008).

As research shows, remuneration can be considered as a percentage of capital. According to research, this percentage is defined as a random value whose average value is 8% per year. It is recognized that such level of remuneration guarantees the preservation of human capital and prevents its depreciation (Renkas, 2016).

Previous studies of the identification of human capital based on models containing remuneration elements have been conducted in entities such as companies (Kozioł, 2010), in the Labour Office in Ukraine (Renkas 2012), and various economic units of the private and state sector (Oliwkiewicz 2018). Similar studies were not conducted in teaching hospitals as medical entities operating during a pandemic. The analyses presented in this paper fill a research gap in identifying the intellectual potential of hospital employees during a pandemic and can be an important complement to the ongoing research on human capital measurement models.

3. Methodology of the research. Characterization of the research subject

The article aims to analyse the changes in remuneration of teaching hospital employees as a factor stimulating the increase in the intellectual potential of hospital employees, including medical staff as the main resource of knowledge workers, in hospital crisis management during a pandemic.

The following research questions were asked in the study:

1. Is the level of remuneration of hospital employees during a pandemic an expression of building the intellectual potential of hospital employees?
2. Do current legal regulations on financing the operations of teaching hospitals in Poland, including the financing of salaries and other labour costs of medical staff, support crisis management during a pandemic?

The analysis was based on economic and financial data resulting from the financial statements, supported by the certified auditors' examination.

The relationship between the increase in salaries of clinical hospital employees in 2020/2019 (pandemic period) and the previous period, i.e. 2019/2018, were analysed. Similar periods were also analysed for the cost of material consumption and the cost of third-party services.

The research process consisted of the following steps:

1. analysis of legal acts concerning the rules of operations of hospitals, including financing their activities during a pandemic,
2. identification of the role of human capital in combating the effects of COVID-19 (literature review, review of websites of teaching hospitals, National Health Fund (NHF), Ministry of Health, review of statistical data, synthesis),
3. obtaining data from financial statements from the National Court Register (selection of data from profit and loss accounts, additional information, other reporting data),
4. compilation and selection of selected data characterizing human resource costs, and other costs incurred by teaching hospitals during a pandemic,
5. the application of selected measures of structure and dynamics to characterize the relationship between the analysed costs, and expert analysis of data relations from financial statements.
6. 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,
7. conclusions from studies conducted during the pandemic.

The study subjects were teaching hospitals. As medical entities, teaching hospitals are active not only in such areas as health services and health promotion, while also the implementation of health programs, but their responsibilities also include:

1. educating medical professionals,
2. serving as an opinion maker, consultant, and adjudicator,
3. completing tasks for defence needs.

In the Register of Medical Entities in Poland, 29 teaching hospitals were registered in the form of independent public health care institutions. The founding bodies of these hospitals are medical universities or local governments. Eleven teaching hospitals were analysed in the study. The inclusion criteria were the possibility to obtain complete financial data on the entity in the form of the financial statements, particularly the profit and loss account, and additional descriptive information in 2018-2020.

The choice of teaching hospitals as a research subject was also dictated by the very high level of qualifications of the medical staff and infrastructure resources. 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 the legal basis of hospital activity.

4. Results. Human capital costs in the fight against COVID-19 versus other costs

Medical employees are undoubtedly the most important resource of hospitals as medical entities. Nowadays, managing these resources is an important task for managers. The scope of operations of teaching hospitals is much broader than in other hospitals.

The broad scope of operations requires a highly specialized workforce, which translates into salary levels and other labour costs. The salaries and work of medical professionals are governed by numerous laws, including:

1. Act of 15 April 2011 on medical activity,
2. Act of 5 December 1996 on the professions of physicians and dentists,
3. Act of 15 July 2011 on the professions of nurses and midwives,
4. Act of 8 June 2017 on the manner of determining the lowest basic remuneration of certain employees working in medical entities.

The regulations stipulate both the rules of practicing particular medical professions, education, acquiring certificates to be licenced to practice a profession, professional responsibility, but also working time and ways of calculating salaries, including the way of calculating the lowest salaries of employees working in medical entities.

During the pandemic period, the afore-mentioned legal acts were supplemented by regulations governing the operation of hospitals under these difficult conditions. These are legal regulations with the nature of acts, regulations, and specific provisions issued by the key decision-makers, i.e. the Minister of Health and the President of the National Health Fund (payer).

Since 29 April 2020, medical professionals who had contact with patients or individuals with suspected COVID-19 infection have been prohibited from working at more than one treatment facility. To compensate for the loss of income due to this restriction, the Minister of Health instructed the National Health Service to provide these professionals with additional monthly cash benefits, funded from the state budget. These benefits were limited to PLN 10,000 per month and accounted for 80% of the wages received at the workplace where the employee stopped working after the restriction or at least 50% of the wages received at the workplace where the employee chose to work after the restriction. The compensation covered the employer's social security contributions (Buchelt, Kowalska-Bobko, 2020).

The analysed teaching hospitals had different financial results during the periods studied. The financial results of the hospitals surveyed are presented in Table 1.

Table 1: Financial results of hospitals studied from 2018 to 2020

No.	Year	Number of hospitals achieving the financial result	
		Net profit	Net loss
1	2020	5	6
2	2019	10	1
3	2018	9	2

Source: Self-study based on the financial statements.

Among the teaching hospitals surveyed in 2020, the number of entities experiencing a financial loss increased. This means that teaching hospitals, despite cutting back on non-COVID-19 services, were not able to cover the rising operating costs with revenue.

In 2020, six hospitals experienced an increase in staffing of 1% - 7%, whereas the increase was 8% - 11% in three hospitals and 2% in two others. This means that the number of employees remained stable. During the pandemic period, hospitals had staffing problems among both physicians and nurses. For many years, Poland has been witnessing an outflow of medical personnel to the private health care sector and due to migration. In 2020, there were 593,000 employees in the health care system. These included 153,000 physicians (26%), 303,000 nurses (51%), 43,000 dentists (7%), 40,000 midwives (7%), 37,000 pharmacists (6%), and 17,000 diagnosticians (3%). The mean age of a working nurse was over 51 years, a physician - almost 50 years, and a doctor with a specialization - over 54 years. Thus, a serious systemic problem is the lack of generation replacement, both in the group of physicians and nurses (Buchelt, Kowalska-Bobko, 2020).

The current shortage of medical staff is due to many factors such as:

1. problems with effective human resource management,
2. lack of a rational personnel policy,
3. mismatch between the structure of employment and the profile and scope of services provided,
4. planning deficits in the education system,
5. underfunding of health care (Buchelt, Kowalska-Bobko, 2020).

One of the factors stimulating the development of the intellectual potential of employees in medical entities is salaries. Therefore, it is interesting to analyse the rate of increase in medical worker salaries during the pandemic period relative to previous periods. The labour costs (salaries plus social security contributions paid by employers) of medical employees in selected teaching hospitals are presented in Table 2.

Table 2: Labour costs of employees of teaching hospitals (in thousands PLN)

Hospital	2020	2019	2018	2020/2019 (%)	2019/2018 (%)
1	93,382	78,158	65,672	119	119
2	82,870	76,357	64,323	109	119
3	327,812	280,869	239,445	117	117
4	407,976	252,661	205,019	161	123
5	220,364	199,613	173,665	110	115

Hospital	2020	2019	2018	2020/2019 (%)	2019/2018 (%)
6	97,754	97,313	88,134	100	110
7	195,363	181,370	160,145	108	113
8	112,586	105,104	92,515	107	114
9	81,219	73,422	63,677	111	115
10	151,910	140,614	117,525	108	120
11	151,074	137,647	113,167	110	122

Source: Self-study based on the financial statements.

As research shows, the increase in labour costs in 2019/2018 was 110 - 123%. For the 2020/2019 pandemic period, the increase in labour costs was 101 - 119%, which was lower than in the previous period. The increase in labour costs in 2020 was higher than in the previous period in only one case. It should be noted that COVID-19 patient work allowances were a significant component of pay in 2020. Significantly lower growth in labour costs means that the systemic factors of wage growth that underpinned their increase in the previous period did not occur.

Besides labour costs, the second major element in the cost structure of hospitals is material consumption. This group of costs includes the consumption of medicines, medical and non-medical supplies, including dressing and personal care materials, small medical equipment, and energy. The costs of material consumption and their growth in the analysed periods are presented in Table 3.

Table 3: Costs of material consumption in teaching hospitals (in thousands of PLN)

Hospital	2020	2019	2018	2020/2019 (%)	2019/2018 (%)
1	28,921	21,990	20,276	132	108
2	10,488	7,482	7,367	140	102
3	217,388	195,331	189,356	111	103
4	120,132	147,222	151,452	82	97
5	198,359	185,760	188,962	107	98
6	287,341	268,440	244,501	107	110
7	232,937	207,867	176,004	112	118
8	84,512	75,008	71,489	113	105
9	48,816	50,959	41,721	96	122
10	106,185	110,783	100,949	96	110
11	118,985	105,064	100,019	113	105

Source: Self-study based on the financial statements.

In the 2019/2018 period, the cost of material consumption in teaching hospitals increased from 97% to 122%. For the pandemic period of 2020/2019, the increase was from 82% to 140%. At six teaching hospitals studied, the increase in costs of material consumption during the pandemic period was significantly higher than in the previous period. In addition to the material needs of fighting a pandemic (oxygen, drugs, dressings, protective gear), the level of these costs is also determined by the scope of the hospital's medical services and its size. Smaller hospitals have limited stockpiling capacity, so each new task involves a significant increase in supplies and material consumption (Hospital 2 is an example of this).

The costs of third-party services, which are medical (pharmaceutical, sanitary transport, diagnostics, medical subcontracting of doctors, nurses, and other personnel) and non-medical (transport, repair and maintenance, repair of medical and non-medical equipment, disinfection, laundry services, nutrition of patients), also play an important role in the fight against the pandemic. The values of costs of third-party services and their changes in the periods studied are presented in Table 4.

Table 4: Costs of third-party services in teaching hospitals (in thousands of PLN)

Hospital	2020	2019	2018	2020/2019 (%)	2019/2020 (%)
1	23,023	19,620	16,782	117	117
2	10,075	9,465	9,532	106	99
3	60,846	53,215	46,738	114	114
4	114,651	87,284	74,377	131	117
5	100,596	84,163	75,981	120	111
6	63,460	61,809	56,671	103	109
7	21,814	16,725	14,738	130	113

Hospital	2020	2019	2018	2020/2019 (%)	2019/2020 (%)
8	18,499	16,300	14,043	113	116
9	26,790	25,986	22,794	103	114
10	11,554	9,125	8,794	127	104
11	66,392	60,151	55,834	110	108

Source: Self-study based on financial statements.

During the 2020/2019 pandemic period, the increase in third-party costs of 103% - 131% at 6 hospitals was higher than in the previous period (99% - 117%). The increase in the costs of labour, material consumption, and third-party services should be analysed, taking account of the fact that other inpatient services of hospitals were reduced to a minimum during the pandemic period. For example, in hospital 10, scheduled hospitalizations were down 17.8% in 2020 compared to 2019, whereas surgical procedures were down 27.2%. The bed occupancy rate was 10% lower. The number of outpatient consultations decreased by 23.3% from the previous year, and there were 18.7% fewer services provided in emergency rooms. From March to June 2020, this hospital did not admit scheduled patients and did not provide consultation in outpatient clinics. Only life-threatening cases and patients infected with Sars-Cov-2 were hospitalized. In hospital 2, 24.33% of the value of the contract with the National Health Fund for medical services (over 20 million PLN) was not completed. In light of the above examples, the increase in the level of labour costs, material consumption, and third-party services in teaching hospitals studied should be considered significant. The percentages of these cost groups in the operating costs are presented in Table 5.

Table 5: Percentage of selected cost groups in the value of operating costs (%)

Hospital	Percentage of costs in the value of operating costs (%)					
	Labour costs		Material consumption		Third-party services	
	2020	2019	2020	2019	2020	2019
1	57	59	18	17	14	15
2	77	79	10	8	9	10
3	49	48	33	33	9	9
4	60	49	18	28	17	17
5	40	39	36	36	18	17
6	21	22	62	60	14	14
7	42	43	50	50	5	4
8	50	51	37	36	8	8
9	46	44	28	31	15	16
10	50	49	35	38	4	3
11	43	43	34	33	19	19

Source: Self-study based on financial statements.

As shown in the table, the percentages of the three major cost groups in the value of operating expenses in 2019 and 2020 changed insignificantly. Health system resources were used for COVID-19 treatment. The pandemic crisis situation forced a short-term focus on the most urgent life-saving measures.

5. Discussion on results and implications for practice

In many countries, political authorities have turned to public health experts and medical specialists (in epidemiology, infectious diseases, virologists, and microbiologists) to provide information, advice, and consultation on pandemic control. In some, this was done with the participation of the Ministry of Health, whereas in others - within the Ministry of the Interior, institutes of public health, and special task forces. Scientists and physicians were by far the most trusted experts (82% and 83%) (Golinowska, Zabdyr-Jamroz, 2020).

The statutory limitation on the working time of medical workers, the statutory rules of the practice of physicians and other groups of medical professionals, the statutory method of calculating the lowest remuneration of workers employed in medical entities, and the limited financial resources of the health care sector in Poland significantly affect the trends in salaries and other costs of labour of employees of teaching hospitals during the pandemic period.

It was observed that the functioning of teaching hospitals in Poland during the pandemic period was characterized by the following conditions:

1. failure to provide health care services other than COVID-19 treatment,
2. the conversion of many hospital wards into COVID-19 treatment wards,
3. limiting the professional activity of physicians to a single health care location,
4. the focus of physicians' professional activity on pandemic treatment processes.

As a result, the salaries and other labour costs of pandemic treatment have largely replaced the salaries of medical professionals for specialized health services.

6. Conclusions and future directions

A significant part of Poland's specialized hospital health services has been delayed until 2021. If it is considered that some non-performed medical services accounted for about 25% of the hospitals' annual contract, then, for a complete picture of COVID-19 medical costs in terms of the labour costs of physicians and other medical personnel, the conclusions of the analyses need to be adjusted. Labour costs for medical professionals at teaching hospitals treating COVID-19 patients were replaced by salaries and wages for health services discontinued and carried forward in 2021.

The increase in labour costs during the period studied did not show any significant deviation from the trends observed in previous years. The claims accompanying media coverage of special bonuses for medical professionals for working in crisis conditions of pandemic COVID-19 are not substantiated.

The trend of changes in salaries of medical professionals in the 2020/2019 period does not warrant consideration as a tool to stimulate the development of the intellectual potential of these employees. Which confirms the implementation of the purpose of the article.

In her previous research on the development of the intellectual potential of employees of teaching hospitals, the authors found that the current legal and information environment of teaching hospitals in Poland ascertains the existence of the intellectual potential of employees and the management of intellectual capital, but, due to several significant limitations, it does not provide a basis for its precise measurement (Chluska, 2021).

The current research indicates that the short-term goals of crisis management during the pandemic dominated the long-term policy of developing the intellectual capital of the medical workforce. Although the intellectual potential of knowledge workers such as those in teaching hospitals is crucial to the development of the health care system, the objectives pursued by hospitals in times of the pandemic must take the conditions of the crisis into account. Legal regulations embedded in crisis management processes performed the functions of coordinating and controlling the use of limited resources of the health care system.

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Impact of ICT Strategy on Intellectual Capital, Quality of Service, and Financial Autonomy in Polish Hospitals

Andrzej Chluski
Czestochowa University of Technology, Poland
andrzej.chluski@pcz.pl

Abstract: Information and Communication Technology (ICT) is crucial for the technological development of most areas of human economic activity. Appropriate ICT can positively influence the development of intellectual capital, knowledge management, enhancement of purely medical technologies, and the financial autonomy of health care units. The article aims to present and verify the model determining the impact of financial autonomy and the orientation of hospital managers on ICT strategy on the quality of medical services, and the development of intellectual capital of medical personnel. The research model was developed based on empirical studies conducted in Polish hospitals. This is the first study of its kind in Poland. Theoretical constructs of the model have been developed for the aforementioned phenomena. These constructs and their mutual relationships are the basis of the research model developed using Structural Equation Modeling (SEM). A survey was conducted among managers of Polish hospitals and used to create SEM measurement models. The survey was developed based on subject-based literature focused on similar research models and interviews with managers of Polish hospitals.The estimation and correctness of the model parameters were assessed using the partial least squares structural equation modeling (SEM-PLS) methodology. The hypotheses proposed in the paper have been acknowledged. The model meets the required quality criteria, and all model parameters are statistically significant. The appropriate use of ICT and the financial autonomy of Polish hospitals positively affect the development of intellectual capital and the quality of services provided. The research findings may be helpful for the knowledge management of hospital personnel.

Keywords: knowledge management, healthcare management, information and communication technology, knowledge management in the public sector, managing intellectual capital, SEM-PLS methodology

1. Introduction

Knowledge management in health care entities is essential due to the fact that they provide professional services. In this case, service providers are required to have a significant level of knowledge and skills, often confirmed by university degrees and other certifications. The basic resource of knowledge management, especially in medical entities, is the so-called intellectual capital. These are intangible resources including the knowledge, skills, and qualifications of the medical staff, and a type of relational capital, i.e. the trust of patients, their positive experiences, and the image of the hospital as an organization (Evans, Brown, Baker, 2015). Therefore, it is crucial to develop intellectual capital as an essential resource for knowledge management in medical entities (Alfiero, Brescia, Bert, 2021).

The modern information society is characterized by a high degree of complexity of social and economic processes. This requires the skillful use of specific methods to collect, process, transmit, and use an enormous and growing amount of data (Teubner, Stockhinger, 2020). Knowledge and ICT are increasingly taking over the role of the primary drivers of the modern economy. This also applies to health care services. Hospital managers should follow the example of other similar sectors to avoid mistakes and apply appropriate levels of good practices in the area of ICT management. Particularly important in this sector is to optimize the use of ICT, i.e., seeking to maximize the therapeutic effects, and reduce the costs of implementing these technologies. This should be part of the long-term strategy of a health care entity.

The primary purpose and mission of health care entities are to provide medical services. The vast majority of these services are provided in hospitals. There are many different systems of financing health care around the world, ranging from purely private, financed by patient insurance, to those financed by the state budget (Thomson, Foubister, Mossialos, 2009). The economic efficiency of private hospitals is one of the important conditions for their operation (Kourtis et al., 2021). For public hospitals, financial and economic autonomy is fundamental regardless of the type of health care system (Rutkowska-Podołowska et al., 2011). Funding for public hospital operations is of interest to politicians and legislators, NGOs, community organizations, patients, and related social media. The financial autonomy of public hospitals is significant from more than just a manager's perspective. Managing this type of hospital requires taking into account the specifics of the healthcare market. Rising health care costs, limited funding, and social and political factors must be taken into account as health has a pretty high value for every human being.

The development of a hospital's intellectual capital and other intangible assets is not possible without the use of ICT, which is a kind of environment for intangible resources like knowledge and intellectual capital. Therefore, the development of intellectual capital is linked to and correlated with the development of ICT. Intellectual capital, especially the knowledge and skills of the staff, undoubtedly supports the improvement of the quality of medical services provided. Efficient financing of hospital operations should positively influence the discussed phenomena and their mutual relations (Wang, Wang, McLeod, 2018).

In research practice, some phenomena that cannot be measured directly have to be explored. This is also true for the issues studied in this paper. In such cases, theoretical constructs with unobservable variables are developed. Analysis of these types of research models can be performed using structural equation modeling (SEM) (Purwanto, 2021). The research model in this paper was designed and verified using the SEM-PLS methodology. WarpPLS v8 software (www.scriptwarp.com, 2022) was used to calculate model parameters.

This paper examines the aforementioned phenomena and their mutual relationships. The graphical form of the model provides a synthetic and simple form of presentation of the relationships studied.

The empirical survey of Polish hospitals presented in the paper aims to fill the research gap in this area. The author has not encountered previous cases of similar studies carried out in Polish hospitals in subject-related literature. The results of the study presented in this paper may be useful to medical personnel and hospital managers in the area of knowledge management.

2. Literature overview

The development of modern economic organizations depends on the intangible resources they own, including knowledge, intellectual capital, and the ability to manage these resources (Hussinki, et al., 2017). Among knowledge in an organization, one can distinguish between knowledge owned and used directly by an individual and knowledge owned by an organization. This corresponds to the concepts of intellectual human capital (e.g., employees' tacit knowledge) and intellectual structural capital (including relational capital) (Chang, Chen, Lai 2008, p. 300). An overview of intellectual capital in contemporary businesses was provided by Goldin (2016) and Paoloni et al. (2020).

Numerous studies in different sectors show the competitive and financial advantage of the companies that manage knowledge and their intellectual capital well and effectively (Jordão, Almeida, Novas, 2022) (Pirozzi, Ferulano, 2016). The effectiveness and efficiency of diagnosis and treatment are important not only for patients but also for the state's economy and health care financing. The recommendations of scientists, practical actions of managers, legal regulations, and actions of politicians in this area vary depending on the degree of economic development of individual countries and the type of financing system for health care. Research on efficiency should take the country's specificity into account (Kozuń-Cieślak, 2020).

In her studies, Krukowska-Miler (2015) analyses the factors influencing the evaluation of Polish hospitals by patients and other possibilities of building a hospital’s image and developing relational intellectual capital. In another study, Krukowska-Miler (2017) demonstrated that patients, in addition to the quality of medical services and waiting time, seek understanding, interest, and partnership in physicians, which are soft skills that can be considered to be a type of intellectual and relational capital. Wielki et al. (2020) studied the problems of knowledge acquisition and ICT implementation and adoption in Polish hospitals. The research of Chluski (2018) showed the positive impact of ICT development on building intellectual human capital in Polish hospitals. The author focused on a narrower perspective of the intellectual capital of Polish hospitals in the form of human capital. The present paper examines the relationships between the strategic role of ITC, the quality of medical services, while also the development of intellectual capital more generally.

For medical activities, ICT is increasingly integrated with purely medical technologies (Aceto, Persico, Pescapé, 2018). In diagnostic imaging, most of the data is digital. This not only applies to computed tomography and magnetic resonance techniques, but also X-rays, endoscopic examinations, ultrasound examinations, various types of apparatus measuring health parameters of patients, apparatus supporting body functions, specialized life support apparatus, and surgical equipment such as surgical robots, etc. Studies conducted by Lopo (2020) and his colleagues have shown the significant effect of ICT on the effectiveness and efficiency of medical entities

and on improving the quality and accessibility of the medical services provided. ICT facilitates the acquisition of knowledge by medical staff and enhances the image of individual physicians and the hospital as an organization.

The quality of health care services is of interest not only to patients, for whom health is a fundamental value, but also to health care financing institutions, politicians, NGOs, social media, etc. (Quentin et al., 2019). The high quality of medical services may be influenced by the following factors (Chluski, 2016): universal accessibility, effectiveness, and efficiency of diagnosis and treatment, while also social acceptance of health care. Social acceptance of medical services (e.g., cultural and religious aspects) means that the hospital has an individual patient's or community's consent for the form and types of providing health care services (Sawyer et al., 2014).

Universal accessibility of medical services is related to the concept of social justice and refers to the equal treatment of all patients by publicly funded health care (Nadziakiewicz, Mikolajczyk, 2019). Fraczkiewicz-Wronka, Austen, Wronka (2010) emphasized the positive impact of the development of the intellectual capital of managers and their management style on the economic efficiency of hospital operations. Extensive research on the evaluation of economic activities including the efficiency of using sources of financing for Polish hospitals was conducted by Strzelecka and Nieszporska (2015), while also Skrodzka and Nieszporska (2015).

3. Theoretical constructs and research hypotheses

SEM-PLS modelling is often used in exploratory research where new phenomena, interrelationships, and corresponding research hypotheses are sought. A mathematically and statistically valid SEM-PLS model allows the corresponding hypotheses to be considered true. As a result of preliminary work, four theoretical constructs defining the basic structure of the SEM-PLS model were identified. The relationships between these variables correspond to research hypotheses.

The first construct, *financial autonomy,* is defined in three aspects. The first one concerns the employees' opinion about the development of their hospital, whereas the second one relates to the revenue, liquidity, and payment of liabilities. The third aspect relates to managers' views on the financial efficiency of the hospital (Opolski et al., 2018). Similarly defined constructs were used in research by Bardhan and Thouin (2013). Research on efficiency should take the country's specificity into account (Cantor, Poh, 2018). The construct *financial autonomy* corresponds to the latent variable finAuton. The relationships between this construct and other elements of the model are expressed by the hypotheses H2, H4, and H6 presented later in this paper.

The second construct: *orientation on a strategic approach to the management of ICT* refers to the extent to which ICT development is compatible with the hospital's overall development strategy. Managers of ICT departments in hospitals should be aware and take into consideration the overall hospital development strategy. Consultation with the hospital's medical staff and mid-level management is crucial because they are the end-users of the ICT systems (Jelonek, Chluski, 2014) (Bardhan,Thouin, 2013). The variable ictOrient corresponds to this construct. The relationships between this construct and other elements of the model are expressed by the hypotheses H3, H4, and H5.

The third construct is the *quality of medical services provided.*This construct is considered in two areas. The first relates to staff views on the increase in the availability and range of medical services provided. The second aspect concerns patients' perceptions of the quality and availability of health care services. Universal accessibility, the efficiency of diagnosis and treatment, and social acceptance of health care are essential factors in the high-quality medical services provided (Chluski, 2018). A similar analysis of the dimensions of healthcare service quality was presented by Pai and Chary (2013) and Quentin et al. (2019). The servQual variable corresponds to the construct discussed. The relationships between this construct and other elements of the model are expressed by the hypotheses H1, H5, and H6.

The fourth construct is *the degree of development of intellectual capital*. It concerns managing the image and brand of the hospital and treating the knowledge and skills of the staff as a strategic and key resource for the hospital (Hsu, Sabherwal, 2011) (Kim, Kumar, 2009). The latent variable devCap corresponds to the construct discussed. The relationships between this construct and other elements of the model are expressed by the hypotheses H2, H4, and H6.

Research hypotheses are as follows:

H1. *Degree of development of intellectual capital* has a positive effect on the *Quality of medical services provided.*
H2. Financial autonomy of hospital has a positive effect on the *Degree of development of intellectual capital.*
H3. Orientation on a strategic approach to the management of ICT has a positive effect on the *Degree of development of intellectual capital.*
H4. Orientation on a strategic approach to the management of ICT has a positive effect on the *Financial autonomy of hospital.*
H5. Orientation on a strategic approach to the management of ICT has a positive effect on the *Quality of the medical services provided.*
H6. Financial autonomy of hospital has a positive effect on *the Quality of the medical services provided*.

The presented path-based SEM model enables the confirmation of the hypotheses proposed in this paper. It allows for the determination of the basic relationships between latent variables in numerical form, their statistical significance, and the direction of impact .

4. SEM-PLS research model

The research model was implemented using the SEM-PLS methodology. The SEM-PLS methodology is increasingly used in the social sciences to carry out non-experimental research (Hancock, Stapleton, Mueller, 2018). The research is non-experimental in nature and based on respondents' opinions on concepts, phenomena, and the relationships between each other.

The SEM-PLS research model is composed of two types of sub-models. The first is a structural model. It is formed by variables and relationships that cannot be measured directly and are called latent variables. Latent variables correspond to predefined theoretical constructs. The structural model examines the relationships that exist between various latent variables. These relationships correspond to path connections. They are pre-determined, based on previous research and theory and the expectations of the researchers (model developers). This model is also termed the inner model.

The second part of the SEM-PLS research model consists of measurement sub-models created for all latent variables of the structural model. The measurement of a latent variable is performed using indicators. These are most often in the form of selected survey questions that often create quantitative measurement scales such as the Likert scales.This model is termed the outer model. The questionnaire used in the present study employed a seven-point interval Likert scale. The ovals correspond to latent variables. The research hypotheses correspond to the relationships between these variables represented by arrows. Rectangles contain indicators of the measurement models connected by arrows to the corresponding latent variables.

The proposed theoretical constructs correspond to the latent variables of the model contained in Table 1.

Table 1: Latent variables of structural model and indicators of measuring models

The theoretical construct	**The latent variable of the structural model**
Degree of development of intellectual capital	deveCap
Financial autonomy of hospital	finAuton
Orientation on a strategic approach to the management of ICT	ictOrien
Quality of medical services provided	servQual

The proposed SEM-PLS research model in graphical form is shown in Figure 1.

The individual questions of the research survey are indicators in the measurement models of the latent variables of the SEM-PLS model. For example, the indicators for the measurement model of the servQual variable correspond to the following survey items:

- serQual1 - The quality of services provided as perceived by patients has increased over the last five years.
- serQual2 - The range of services provided at our hospital is constantly expanded.
- serQual3 - The number of services provided at our hospital shows an upward trend.
- serQual4 - The availability of services provided as perceived by patients has increased over the last five years.

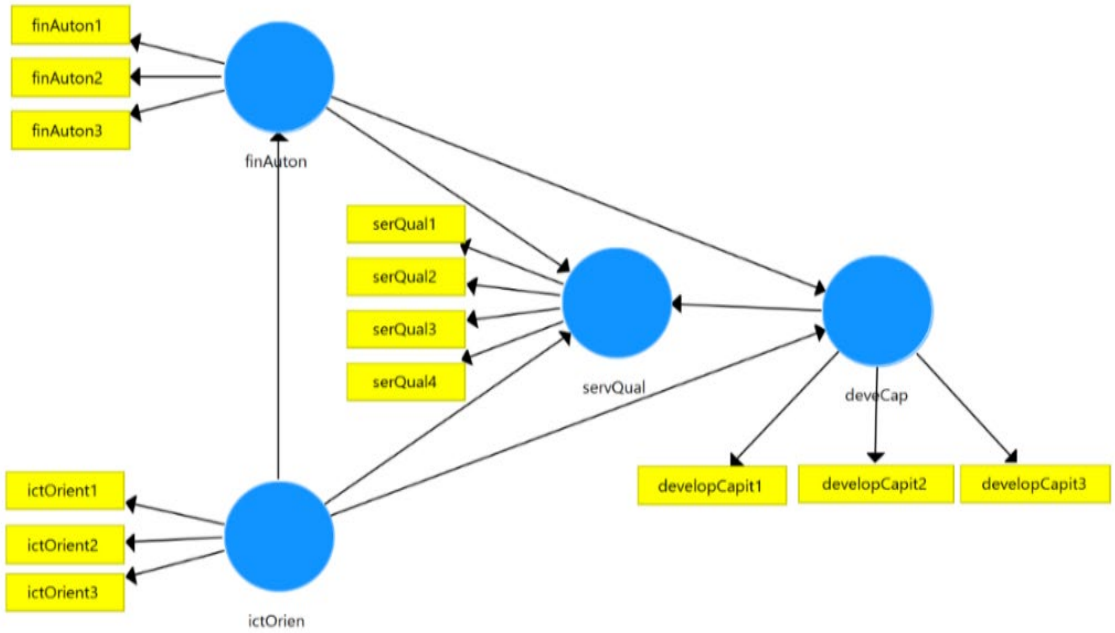


Figure 1: The research model in graphical form (source: own elaboration)

5. Research sample and data collection

A research questionnaire was developed as a research tool to measure variables of the model, and it consisted of statements corresponding to the individual indicators of each measurement model. An interval Likert-type scale was used. The survey was addressed to managers and was sent to selected Polish hospitals. To ensure sample representativeness, 170 questionnaires were sent to all 16 voivodeships (provinces). Correct responses were obtained from 96 respondents. The percentages of particular types of hospitals in the research sample approximately corresponded to the structure of the entire population of Polish hospitals (hospitals were divided by taking account of the founding body). Questionnaires were received from all over Poland. Table 2 contains the quantitative structure of the research sample. The number of Polish hospitals slightly exceeds 850 (Bank DanychLokalnych, 2022).

Table 2: Structure of the research sample

district hospitals	29
municipal hospitals	21
provincial hospitals	17
teaching hospitals	12
private hospitals	10
other hospitals	7

The minimum sample size was estimated based on the requirements specified for the SEM-PLS method using the appropriate assumptions about the statistical power of the test.The minimum sample size was calculated assuming the smallest path coefficient of 0.267, the significance level of 0.05, while also the test power of 0.825. For the inverse square root method the minimum sample was 94 (Kock, Hadaya, 2018). The research sample turned out to be sufficient to yield adequate parameters of the research model for the SEM-PLS methodology.

6. Research results and model evaluation

The research model in graphical form and the basic computational results are presented in Figure 2.

The path coefficients are shown next to the arrows connecting the latent variables. Furthermore, next to the endogenous variables are the corresponding values of the R^2 coefficients of determination, which indicate the amount of variance explained by each variable.

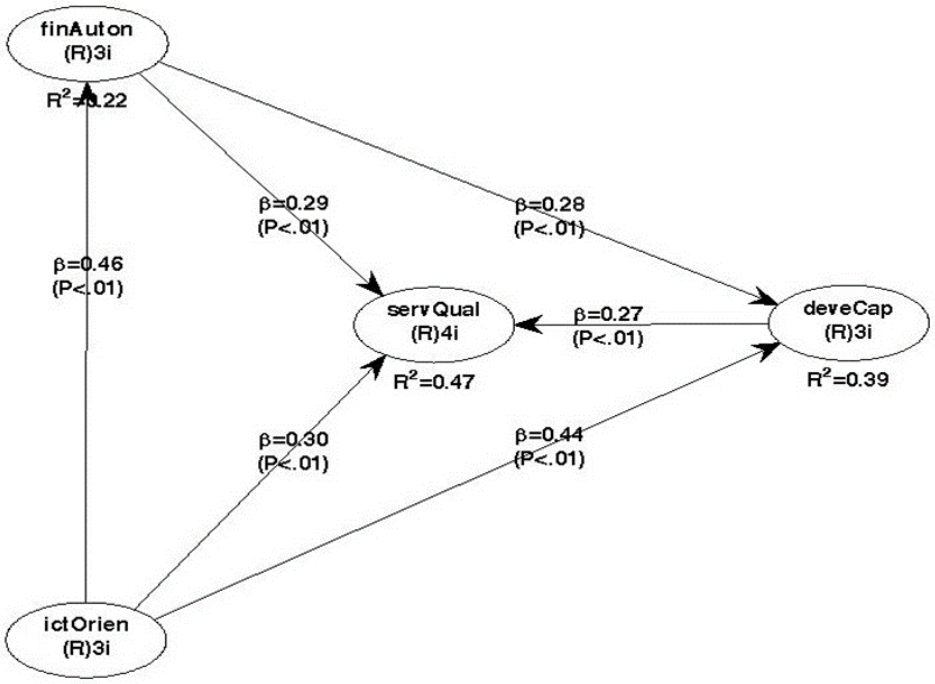


Figure 2: Research model and calculation results presented in graphical form (source: own elaboration)

Table 3: Path coefficients β of the structural model

	ictOrien	finAuton	deveCap
finAuton	0.465	-	-
servQual	0.297	0.289	0.267
deveCap	0.442	0.281	-

The p-values for all path coefficients are less than 0.005 whereas standard errors are less than 0.095.

Path coefficients β represent the relative effect size for the relationships between the variables of the SEM structural model. They are similar in nature to the coefficients in an econometric regression equation. It is assumed that variables are measured on quantitative scales. Therefore, the effect of a particular variable with a path coefficient twice as large is correspondingly twice as large. Path coefficient values must be statistically significant. Statistical significance is a strict and unambiguous feature of the estimated parameters. If the parameters are not statistically significant, they are not taken into account and discarded. Values of β greater than 0.20 are considered acceptable in path modeling (Hair et al., 2010).

6.1 Assessment of the structural model and measurement models

There is no one-size-fits-all and universally accepted quality criterion for the SEM-PLS model. Therefore, several types of indices are used to evaluate the quality of PLS SEM modeling. Using the WarpPLS program, a number of different indicators of research model quality can be calculated.

The quality assessment applies to the structural model and measurement models. The assessment measurement models require verification of the parameters for model reliability and validity. This includes internal consistency reliability, convergent validity, and discriminant validity for each measurement model. The internal consistency reliability was determined by composite reliability, Cronbach's alpha coefficient, and Dijkstra's rho_a coefficient.The values of coefficients determining the internal consistency of the research model are presented in Table 4.

Table 4: Basic reliability coefficients for latent variables

	ictOrien	finAuton	servQual	deveCap
Composite reliability	0.838	0.869	0.905	0.885
Cronbach's alpha	0.712	0.770	0.861	0.805
Dijkstra's rho_a	0.723	0.769	0.869	0.808

The coefficients shown in Table 4 are statistically significant and are greater than 0.7. Therefore, they meet the assumptions for SEM PLS measurement models (Hair et al., 2021).

Table 5: Values of loadings and cross-loadings

	ictOrien	finAuton	servQual	deveCap
ictOrient1	*0.742*	-0.081	-0.099	0.003
ictOrient2	*0.841*	-0.036	-0.140	0.160
ictOrient3	*0.802*	0.096	0.206	-0.153
finAuto1	-0.039	*0.865*	0.070	-0.066
finAuto2	-0.108	*0.889*	-0.066	0.020
finAuto3	0.140	*0.729*	-0.010	0.048
serQual1	0.054	0.046	*0.823*	0.203
serQual2	-0.101	-0.153	*0.828*	-0.033
serQual3	-0.035	-0.108	*0.886*	-0.098
serQual4	0.051	0.167	*0.819*	-0.113
developCapit1	0.097	0.180	-0.091	*0.793*
developCapit2	0.074	-0.112	0.025	*0.892*
developCapit3	-0.197	-0.077	0.076	*0.858*

Table 5 shows the values of loadings and rotated cross-loadings. Loading values are greater than 0.725 and significantly exceed cross-loadings. The basic conditions of reliability and validity (discriminant validity) are met.

The Fornell-Larcker criterion was used to determine discriminant validity. Table 6 illustrates correlation coefficients and the Average Variance Extracted (AVE) root values on the diagonal. They are greater than the correlations between the latent variables. The Fornell-Larcker criterion is thus satisfied (Santos, Cirillo, 2021)

Table 6: Correlations between latent variables with AVE root values

	ictOrien	finAuton	servQual	deveCap
ictOrien	*0.796*	0.458	0.565	0.567
finAuton	0.458	*0.831*	0.518	0.470
servQual	0.565	0.518	*0.840*	0.557
deveCap	0.567	0.470	0.557	*0.849*

The heterotrait-monotrait criterion (HTMT) was used to evaluate discriminant validity. The results of HTMT calculations are presented in Table 7. They are significantly less than the threshold value of 0.9 (Henseler et al., 2015) and are statistically significant.

Table 7: HTMT criterion ratios

HTMT ratios	ictOrien	finAuton	servQual
ictOrien	-	-	-
finAuton	0.606	-	-
servQual	0.701	0.621	-
deveCap	0.740	0.592	0.657

The R^2 coefficient of determination is an important measure in SEM-PLS modeling. Table 8 shows the R^2 values. All coefficients are statistically significant ($p < 0.001$). The effect sizes are considered small for R-squared below 0.19, moderate for 0.33, and large for values above 0.67 (Chin, 1998, p. 323).

Table 8: Coefficient of determination R^2

variable	R^2	Adjusted R^2
finAuton	0.216	0.208
servQual	0.474	0.457
deveCap	0.386	0.373

Cohen (1992) proposed another measure (effect size: f^2) similar to R^2. Table 9 reports the f^2 values for the model tested. According to Cohen (1992), 0.02 indicates small, 0.15 indicates medium, and 0.35 indicates large effect size.

Table 9: The f^2 effect size for the model studied

	ictOrien	finAuto	servQua	deveCap
finAuto	0.216			
servQua	0.168	0.156		0.151
deveCap	0.251	0.135		

In the case of the model studied, the effect size values are medium. Only for finAuton->deveCap f^2 is it less than 0.15 (0.135).

The total variance inflation factor (VIF) is a measure of the degree of collinearity between the two latent variables and should be less than 5 (Hair et al., 2021), and, according to Knock (2015), even less than 3.3. The VIF values are presented in Table 10.

Table 10: Values of full collinearity VIFs

ictOrien	finAuto	servQua	deveCap
1.742	1.499	1.817	1.737

The effect of multicollinearity in the model studied is negligible.

6.2 Indices of research model fit

Several types of indices are used to evaluate the fit of PLS-SEM modeling. The WarpPLS program was used to compute the most commonly used SEM-PLS model fit indices, which are presented in Table 11. All the presented values of the research model quality indicators have relatively high values. The exception is the standardized root mean squared residual (SRMR).

Table 11: Basic model fit indices for the SEM-PLS research model

Fit indices of research model	Computed value	Fit quality conditions
Average path coefficient	0.357	p<0.05
Average R-squared	0.387	p<0.05
Average adjusted R-squared)	0.375	p<0.05
Average full collinearity VIF	1.699	acceptable if <= 5, ideally <= 3.3
TenenhausGoF (GoF)	0.516	small >= 0.1, medium >= 0.25, large >= 0.36
Sympson's paradox ratio	1.000	acceptable if >= 0.7, ideally = 1
R-squared contribution ratio	1.000	acceptable if >= 0.9, ideally = 1
Statistical suppression ratio	1.000	acceptable if >= 0.7
Standardized root mean squared residual	0.109	acceptable if <= 0.1
Standardized chi-squared with 77 degrees of freedom	2.365	p<0.05

SRMR is an absolute measure of model fit. It is a standardized difference between the predicted and the observed correlation. SRMR has larger values for small sample sizes and models with a low number of degrees of freedom. This is probably why the SRMR of the tested model is slightly above the acceptable value and is 0.109. Cangur and Ecran (2015, p. 164) do not recommend using SRMS as a measure of fit of SEM-PLS models. All other indices of research model fit reported in Table 10 are well above the minimum acceptable values.

7. Results and discussion

The path parameters of the model determine the relative strength and direction of the relationships that exist between the theoretical constructs of the model. Based on the results, the *Degree of development of intellectual capital* has a positive effect on the *Quality of medical services provided.* The relative strength of this interaction

(path coefficient) is 0.27. This is in line with expectations, as medical services belong to professional services, in which a high level of knowledge, skills, and trust in the people providing these services is the key thing. Therefore, the development of such intellectual resources in the hospital has a positive effect on the quality of medical services provided.

The Development of intellectual capital is positively affected by the *Financial autonomy,* with a strength of 0.28, and the *Orientation on a strategic approach to the management of ICT,* with a relative strength of 0.44. There is a general consensus that modern ICT tools and resources facilitate knowledge acquisition and creation, while also enhancing workforce competencies in health care. This is also supported by a high level of employee compensation and the ability to purchase the required equipment, tools, and medical supplies.

Financial autonomy also has a positive effect on the *Quality of medical services provided* with a power of 0.29. *Orientation on a strategic approach to the management of ICT* has a positive effect on other latent variables of the model, such as the *Financial autonomy of a hospital,* with a strength of 0.46, the *Quality of the medical services provided,* with a strength of 0.30, and the *Degree of development of intellectual capital,* with a strength of 0.44.

The model presented in this paper represents the relationships between the constructs studied. It determines the relationships between the financial autonomy and the orientation of hospital managers on ICT strategy, while also the quality of medical services and the development of intellectual capital of medical personnel. In addition to a numerically expressed relative strength, these relationships have a specific direction of effect. Some researchers equate this direction of effect with a cause-and-effect relationship (Loehlin, 1987, p. 13). However, the prerequisite for the existence of such relationships is to demonstrate that the cause occurred earlier, before the moment of the appearance of the effect, which is impossible in this type of modeling (Bollen, Pearl, 2013).

8. Conclusions

Medical activities are inextricably linked to the use of ICT in a manner adjusted to hospital specificity. This is especially important for publicly funded hospitals. For providing medical services, the knowledge and skills of the medical staff are critical, as they mean resources of the nature of intellectual capital. Undoubtedly, the development of this capital has a positive effect on the quality of medical services.

The research model presented in this paper meets all the basic quality criteria used in SEM-PLS modeling. The measurement models and the structural model meet the assumptions required by the social sciences for the SEM-PLS methodology. All model parameters are statistically significant and take positive values. The model parameters are within acceptable ranges of values. Depending on their type, they reach medium and large values. This allows for the confirmation of the hypotheses posed in the paper.

The model developed in the paper can be useful for the managers and staff of health care providers. It presents specific phenomena and complex relationships between each other in a precise manner, with the direction and strength of their effect. The graphical presentation of the model facilitates the interpretation of the phenomena studied and the practical use of the model.

No studies have been conducted to date in Polish hospitals on the discussed constructs using the SEM-PLS methodology. The research carried out in this paper was exploratory and was of a pilot study nature. This can form the basis for further more in-depth analyses. The structural model presented in this paper can be extended with additional variables that describe the analyzed phenomena in more detail. Expanded research involving other European countries with similar health care systems is also possible.

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Developing User Personas as a way of Managing Knowledge About Ecolabnet Project Participants

Grzegorz Chmielarz
Czestochowa University of Technology, Faculty of Management, Czestochowa, Poland
grzegorz.chmielarz@pcz.pl

Abstract: One of the vital elements that decide about a success, or a failure of a project is adjusting its offer to the requirements of the beneficiaries. Various methods and tools are used in this respect to make the project's offer consistent with these requirements and guarantee that they are satisfied. One of the methods used in this area is application of user personas. The idea is extensively used in the field of computer-human interactions, as it allows to improve user experience as well as the whole communication in the process of developing IT systems. However, the use of personas is not limited only to designing computer-based systems and solutions. The concept of personas has been also exploited in the Ecolabnet project, financed by Interreg, and implemented in six partner countries in the years 2019-2021. The process of knowledge management in the project assumed gathering the knowledge on its future beneficiaries - manufacturing SMEs from the Baltic Sea Region – and adjusting the offer of the project consortium (RDIs and Intermediary Organisations) to the signalled needs of these enterprises. To facilitate the management of knowledge on the enterprises investigated in the project the concept of persons was used. The underlying objective of the paper is to present the process of transforming the knowledge on project participants into the concept of personas. It consists of two parts. The first part, the theoretical one includes the results of a literature review that provides essential knowledge on utilising the concept of personas in design and management processes. The second part, the empirical one, is based on the empirical research that was conducted at the initial stage of the project. The answers provided in the survey questionnaire allowed for identification of primary needs and barriers in the area of eco-innovations development. This knowledge has led to determining main personas of the project. The analysis of the process of mapping the project users' needs and objective is supposed to answer the following research question: How does the exploitation of personas improve management of knowledge in international projects?

Keywords: eco-innovations, knowledge management, personas, SMEs

1. Introduction

One of the primary objectives of the European Union is the promote the development of the society in the desired and envisioned frames and goals for the future. One of the instruments utilised in this regard are European projects, funded through more than 40 funding programmes. The funds are provided for multiple purposes. For example, within the Multiannual financial framework 2014-2020, €213 billion was provided for job creation and business support, €1.5 billion was invested in the Culture sector, €80 billion for research and innovation, €33 billion in infrastructure, and more than 4 million people were able to receive support to study, train and work or volunteer abroad (out of the box International, 2020). One of such EU's projects is the ECOLABNET project. It was funded by Interreg Baltic Sea Region (Project #R077 ECOLABNET of Interreg Baltic Sea Region), and its objective was to create a collaborative network of service providers to stimulate development and implementation of eco-innovations in manufacturing Small and Medium-Sized Enterprises (SMEs) of the Baltic Sea Region (BSR). Eco-innovations and more broadly innovation as well as creativity are believed to be these important factors that allow an enterprise to face the competition pressure (Gede et al., 2019). Eco-innovations are even more important in case of small and medium-sized enterprises than the large ones with regard to their environmental impact's assessment. According to the data by the European Commission there are more than 20 million SMEs in EU countries, compared to around 40,000 large companies (i.e. with more than 250 persons employed). Eco-innovations are of special importance for SMEs as their collective impact on the environment is quite significant, despite their small size. For example, a 2010 study showed that SMEs are responsible for about 64% of the overall environmental impact of businesses in the EU. Until recently, policy-makers and practitioners have tended to focus on promoting pro-environmental practices and innovations in larger firms. As a result, there is considerable scope to reduce environmental impacts in Europe by promoting eco-innovation in the SME population (European Commission, 2020). Therefore, it can be stated that pro-ecological activities are an indispensable element in achieving the goals of sustainable development for all enterprises. However, due to the fact that SME sector enterprises are the backbone of the European economy, they play a crucial role in implementing eco-innovation (Koszarek-Cyra, 2021).

The concept of personas is frequently used while designing services and products for target customers. It was applied while preparing the offer of the ECOALBNET project consortium for SMEs from the Baltic Sea Region. Bases on the conducted research personas constituted an embodiment of the needs and requirements of those

companies. This in turn translated into the adjustment of the ECOLABNET's offer to the expressed in the course of the research requirements of the SMEs pertaining to lack of expert knowledge in the area of eco-innovations. The design approach utilising the concept of personas was supposed to homogenise the offer of the RDI partners with respect to particular groups of enterprises signalling areas in which they needed support pertaining to provision of knowledge about eco-innovations. It can be stated then that personas constituted an important element of KM strategy in the ECOLABNET project. Therefore, the author of the paper has formulated its primary objective – an attempt to answer the following research question:

- *RQ* – Does the application of personas concept in service design positively contributes to management of knowledge in international projects?

The paper constitutes a contribution to the literature by analysing one of the stages pertaining to the process of knowledge management in projects – categorising the offer of the project consortium for SMEs based in the concept of personas. The research gap covered in the paper pertains to the application of the personas concept in service design aimed at culturally differentiated target group of SMEs. In this case the process of adjusting the offer of the project consortium needs to consider the variety of needs and expectations towards the offered services to a large extent conditioned by the local and cultural distinctiveness of the final recipients. The underlying objective of the paper is the analysis of the impact of utilising the personas concept on improved knowledge management process, which translates into an overall success of the ECOLABNET project, as well as similar transnational projects. The paper may constitute a precious source of information on issues of knowledge management in international projects both in the theoretical and practical aspects. The theoretical contribution pertains primarily to the advantages of utilising the concept of personas in service design process, tailoring in this way the service offer to the particular needs of target groups of service recipients. The practical aspects of service design with the use of personas concept in projects including partners from various, culturally and economically differentiated countries, may prove beneficial for future project consortiums that can apply similar steps in the KM process to ensure the overall success of their projects.

The paper has the following structure. Introduction includes basic information about EU funded projects and the role of eco-innovativeness in gaining a competitive advantage on the market. Chapter 1 presents the results of the literature review conducted so as to investigate the utilisation of the concept of personas in the proces of designing services and products. Chapter 2 outlines the assumptions regarding KM in the ECOLABNET project and provides the details regarding the research sample and methodology. In the third chapter the author describes the process of utilising the concept of personas in developing service packages for SMEs from the BSR region. The last chapter concludes the paper and contains suggestions regarding further research works.

2. Literature review - concept of personas in design and management processes

Personas constitute an element of the process of User Centred Design. User-centred design (UCD) is a design philosophy that models the interactions between humans and computers. It is a multi-stage, problem-solving process which involves the analysis of the needs, desires and limitations of users. Assumptions of user behaviour are transferred into prototypes that can undergo further testing (LeRouge et al., 2013). It is believed that personas combine the benefits of quantitative and qualitative methods. They are also considered to be more engaging than scenarios as a design technique (Pruitt and Grudin, 2003). The underlying objective of utilising the concept of personas in the design process is to enable the designer to identify with the people for whom the system is being designed. As each persona represents a group of target users that share the same behavioural characteristics, they are frequently referred to as archetypes of users, target customer characterizations, or abstract/fictitious representations of users". The application of personas is highly beneficial for the development of usable products as personas depict behaviours of each group of target users and therefore facilitate greatly the design process (Aquino and Filgueiras, 2005).

According to Phil and Susan Turner (2010), the first public appearance of the concept occurred in the work of Cooper (1999) following the observation that designers usually possessed only limited knowledge of the final users. Therefore, it can be stated that fitting users with various humanlike features makes them fairly individualised and, in this way, makes designers more aware of the fact that in the design process they need to consider perspectives of multiple, highly differentiated persons, not just a dehumanised "user".

Yu and Sangiorgi (2018), who analysed the process of design thinking and relationship between designer and customer indicate the existence of various taxonomies that can be applied to categorise this relationship. The most popular ones have been summarised in Table 1 below.

Table 1: Examples of taxonomies applied in design thinking process

Author	Category of relationship	Brief description
Bruce and Docherty (1993)	Relationships perceived in three ways: family, arms-length, and one-off purchase	The 'family' approach allows designers to proactively engage in creating corporate strategies and innovation solutions based on an understanding of clients' tacit knowledge, culture, vision and strategy, whereas designers in the 'arms-length' and 'one-off purchase' approaches work according to the client's requirements, remaining external to the client organisation's internal practices and processes
Bruce and Morris (1994)	designer-client relationships as short-term and long-term relationships	
Gericke and Maier (2011)	passive coupling and active coupling	Passive coupling is design-led and active coupling is based on the two disciplines' co-creation

Source: own elaboration based on Yu and Sangiorgi (2017)

Bradley et al. (2021), point out how important it is to look at the designed service or product from the perspective of their users, using the concept of personas. They state that any kind of system-wide utility not only stems from individual users' feelings of pleasure and ease, but is highly dependent on an interconnected network whereby users' negative values can impact other users' valuations of a system. This results in a situation where one person's negative experience can damage the total ease of use felt across all users' experiences. This view is also shared by Huynh and colleagues (2021), who stress the fact that although designers frequently attempt to impersonate users and develop products and services they think users would like, it does not produce expected results. This stems from the fact the designers differ from real users as they possess better technical skills, knowledge, expertise and usage goals. In addition, the final product or service on numerous occasions is a compromise between the ease of developing them and their power and usability. Therefore, from the knowledge management perspective, the design process that aims at providing products and services that will actually meet the expectations and requirements of their future users. If the knowledge about particular requirements of the target group is grouped in the categories that can be then represented with the use of personas concept, then the designed products or services will be free of the bias of the designers' perspective, but will promote product usability and satisfaction of the users.

Salminen et al. (2021), stress the importance of understanding that the different worldviews of users are closely linked to personas' ability to challenge the established preconceptions about the users within the organization. These preconceptions refer to the mental representation of users and their behaviours. The primary advantage of creating personas from actual user data is that the user insights inferred from them can be different from the already existing beliefs about who the users are, why they choose the company's product, and what can be done in order to enhance the user experience. This is of particular importance in the case of eco-innovative services and products. They do not only need to be developed by service/product providers, but also need to be accepted and consciously chosen by users.

Singh and colleagues (2022) stress the negative consequences of not recognising the needs and demands of final users of products and services being designed for them. According to the authors possible consequences resulting from not considering the human aspects may lead to huge economic costs, inefficiencies, not fit-for-purpose solutions, or dangerous and potentially life-threatening situations. Negligence of human aspects while designing products and services that are supposed to solve human needs – not fulfilling the end-users' expectations and causing frustration. This emphasises the need for managing the knowledge about end-users and their requirements prior introducing to the market services and products, including eco-innovative ones. This was exactly the idea behind the ECOLABNET project, which in this case can serve as a model of KM process management that combines the concept of personas and adjustment the project's offer to the actual needs signalled by the end-users.

3. Assumptions of knowledge management in the ECOLABNET project and research methodology

The ECOLABNET project was set up in a response to the observed lack of collaboration between SMEs from the Baltic Sea Region and RDIs. This in turn translated into a relatively poor level of developing and implementing eco-innovations in these enterprises. This occurs despite the existing potential for implementing in business new products and services compliant with the principles of sustainable. The underlying objective of the ECOLABNET project was create a network that will unite all the links of value creation chain, and integrate actors including product-service system designers, bio-based material researchers, 3D print technology providers, eco-branding specialists and business developers. This is supposed to foster the uptake of sustainable eco-innovations among the SMEs from the Baltic Sea Region operating in various sectors of the economy. The primary reason behind the insufficient absorption of eco-innovations by SME is believed to be insufficient access to relevant services and expertise on eco-innovations. Therefore, the ECOLABNET project unites a network of research facilities from 6 partner countries with an idea to provide support for SMEs in the Baltic Sea region pertaining to implementing environmentally friendly innovations. The project provides new business opportunities for those SMEs that want to increase their market advantage by offering products and services that are accordant with the principles of sustainability. This is achieved thanks to the cooperation with the research sector. The ECOLABNET network consists of eleven partners from Denmark, Estonia, Finland, Lithuania, Poland and Sweden. The project partners analyse the requirements of SMEs and business support organisations regarding expert knowledge indispensable to ensure successful introduction of eco-innovations (Interreg – ECOLABNET, 2021).

It was assumed by the project partners that the knowledge management process in the project would allow all its participants - Small and Medium-Sized Enterprises – SMEs; Intermediary Organisations – IOs; Research, Development and Innovation - RDIs – to achieve their individual goals based on the collaboration of the entire network . Therefore, the model of collaboration, and at same time knowledge management in the project, was based on the assumption of providing by RDIs expert knowledge to SMEs with the assistance of IOs. This has been demonstrated in Figure 1.

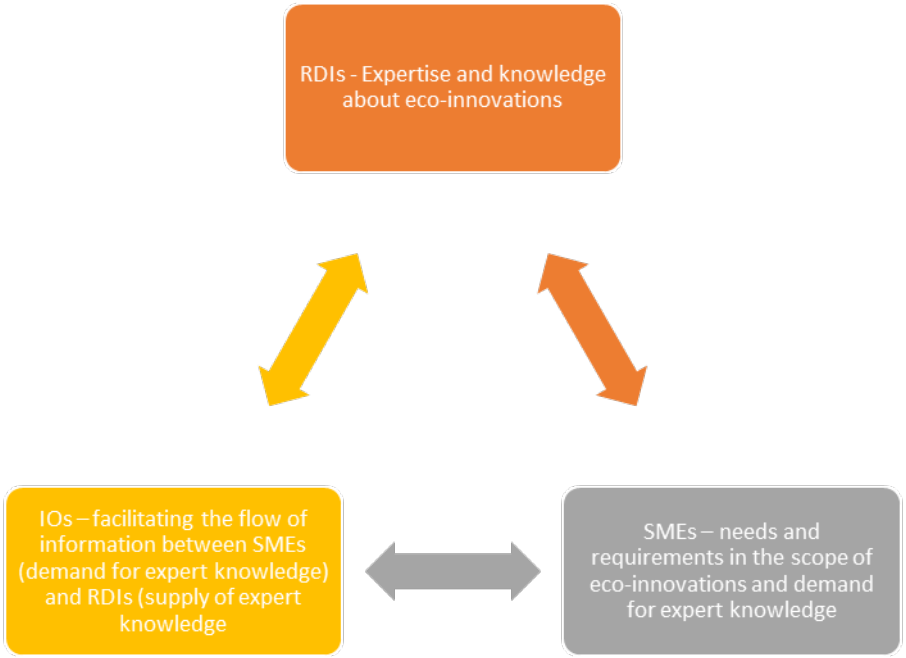


Figure 1: Model of knowledge management in the ECOLABNET project

Source: own analysis

The whole process of knowledge management in the ECOLABNET project was divided into the following three stages:
Stage 1 - knowledge gathering – recognition of needs and expectations of SMEs in the scope of eco-innovations,

Stage 2 - knowledge analysis – identifying needs and barriers for eco-innovations among the investigated for SMEs, identifying own competence gaps – internal development – strategy of internal development for RDIs and IOs, product and service cards, service packages.

Stage 3 - creating ECOLABNET knowledge repository (Digital Collaboration Tool - DCT, service journeys and knowledge dissemination.

Due to the limited content of the paper the author focuses in particular on the selected elements of KM in the project – methodology of data acquisition (Stage 1) and process of categorising project beneficiaries applying the concept of personas (Stage 2). Personas were utilised in the second stage of the process of KM while preparing the offer of RDI partners, in the form of service and product cards and services packages. Service and product cards constitute essential elements of the project consortium's offer for SMEs. They contain essential information about the service or product provider as well as detailed information about services and products themselves. Service packages in turn are bundles of services developed based on the demand signalled by the SMEs participating in the research, and information about services that the project partners are capable of offering, which have been described in service cards.

In accordance with the assumptions the project began with the research intended for the SMEs in the partner countries (Stage 1). The research was supposed to provide essential knowledge on the current level of pro-environmental awareness, and also the level of pro-environmental activities already implemented by the investigated SMEs. The data gathering process utilised the CAWI (Computer Assisted Web Interview) method.

According to the definition by DJS Research (2008) in the CAWI method the survey appears in the browser in the form of a web-page that can be reached by the respondents in different ways. The survey respondents only see the questions to be answered 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. The survey questionnaire used in the ECOLABNET research included 27 questions that were divided in five groups. The first group of 5 questions provided basic information about the surveyed enterprise and its profile of operation. The second group, questions 6 to 15, pertained purely to eco-innovations, in particular knowledge about eco-innovations, motivating factors and barriers to introducing eco-innovations in manufacturing SMEs of the BSR region. Questions 16 to 21 were supposed to investigate the knowledge of the surveyed SMEs with regard to 3D printing as an eco-friendly solution that can be applied in manufacturing processes and replace the previously used one that contribute to environmental degradation. Then, questions 23-24 were supposed to provide an answer to the question of how big the demand for expert knowledge was and if it could be satisfied by project partners. The questionnaire finished with the 3 questions concerning the possibility of future cooperation and address details. The research that was supposed to identify the needs of the target group of SMEs in all the partner countries of the project was carried out in 2019, with a total of N=296 SMEs participating in it. In a breakdown into particular countries the participation of SMEs was as follows: Estonia – 23,31% (69), Poland – 19,26% (57), Finland –18,24% (54), Lithuania – 15,88% (47), Sweden – 12,84% (38), Denmark – 10,47% (31). With regard to the structure of the investigated SMEs, micro enterprises accounted for 42.23% (125) of the investigated population, small enterprises - 27.36% (81), the remaining group - 30.41% (90) being medium-sized enterprises. The enterprises participating in the survey represented 20 production areas/sectors such as: Food products 11.14% (33), Other manufacturing 10.47% (31), Machinery and equipment 8.44% (25), Rubber and plastic products 6.41% (19), Wearing apparel and Textiles 6.41% (19), Computer Electronic and optical products 4.05% (12), Paper and paper products 3.71% (11), Fabricated metal products 3.71% (11), Electrical equipment 3.71% (11), Beverages 3.04%. The data collected in the first stage of the KM process was used in the subsequent stages in the process of tailoring the offer of the project consortium to the needs signalled by the surveyed SMEs.

4. Applying the concept of personas in the Ecolabnet projects

In the further steps the knowledge accumulated in the first stage of the project's duration was analysed with respect to designing services that would support development of eco-innovations in the target group of SMEs. The primary goal of such an analysis was to create ideas of ECOLABNET services that could be offered to SMEs by the project partners. The service design approach was used in this process and user personas were utilised so as to facilitate making relationships between the ideas for services and types of their target recipients. The process of generating service concepts has been presented in Figure 2.

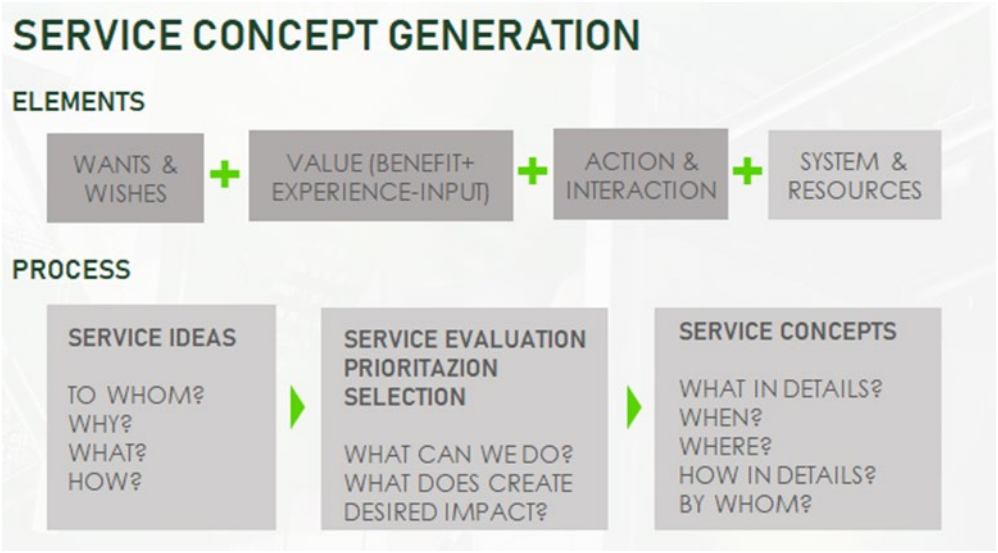


Figure 2: Service Concept Generation

Source: internal materials of ECOLABNET project

While categorising the SMEs in accordance with the concept of personas, each of the personas was assigned its individual message for change (benefits of plunging into eco-innovations for this particular group of enterprises. Additionally, the ideas for services and collaboration activities were incorporated in the descriptions of service ideas. The next step involved investigating the similarities between groups of SMEs and their expressed needs for services. The personas were grouped accordingly. Then, based on the nature of the service, service ideas were categorised for each user persona. In the last step appropriate personas representing IOs were added as collaborative partners. In the graphic form the process of creating personas has been presented in Figure 3.

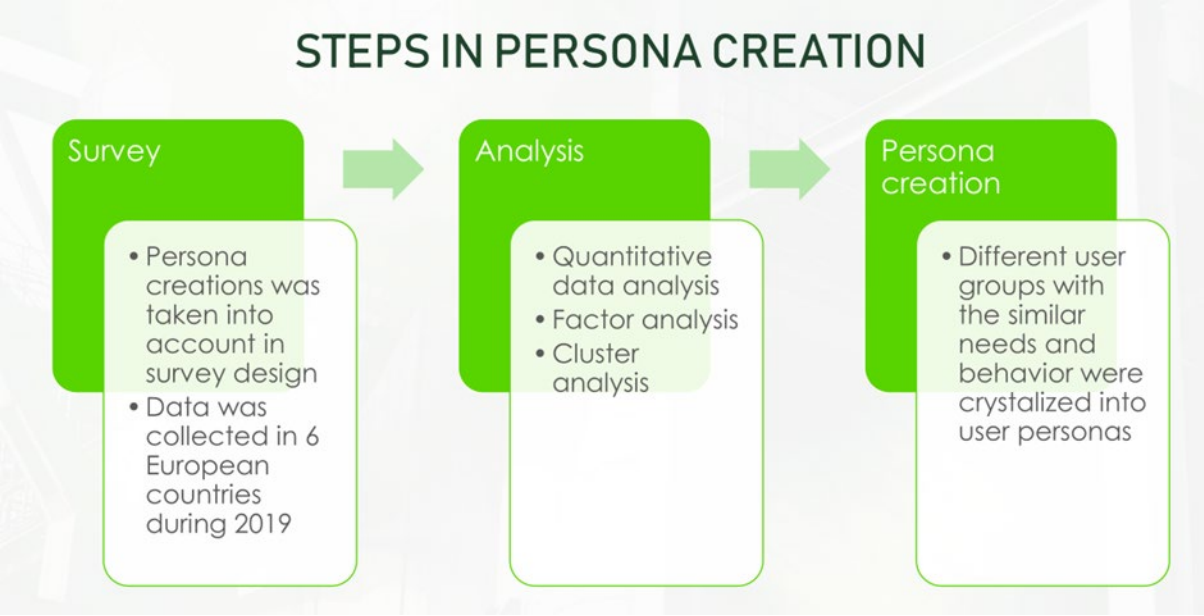


Figure 3: Steps of personas creation

Source: Internal materials of ECOLABNET project

As Figure 3 demonstrates and what needs to be stressed, the whole process of generating concepts of ECOLABNET services and their breakdown into particular categories of personas was based on the survey conducted in the first stage of the project – the stage of knowledge gathering. According to Madsen and colleagues (2014), personas are not simply a description of individuals or average information of specific groups of users. They constitute combined patterns of users' behaviour and motivations, where

the rich information of an amalgamation of users is synthesized into a set of user archetypes or personas (Madsen et al., 2014). This was done at this stage of the ECOLABNET project and allowed us to identify the main elements of the service offer of the project consortium and led to distinction of the services and support activities that were especially desired by the targeted SMEs. Also, the signalled by SMEs limitations pertaining to access to expert knowledge were addressed in the service offer with an intention to boost the change in the area of eco-innovations in the analysed BSR countries (Kuceba et al., 2021). Therefore, it can be stated that establishing main similarities with regard to the needs of the said SMEs and grouping them under the corresponding personas that would represent the nature of the services was one of the major elements of KM in the project. As a result, the following six types of personas were distinguished with regard to the SMEs participating in the research: eco-booster, eco-opportunist, eco-optimizer, eco-developer, eco-cautious, and eco-laggard. The information regarding the characteristics of particular types of personas has been aggregated in Table 3 below.

Table 2: Personas and their basic characteristics

Persona	Interest in eco-innovations	Main barriers	Focus area
Eco-booster	Highly motivated in developing eco-innovations for the following reasons: • to satisfy customer needs • to use resources efficiently • to strengthen corporate brand image	• lack of capital • certification costs • limited access to external knowledge	• Business • Development • Technology/Production
Eco-opportunist	Not interested in developing eco-innovations, unless they can provide: • potential business opportunities • efficient use of resources • reduction of environmental effects on the business operations	No major barriers, main worries: • lack of capital • limited access to external knowledge • lack of suitable tools and methods	Business (value chain assessment)
Eco-optimizer	Interested in eco- innovations mainly for: • Cost reduction • Efficient use of resource • Satisfying customer needs	No major barriers, main worries: • lack of alternative materials • lack of capital • uncertain return on eco-innovation investment	Technology/Production (Increasing efficiency)
Eco-developer	Interested in eco-innovations mainly for the following reasons: • to satisfy customer needs • to differentiate from competitors • to use resources efficiently • to strengthen corporate brand image	No major barriers, main worries: • lack of alternative materials • lack of capital uncertain return on eco-innovation investment	• Business • Development • Technology/Production
Eco-cautious	Interest in eco- innovations mainly driven by: • compliance with legislation • differentiating from competitors • strengthening corporate brand image • cost reduction	• Uncertain return on eco-innovation investment • Lack of capital • Uncertain demand from the market • Lack of in-house expertise	No important focus areas
Eco-laggards	Interest in eco-innovations mainly driven by: • cost reduction	• uncertain return on eco-innovation investment	No important focus areas

Persona	Interest in eco-innovations	Main barriers	Focus area
	• compliance with legislation • using resources efficiently	• uncertain demand from the market • certification costs • legislative demands	

Source: own elaboration based on the internal materials of the ECOLABNET project

As Table 2 demonstrates the six types of personas exemplify the types of services that need to be provided for each sub-group of enterprises based on the level of their involvement in eco-innovations. Each of the personas represents attitudes of the given group of enterprises towards eco-innovations. Eco-boosters are these enterprises that are motivated in eco-innovations. They perceive eco-innovations as a way to increase the effectiveness of their company. Eco-opportunists lack both motivating factors and barriers. The only thing that makes them interested in eco-innovations is expected financial reward. Eco-optimizers are a group of companies primarily interested in reduction of costs of their operations and resource use. They see the need for more expert knowledge about eco-innovations. Eco-developers in turn are focused on differentiating their offer from the competition and strengthening their brand's image. For Eco-cautious ones the primary goals include differentiating from competition and strengthening the brand's image. However, their main barrier is financial uncertainty of investments into eco-innovations. Eco-laggards are motivated towards eco-innovations when they can reduce the costs of their operations and improve efficiency of used resources. Yet, they lack knowledge pertaining to legislative issues and certification costs. They are also unsure whether investments into eco-innovations will prove beneficial. Thus, it can be concluded that the determination of the personas constituted a crucial step in tailoring the offer of the ECOLABNET network to particular needs and gaps of knowledge reported by the SMEs from the BSR in the survey. This ensured that the final offer of the project consortium would address the issues that were actually perceived by the investigated SMEs as the ones that had the direct impact on their attitude towards eco-innovations. This conclusion is also supported by the literature on the subject, which includes various examples stressing the role of knowledge management in achieving the set goals especially in case of project involving partners from several countries. Proper KM provides benefits in the form of internationalisation and effective utilisation of knowledge, and this can support organisations in achieving improved innovation and overall performance (Zia and Shafiq, 2017). This also constitutes the answer to the RQ – Does the application of personas concept in service design positively contributes to management of knowledge in international projects? Utilisation of the concept of personas allows all the project actors to streamline their offer based on the characteristics of the target groups. Most importantly, however, personas represent the needs and expectations of the beneficiaries based on the actual data about them collected in the research. In this way, the improved KM in the ECOALBNET project, and all similar international projects, can result in a better adjustment of the offered range of services and products that is intended for the project beneficiaries and contribute substantially to the overall success of the entire project.

5. Conclusion

The success of a product or a service on the target market depends largely on the ability of the designer to look at them from the perspective of their users. Failing to do so can produce a number of potential consequences being an outcome of not considering the human aspects properly. One of the possible solutions to prevent such occurrences may be utilisation of the concept of personas in the design process. Rather than rely on their own perspective designers ever more frequently make use of personas in the creative process of developing products or services to make sure that they will be free of their own bias. Although the concept of personas was originally used in developing computer software, its utilisation is currently possible across various areas and methods of developing new products and services. Utilisation of personas seems particularly useful in the processes of KM in international projects. Application of persons in the ECOLABNET project facilitated the process of designing products and services, in this particular case eco-innovative ones, to ensure that they best match the requirements of final users. In addition, utilisation of the concept of personas in international projects, such as the ECOLABNET project, prevents the situation when particular project partners develop their product and/or service offer in the way they consider as the most appropriate from their perspective. As the outputs of projects are meant to serve the purposes of particular target beneficiaries, considering their actual needs and expectation, categorising the future users of products/services made it easier for the ECOALBENT partners, coming from various countries, to homogenise their offer. This in turn contributes substantially to the overall success of the project in all the participating countries. This has been the case with the ECOALBNET project. Therefore, it can be concluded that utilisation of personas concept is of great practical value in the process of managing knowledge about the requirements and expectations of final users. This seems particularly effective

while designing services that are supposed to reflect the actual needs of target groups, rather can addressing them from the perspective of service/product designers themselves. As the example of the ECOLABNET project demonstrates, such an attitude translates into streamlining the offer of service/product providers ensuring their successful commercialisation and market acceptance. Undoubtedly, there are still a number of issues to be investigated in this domain to provide more details on the limitations and benefits of applying the personas concept. The author is going to continue the research on the effectiveness of utilising personas in the design process. Future research in this domain may concentrate on the evaluation of personas application in the design process of eco-innovative products and services by the target groups – SMEs from the BSR participating in the first stage of research in the ECOLABNET project.

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Improving the Offer for SMEs Through Managing Internal Competency Gaps in Ecolabnet Project: The Case of Czestochowa University of Technology (Cut)

Grzegorz Chmielarz and Robert Kuceba
Czestochowa University of Technology, Faculty of Management, Czestochowa, Poland
grzegorz.chmielarz@pcz.pl
robert.kuceba@pcz.pl

Abstract: Proper knowledge management is of particular significance in all projects, and especially important in the case of international ones. Such projects involve actors from several countries, and thus, have to allow for considerable differences stemming from cultural differentiation, diverse work patterns, and various levels of competencies in the project's area. The latter ones seem to be most prone to changes, and improving the level of internal competencies in the case of one of the project partners can greatly contribute to a larger success of the project as a whole. To do so, it is crucial to analyse one's gaps of competencies and draw up a plan of introducing corrective measures in this respect. This has been done during the implementation of the Ecolabnet project, financed by Interreg, and implemented in the six partner countries: Finland, Denmark, Poland, Sweden, Estonia, Lithuania, in the years 2019-2021. All the project partners formed the project consortium, whose objective was to accelerate the development of eco-innovations in manufacturing enterprises from the SME sector in the Baltic Sea Region. One of the stages of knowledge management in the project constituted identification of own competency gasps and addressing this issue. The paper presents the process of managing the knowledge on own competency gaps, and the measures that were taken so as to eliminate them. Additionally, the authors present the results of the survey conducted among the SMEs in the project partner countries, which illustrates the needs of the said SMEs in the area of eco-innovations. The authors also describe the steps taken so as to eliminate own competency gaps and improve the quality of CUT's offer for SMEs based on the results of the survey.

Keywords: eco-innovations, internal competencies, competency gaps, SMEs

1. Introduction

The process of internal development that has been presented in the paper was conducted within the confines of implementing the international project ECOLABNET. The project was funded by Interreg Baltic Sea Region (Project #R077 ECOLABNET of Interreg Baltic Sea Region), and its objective was to create a collaborative network of service providers to stimulate development and implementation of eco-innovations in manufacturing Small and Medium-Sized Enterprises (SMEs) of the Baltic Sea Region (BSR). The project consortium ECOLABNET comprised scientific institutions and Research and Development Institutions (RDIs) from six Baltic Sea Region countries, and included the following: 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) represented, among others, by the author of the present paper. The project was carried out in the years 2019-2021. The main actors involved in the project constituted Research and Development Units, Intermediary Organisations (IOs) and Small and Medium-Sized Enterprises. The creation of ECOLABNET network was an attempt to address the gap between the demand for expert knowledge on eco-innovations (including sustainable eco-innovations) on the side of SMEs from the BSR and the offer of RDIs in this area (ECOLABNET, 2021). It is believed that creativity and innovation constitute these important factors that allow an enterprise to face the competition pressure (Gede et al., 2019). More importantly, applying the network-based concept of developing innovations means that both organisations from the local community and from other geographies provide important tangible and intangible resources making such networks including non-local actors very effective in gaining and diffusing knowledge (Ferreiro and Lourenco, 2019).

The present paper constitutes a precious source of knowledge on the improvement of the process of knowledge management in the ECOLABNET project, and so in alike projects. It also highlights the relationships between utilisations of the potential of Research and Development Institutions and expert knowledge they provide to stimulate a wider implementation of eco-innovations in SMEs. With this in view the authors have formulated the objective of the present paper – an attempt to answer the following research question:

- RQ – Does internal development strategy formulation contribute to better knowledge management and improved quality of RDIs offer?

The paper constitutes a contribution to the literature by analysing one of the stages pertaining to the process of knowledge management in projects – internal development of organisations involved in the project. It has the following structure. Introduction includes basic information about the ECOLABNET project, its main actors, goals, and important role of RDIs in fostering development of eco-innovations in SMEs. Chapter 1 refers to the role and importance of strategy of internal development for better knowledge management. Chapter 2 presents the research sample and main findings pertaining to identified needs of SMEs from the Baltic Sea Region. In the third chapter the authors present the internal development plan for the partners. Chapter 4 focuses on the analysis pertaining to identification of own competency gaps and introducing corrective measures in this area by the CUT Partner. The last chapter concludes the paper and contains suggestions regarding further research works.

2. Literature review - role and significance of strategy of internal development

Organisation's internal development can be perceived as one of the crucial processes that improve organisation's efficiency of functioning and at the same time results in improved offer of products and services of a given organisation. In the opinion of Henry (2021), improved competencies resulting from learning within the organisation can be used for its internal benefit. In addition, there is no need to use valuable resources to manage various cultures (especially important in projects of international scope). No wonder then that much attention in the literature on the subject has been devoted to all the elements that contribute to a successful implementation of internal development strategy in organisations of various types. The process of drawing up an organisation's development strategy, including internal development strategy, involves such elements as planning the strategic activities to be performed, setting the goals to be achieved, formulating and defining strategy's implementation form. All of the abovementioned elements are supposed to ensure that the final strategy will improve organisational capacity in the scope of a given organisation's field of expertise. The literature on the subject is abundant in the examples demonstrating that these organisations that are able to define their strategic goals, plan the activities that ensure elimination of soft spots in the range of possessed competencies, and successfully implement the strategy in practice are more successful in their operations than the ones that fail to do so. Some of the examples have been presented below.

In their paper Elonen and colleagues (2002) examine projects of internal development and divide them into problem solving, utility, maintenance and research projects. The researchers state that the underlying goal of projects of internal development is typically performance improvements. Examples of these can include development of business processes, internal information technology development, organisational change or re-engineering – they pertain directly to learning and improved knowledge management.

George and colleagues (2019) point out the fact that it has been recognised in the goal-setting theory that organisations with clear set goals perform better. This stems from the fact that setting the goals translates into the focus on these activities and resources that pertain to core issues. What is also relevant, in this way employees understand the priorities of the organization as a whole. It can be stated then that application of goal-setting theory to strategy formulation makes it clear to the organization and its stakeholders what the organizational priorities are and how they are going to be addressed.

Bryson Crosby, and Bryson (2009) argue that critics of strategic planning usually present it to occur in the form of fairly rigid, mechanistically applied sequence of prescribed steps, completion of which is frequently impossible without involvement of huge amounts of information, power, and authority. They also tend to be separated from processes, methods, and mechanisms of implementation, therefore not contributing to learning within the organisation. However, according to these researchers it is necessary to stress the essentially uniform view of strategic planning, which is linking the process to context. In addition, what actually counts here is not specific steps nor information needs but how the process is used to promote strategic thinking, acting, learning and knowing, and also how to ensure that the right actors will be involved and stakeholders affected in the proper way.

Equally important issue is formulating internal development strategy. According to Brorström (2020), the process of strategy formulation itself can be more important than the actual content of the strategy. This means that as the process of formulating the strategy results in organisational changes and learning, then it can prove more beneficial and more important for the organisation that what has been included in the final document. Mitchel (2004) defines strategy formulation as the second phase in the strategic management process. In his

opinion this produces a clear set of recommendations, with supporting justification, that revise as necessary the mission and objectives of the organization, and supply the strategies for accomplishing them. Acur and Englyst point out to the fact that a strategy's effectiveness is frequently evaluated in retrospect, which is certainly valuable in determining the appropriateness of current ones. The authors stress the importance of assessing strategy formulation process rather then the resulting performance. According to them an effective strategy formulation process leads to a good strategy.

3. Method of acquiring data on needs of SMEs from the Baltic Sea Region and main findings

The ECOLABNET project was implemented in the years 2019-2021 and it will be maintained for further five years, each year one of the partners taking over presidency. This is supposed to ensure that the results of the project will reach its main beneficiaries – SMEs from the BSR. The starting point of the project was the research aimed at recognising the level of knowledge about eco-innovations among the manufacturing SMEs from in the six partner countries of the project. The research was assumed to provide data on the current level of pro-environmental awareness, and also the level of pro-environmental activities already implemented by the investigated SMEs. Another issue investigated in the research was primary stimuli and barriers for implementing eco-innovative solutions signalled by the SMES. For this reason, the CAWI (Computer Assisted Web Interview) method was applied in the data gathering process. According to the definition by DJS Research (2008) in the CAWI method the survey appears in the browser in the form of a web-page that can be reached by the respondents in different ways. The survey respondents only see the questions to be answered 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.

The survey questionnaire used in the ECOLABNET research included 27 questions that were divided in five groups. The first group of 5 questions provided basic information about the surveyed enterprise and its profile of operation. The second group, questions 6 to 15, pertained purely to eco-innovations, in particular knowledge about eco-innovations, motivating factors and barriers to introducing eco-innovations in manufacturing SMEs of the BSR region. Questions 16 to 21 were supposed to investigate the knowledge of the surveyed SMEs with regard to 3D printing as an eco-friendly solution that can be applied in manufacturing processes and replace the previously used one that contribute to environmental degradation. Then, questions 23-24 were supposed to provide an answer to the question of how big the demand for expert knowledge was and if it could be satisfied by project partners. The questionnaire finished with the 3 questions concerning the possibility of future cooperation and address details. The research was conducted on the group of 298 enterprises located in the six partner countries: Estonia, Poland, Finland, Lithuania, Sweden, and Denmark. The data collected in the research was then processed and utilised at formulation of knowledge management strategy in the project. It also provided valuable knowledge on the needs of the investigated SMEs with regard to barriers that hinder their effort in introducing eco-innovations in their operations. During the survey its respondents were asked to assign scores from 1 to 5 to these barriers on the five-point Likert scale. Additionally, the weighted average has been used here to illustrate their significance. In this way the values that have been assigned greater values play a more important role in determining the weighted average than the values that have been assigned lower values. This data has been summarised in Table 1 below.

Table 1: Barriers related to knowledge according to the SMEs from the BSR (five-point scale, and weighted average)

Barriers related to knowledge	Score 1 (%)	Score2 (%)	Score 3 (%)	Score 4 (%)	Score 5 (%)	Weighted average (WA)
Lack of suitable tools and methods	6,99	20,96	28,82	25,76	18,78	WA – 3.26
Limited access to external knowledge	10,48	21,40	35,37	20,96	11,79	WA – 3.24
Lack of proven technologies	8,30	18,78	31,00	26,64	15,28	WA – 3.22
Lack of in-house expertise	9,17	17,90	30,57	27,51	14,85	WA – 3.21
Legislative demands	13,10	18,78	28,38	27,07	12,66	WA – 3.07

Total responses N=296, Answered: 229 Skipped: 67

(…) – number of indications

Source: Based on the research conducted in the ECOLABNET project

As Table 1 demonstrates, the main barriers related to knowledge that were signalled in the survey include in the first place the lack of suitable tools and methods. The surveyed SMEs also indicated limited access to external

knowledge, lack of proven technologies or in-house expertise as the barriers that hinder introduction of eco-innovations by them. Additionally, legislative demands with regard to frequently changing legal regulations were recognised as a barrier to a greater involvement in the concept of introducing eco-innovations by small and medium-sized enterprises in the six partner countries of the project.

4. Internal development plan of Project Partners

One of the primary objectives of all the project partners was to assess their competencies level in the scope of providing expert knowledge on eco-innovations, identify gaps of their competencies in this respect, and introduce corrective measures in this area. This was supposed to improve the range of services rendered in particular by RDIs, and ensure their better adjustment to the needs of manufacturing SMEs struggling to introduce eco-innovations in their operations. A particular role in expert knowledge transfer play universities. Certainly, the flows of knowledge to SMEs can occur from various directions and come from a range of actors.

Yet, as the research by Etzkowitz and Zhou (2006), and Jones and de Zubielqui (2017) shows, universities have long been considered to be key sources of knowledge in knowledge-based societies. In addition, more recently they have been thought to be also knowledge source for eco-innovations and Sustainably-Oriented Innovations (SOI) in SMEs. In general, the competencies of the network included: knowledge in additive manufacturing, bio-based materials, product-service system design, eco-branding, value chain assessment, business model development, legislation, customer insights, certifications and life cycle assessment. Having analyses the possessed gaps of competencies the project partners introduced internal development strategies that included plans of actions aimed at elimination of the identified competency gaps. The expected result of the process of internal development was better management of knowledge and expertise by the partners, which would translate into a better tailoring of their service offer to the needs signalled by the target SMEs in the BSR. As these enterprises are frequently not involved in their own Research and Development (R&D) activity, they report the lack of access to expert knowledge on eco-innovations to be one of the crucial factors that impedes their innovativeness (Kucęba and Chmielarz, 2020). As a result, they find it difficult to meet the criteria set out in the Europe 2020 strategy and are unable to increase the competitiveness of their offer. Therefore, the process of internal development of the project partners seems to be of particular significance, as better knowledge management with regard to the expectations of the targeted SMEs would boost their eco-innovative development (Penttinen et al., 2021). As the partners of the project consortium were striving at adjustment of their offer to the particular needs signalled by the survey respondents one of the subsequent stages of knowledge management process was an analysis of own competency gaps. This was part of the development activities planned in the project. According to the guidelines of the Project Leader all the project partners were supposed to develop required organisational competencies for creating better access to their facilities and competencies. Within this task the partners had to first identify the gaps of competencies in their own organisations so as to comply with the needs of SMEs. In the first step each of the RDI partners established a development team. The task of the development team was to create a development program including strategic objectives, at least 3 development activities as well as an action plan and steps necessary to implement it. To assist the RDI partners in identifying own gaps of competencies the Project Leader drew up a template to be filled in by them. The template has been presented in the graphic form in Table 2 below.

Table 2: Template for establishing own competency gaps

Competencies and expertise in specific expertise areas within the partnership		
Partner name	Competencies and expertise in Solving Barriers issues of SMEs	
	What do we need here?: We listed the main barriers that the SMEs identified in the surveys. We ask every partner to think (and write down!) if (and how) they would be able to help the SME's to overcome each of these issues. Familiarising with the Reports would be beneficial for delivering this task ---------->	SMEs report
		IO report
Lack of capital	counselling in the scope of acquiring external resources, facilitating access to information, who can ensure financial resources for SMEs, venture capital, business angels	
Lack of alternative materials	cooperation with research centres, institutes, development centres, technology transfer centres, developing alternative materials; enabling contact with for SMEs with partners	
Lack of knowledge/experience	counselling in the scope of benchmarking, direct support in the scope of eco-innovations, bio-degradability, recycling, prosumer energy, low emission reduction , energy savings, waste treatment	

Competencies and expertise in specific expertise areas within the partnership		
Certification costs	counselling in the scope of diversifying costs related to implementing innovations among a group of recipients	
Uncertain return on eco-investments	counselling in the scope of preparing business plans and innovations, identifying risks and methods of limiting them	
Limited access to external knowledge	Rendering direct services in the scope of information and knowledge, transfer of Partner's expert knowledge, assistance in access to external knowledge, search for and matching external experts and SMEs that need knowledge in a given scope (e.g. in the scope of eco-innovations, bio-degradability, recycling, prosumer energy, low emission reduction, energy savings, waste treatment)	

Source: Based on the internal materials of the ECOLABNET project

As one can observe based on the content of Table 2 the barriers included in the template had been previously indicated by the investigated SMEs. They basically concentrated on six reasons behind these barriers' occurrence, namely: lack of capital, lack of alternative materials, lack of knowledge/experience, certification costs, uncertain costs of return on eco-investments, limited access to external knowledge. While developing their internal development plans the project partners were supposed to address their gaps of competencies in assisting SMEs in overcoming these particular barriers. This was based on two surveys – the SMEs survey and the Intermediary Organisations survey (third column of Table 2).

5. Development and implementation of internal development strategy by CUT

In order to bring the internal development plan into effect the Team of Czestochowa University of Technology, following the guidelines of the Project Leader, drew up a strategy of internal development. The strategy included details of the actions that needed to be undertaken so as to identify the gaps of own competency and address them in the subsequent steps. It needs to be stressed that the template of the internal development strategy developed by CUT was used by all the remaining Project Partners to assist them in the process of identifying own gaps of competencies. Particular stages of the strategy for the internal development have been summarized in Table 3.

Table 3: Stages of Internal Development Strategy for the CUT Partner

Stage	Stage description
1. Identifying or creating a team in charge of internal development. The team responsible for the collaboration with SMEs in the given organisation	The conducted analysis showed that at the CUT there was not a unit responsible for collaboration with SMEs strictly in the scope of developing eco-innovative initiatives. Therefore, a decision was made to appoint a team for collaboration with SMEs in the scope of developing eco-innovative initiatives. The team includes employees of two departments of Czestochowa University of Technology: Faculty of Infrastructure and Environment and Faculty of Management.
2. Determining by the identified/created team the priorities and strategic actions in the context of collaboration and support for SMEs	The following major priorities and strategic actions were defined in relation to collaboration with the SME sector: 1.Stressing the importance of eco-innovations and eco-innovative activity as key sources of SME sector enterprises competitiveness. 2. Supporting technological research in the aspect of early validation of products and services, including so called first production. 3. Promoting investments of enterprises into research and development of eco-innovations in synergy with R&D centres and higher education sectors. 4. Creating networks of knowledge and technology transfer. 5. Developing competencies in the scope of designing and creating eco-innovations through investments in knowledge and skills.
3. Identifying by the internal development team the needs of SMEs in the scope of eco-innovative actions (including the needs identified in the survey conducted among SMEs in partner BSR countries).	The needs of SMEs in the scope of eco-innovative solutions were identified based on the conducted survey and direct interview with the use of survey questionnaire.
4. Identifying competence gaps in particular areas of knowledge within the partnership (in the scope of theoretical and practical	The Internal Development Team identified gaps of competence in particular areas of knowledge within the partnership (in the scope of theoretical and practical knowledge, know-how, skills; providing

knowledge; know-how; skills; providing services; support in the scope of information, technology, and infrastructure; consulting, eco-innovative, project actions; etc.).	services, information, technological and infrastructural support; consulting, eco-innovative, project activities, etc.).
5. Determining lines of actions so as to eliminate competence gaps.	The following actions were to be undertaken to eliminate competence gaps in the context of the needs of SMEs: • determining development objectives and identification of external factors that influence the occurring problems; • determining the current level of competencies and knowledge in the scope of innovations; • recognising development needs in the scope of eco-innovative initiatives.
6. Drawing up development strategy with regard to determined primary lines of actions	The underlying objective of the strategy is to strengthen the competencies of the team for collaboration with SMEs in the scope of developing eco-innovative initiatives and strengthen its internal development at Czestochowa University of Technology.
7. Decomposing strategic objectives	With reference to the strategic objectives distinguished in pt. 6 , the Internal Development Team defined 8 specific objectives to be achieved in this area.
8. Indication of key development actions/activities - min. 3 activities (please specify activities):	Identification of key development actions/activities in the scope of eco-innovative solutions has been conducted based on the survey and direct interview with the use of a survey questionnaire and in the context of the adopted strategy of internal development. It was established that in the case of the CUT Team three primary development area concerned: ▪ development of research infrastructure ▪ developing the network of contacts ▪ designing, drawing up and developing the portfolio of services for the SME sector
9. Establishing an action plan and tasks implementation within the developed strategy.	The CUT Team members drew up an action plan regarding the tasks to be performed within the developed strategy.
10. Determining implementation steps/stages in the scope of strategy implementation	Defining stages for the strategy implementation within the established action plan.
11. Monitoring the progress of undertaken actions (periodical check-up of tasks implementation progress, applying corrective measures if necessary).	Monitoring the level of performing tasks - based on the adopted strategy of the team regarding collaboration with SMEs in the scope of developing eco-innovative initiatives.
12. Developing and accepting benchmarks of internal development evaluation	To evaluate the internal development of the CUT Team a set of ratios was developed to measure the progress of the team's internal development.
13. Evaluating strategy implementation	It was established by the Infernal Development Team that to evaluate the strategy implementation periodical checks would be performed ending with conclusions about the need or lack of need to revise/change the strategy or its part.

Source: Based on the internal materials of the ECOLABNET project

As one can observe based on Table 3, the strategy of internal development for the CUT Partner included carefully planned stages. These began with creation of the team responsible for drawing up the strategy. In the next steps the newly-formed team analysed the needs of the SMEs from the BSR with regard to eco-innovative initiatives and identified its own gaps of competency in this area. Having done so, the team addressed the issue of eliminating own competency gaps by determining actions to be carried out in this respect. This in turn led to formulation of the strategy, which included strategic objectives and an action plan with the details of actions and tasks to be performed in the course of the strategy implementation. Finally, benchmarks of internal development were developed to measure the level of strategy implementation and also to evaluate the team's internal development. A measurable output of defining the stages of internal development for the CUT Team in the drawn-up strategy was improved knowledge on the needs of SMEs pertaining to eco-innovative actions. This in turn allowed the team to analyse own gaps of competencies in this respect and introduce corrective measures. It can be stated that the formulation of the strategy contributed greatly to the further improvement of the CUT's offer for SMEs and motivated the entire team to develop their knowledge in the areas its lack was observed. Therefore, in the light of the above, it can be stated that the research question *RQ – Does internal development*

strategy formulation contribute to better knowledge management and improved quality of RDIs offer? has been answered positively.

6. Conclusion

To sum up, internal development can be defined as the process of key importance with regard to its impact on organisation's efficiency of functioning. The process of internal development was also one of the key areas of knowledge management in the ECOLABNET project. It provided an opportunity for all the partners involved in the project to analyse their capabilities and seek for one's gaps of competencies that needed to be eliminated to support the targeted SMEs better in their eco-innovative development. The process of eliminating the gaps of competency was based on the research that had been conducted among SMEs from the Baltic Sea Region, in particular barriers and needs with respect to eco-innovations. These were supposed to be addressed by all the project partners while developing their internal development plans so as to assist the SMEs in overcoming them. For this reason the CUT Team developed the strategy for internal development that aggregated and ordered all the indispensable stages and steps that ultimately led to the implementation of the strategy and internal development of the team. A template of the internal development strategy was sent to all the project partners to assist them in the process of developing their own ones. The template included 13 stages of the process of internal development accompanied by details of setting and achieving the objectives of each stage. As universities are believed a special role in dissemination of expert knowledge, including the knowledge on eco-innovations, it was considered vital for the CUT partner to improve its offer of RDI services. The members of the internal development team eagerly participated in defining the framework of the strategy, and implementing the set objectives in the team's operations. It turned out that the process of formulating the strategy itself, concentration on own deficiencies, and an attempt to address the needs of SMEs from the BSR identified based on the survey conducted in the first stage of the project, allowed the CUT Team to improve their competencies in the scope of offered expert knowledge and eco-innovative services. This confirms the findings of the literature study conducted by the authors, where a number of researchers stress the importance of a properly defined strategy, pointing out that drawing up a development strategy contributes to learning within an organisation. The research pertaining to the implementation of internal development strategies of the Project Partners constitutes a separate paper of the authors, submitted for this year's edition of the conference.

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Counterproductive Aspects of Remote Work in the Context of Exchange of Knowledge

Leszek Cichobłaziński
Czestochowa University of Technology, Czestochowa, Poland
leszek.cichoblazinski@pcz.pl

Abstract: The article is devoted to the problem of impact the remote work might have on exchange of knowledge in an organisation, with particular emphasis on the aspects of counterproductive work behaviour. Due to the COVID-19 pandemic, remote work has become an everyday element of human resources management almost all over the world. However, not all the consequences of introducing remote work on a massive scale have a positive impact. Some of them imply significant problems in organising information exchange, at levels of creation, distribution and perception of knowledge. The cognitive goal of the article is to identify remote work factors that imply counter productivity at work. The purpose of the study is to develop methods to support pro-effective work behaviour in the context of knowledge exchange in remote work. The article analysis will be based on quantitative research conducted among people working remotely. The survey was conducted in December 2021 among generation Z. For this purpose, the author used an interview questionnaire. It was completed by respondents both in a traditional way and using an online survey. Until now, attention has been paid mainly to the positive aspects of remote work, which significantly improves knowledge management in organisations. The novelty of this research relates to paying attention to counterproductive implications of remote work as well as an attempt to develop methods to overcome these implications in the field of knowledge exchange in an organisation.

Keywords: Counterproductive Work Behaviour, Knowledge Management, Remote Work.

1. Introduction

The issue of counter productivity is important and can be burdensome. On the one hand, the market economy and the resulting competition on the labour market should eliminate such phenomena from the workplace, but on the other hand, counterproductive behaviour sometimes is on such a large scale that make the employers helpless. Nothing seems simpler than firing an employee who exhibits this type of behaviour. In practice, however, it is not that simple. The problems that arise in this area are closely related to management, e.g. is it more profitable to fire such workers, or can it better help them to change their behaviour to generate mutual benefit? This may particularly apply to highly qualified workers who have rare and important competences for the employer.

This problem is important due to several reasons. Firstly, it is important from the point of view of an organisation hiring employees exhibiting counterproductive behaviour. It happens that such behaviours are transferred from the environment of the organisation, e.g. from the culture of the local community. Secondly, this problem is also important from the employee's point of view, because counterproductive behaviours are often a form of adaptation to organisational pathologies and can cause moral conflicts, especially when they are forced by an employee group. “Counterproductive work behaviour can be seen in the context of the theory of organisational stress, according to which organisational tensions, interpersonal conflicts and perceived injustice are stressors, to whom counterproductive behaviour is an adaptive reaction.” (Fox, Spector & Miles 2001, p. 291) It is worth emphasizing here the importance of the issue of the sense of justice in the organisation and its impact on productivity (Macko 2009). Some counterproductive behaviours can also be very burdensome outside the organisation, e.g. for the families of employees (using psychoactive substances or aggressive behaviours), which may adversely affect the work-life balance.

This issue can also be approached in terms of the human resources process. It is primarily related to hiring and dismissing workers. That is, how to recognize and assess the risk associated with counterproductive behaviours during recruitment and employee selection, and secondly, who, when and on what basis can be dismissed if these problems become dangerous for the organisation? But other aspects of the human resources process are also important, such as transferring employees, managing careers and competences, etc.

Another aspect relates to the culture of the organisation and the organisational stress occurring in it. These are cultural norms that tolerate and even support counterproductive behaviours (e.g. pathological informal groups focused on protecting their members, not on achieving the goal of the organisation, or taking psychoactive drugs) as actions that reduce organisational stress. The above circumstances justify the choice of a research

problem, especially because there are not many studies based on empirical research in Polish publications on this subject.

In this study, the emphasis will be placed on the impact of remote work on counterproductive behaviours.

2. Literature overview

The analysis of counterproductive behaviours carried out so far focused mainly on the phenomenon of organisational pathologies. However, it is worth paying attention to a more constructive approach, namely the concept of a "healthy organisation". Józef Penc defines this concept as follows: "it seems that a healthy organisation is a naturally efficient organisation in the pragmatic sense, but also capable of remedying all difficulties that stand or may stand in the way of its development and harmonious cooperation with the environment of its activity. It is therefore an organisation sensitive to innovation and change, capable of generating and implementing them, competing with the advantage of customer values, friendly to employees and the environment." (Penc 2001, p. 12) While the concept of organisational pathologies has become well established in publications on the subject, the concept of a healthy organisation is not found often. It is also used by Ryszard Stocki, who even writes about the "anatomy of a healthy organisation" (Stocki 2005). The increasingly more frequent medical analogies may attract attention. Penc's definition is interesting because it brings attention to the positive aspects of a "healthy organisation" (it is supposed to be able to adopt adaptive changes, among other things), and not only to the lack of pathology. Jerzy Terelak describes this issue in a similar way when he writes about the concept of a norm at an organisation. Nevertheless, earlier he mentions the following models of the norm: a quantitative model - those behaviours that constitute a statistical majority are considered normal; a socio-cultural model – those behaviours that are consistent with the cultural pattern of normality (normative model) are considered normal; a pragmatic model - also called a holistic model is defined as follows: "In the practice of managing human resources, synonyms of such a health standard, useful for an organisation are the concepts of well-being or quality of life, and in empirical research, due to methodological limitations, we encounter rather detailed approaches, separately analysing the biosphere (biology) in general biological categories and the cultural sphere (psychology) – in terms of personal or organisational potential." (Terelak 2012, p. 447) In the last model, the concept of well-being is the most important, which can be identified with the ability to develop - both in terms of people and the organisation.

However, it should be remembered that counterproductive behaviours, just like any pathology, are not senseless or irrational actions. They always play a function towards achieving a goal, but it is contrary to the goal of the organisation. The basic question in the diagnosis of such behaviours should be: what goals makes it possible to implement counterproductive behaviours and why are members of the organisation more interested in achieving competitive goals, triggering pathological behaviours, rather than the initial goals of the organisation?[1]

One of the factors perpetuating counterproductive behaviours is the mechanism of denial. This defence mechanism known from psychology is also often found in organisational behaviours, and in this case serves to deny the costs resulting from counterproductive behaviours. In other words, "perhaps such behaviours are inappropriate, but after all, nothing serious is happening". This type of attitude usually leads to such intensity of organisational pathologies that counteracting them becomes extremely difficult. The denial mechanism is one of the most typical self-destructive processes in the organisation. Some authors even use the term "Self-Defeating Organisation." (Hardy & Schwartz 1996, p. 142 – 143)

3. Remote work

When referring to Davenport and Prusak, it can be stated that "Knowledge is a fluid mix of framed experience, values, contextual information, and expert insight that provides a framework for evaluating and incorporating new experiences and information. It originates and is applied in the minds of knowers. In organisations, it often becomes embedded not only in documents or repositories but also in organisational routines, processes, practices, and norms." (Davenport and Prusak 2000, p. 5). Standards, values or artifacts as elements of the

[1]An interesting example is provided by "Hotel Pacific", a film from 1975 directed by Janusz Majewski based on the novel by Henryk Worcel with the same title. A young waiter in an internship found a large amount of money on a table while cleaning. He wanted to give it to his supervisor, but his colleague instructed him that if he did, he would make himself suspect that he was stealing elsewhere, since he was demonstrating such honesty. There were double standards in this organisation. Fair conduct would be against the tacitly accepted value system, according to which acting to the detriment of the employer is the most normal course of action.

organisational culture may include knowledge of the organisation, among others, about the ways of achieving goals or responding to crisis situations. This also applies to the type of organisational culture, e.g. a culture based on individualism or collectivism, based on competition or cooperation that conveys knowledge about ways of achieving goals in various ways. A change in this type of knowledge is significantly more difficult than knowledge of a technological type, because Information Technologies relate to the sphere of mechanisms regulating human behaviour in companies, and at the same time remain outside the sphere of consciousness. There is one feature of knowledge that is worth emphasizing: people have 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 about this situation relate to other situations we know about? - Consequences: how important is information for decisions and actions? – Connections: does this knowledge refer to the already possessed knowledge? - Conversation: what do others think about this information? (Davenport and Prusak 2000, p. 6) The data comes from appropriate databases, records, archives, etc. The information is obtained through messages but knowledge is generated in the minds of people, among people who are professionals in certain areas. Knowledge can also originate in contacts between people, conversations and learning. Hence, the exchange of knowledge is an important tool for creating and developing knowledge.

4. Knowledge sharing

Why is knowledge sharing so important? “Another aspect associated with creating knowledge is the exchange of this knowledge. There is no new knowledge without contact being made between different research centres, which interact and inspire one another. This is the reason why most innovations came into being in places where communication amongst those centres had been facilitated. Usually communication was stimulated by economic contacts and wars that helped technological innovations and cultural patterns to intermingle in different regions. Stagnation and regress was perceived in all places which were short of knowledge exchange.” (Cichobłaziński 2021, p. 199). The best example are 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 (Brockman 2003).

The importance of knowledge sharing can be considered both at the macro and micro level, i.e. at the enterprise level. “Knowledge sharing 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)

In this context, the relationship between remote work and knowledge exchange is becoming an important issue. It is about the extent to which remote work helps and hinders the sharing of knowledge in the organisation. Remote work has become very common during the COVID-19 epidemic to an unprecedented degree and everything indicates that its application will increase. For this reason, this problem seems to be important and unrecognised.

The phenomenon of knowledge sharing has recently been highly explored. It is important due to the widely used digital technologies (Kukowska & Skolik 2021). Nevertheless, in this study, the focus will be placed on the analysis of the phenomenon at the micro level, i.e. the enterprise. It is at this level that knowledge sharing is most exposed to all kinds of distortions caused by the replacement of face to face employee relations by remote relations (Nemțeanu, Dabija & Stanca 2021). Remote work also has an impact on the process of sharing knowledge in the aspect of organisational hierarchy and power distribution in organisations (Skolik & Karczewska 2021).

Another key factor of work productivity in knowledge management is remote work. “Telecommuting is becoming a common work option for knowledge workers with benefits for both employers and employees. In an information age, where information itself is key to performing work tasks, understanding how telecommuting knowledge workers find, use, and depend on information is key to good management.” (McInerney 1999, p.69)

5. Methodology

The research results presented in the study constitute a part of a quantitative survey conducted among young people at the turn of 2021. The research problem of the project related to the impact of the remote learning

experiences on the preferences in the area of remote work among young people in reference to: employee relations, knowledge, development and learning, motivation, communication, teamwork, creativity, work organisation, work-life balance and counterproductive behaviours.

The study presents a fragment of the research results related to knowledge exchange. The following research assumptions were adopted in the area of analysis of the influence of preferences in the field of remote work on the perception of knowledge exchange processes in the organisation:

- the COVID-19 pandemic situation resulted in a mass transition of young people to the remote learning and remote work mode, which contributed to the popularisation of remote work;
- the advantages and disadvantages of working remotely, also in the area of knowledge exchange, are described in literature on the subject;
- the motives of the knowledge exchange transaction were analysed in accordance with the typology of Devenport and Prusak and include: trust, reciprocity, reputation and altruism.

As part of the research, the following problem was posed: Has the experience of remote learning contributed to the creation of an erroneous perception (in relation to the features of remote work described in literature) of remote work and its impact on the exchange of knowledge?

The survey was conducted using quantitative research methods using the survey technique. The technique was chosen because of the possibility of a direct contact with the respondent. The study covered young people studying various areas and majors, coming from the Silesia Voivodeship, because in relation to this group of youth, due to their professional competences, it is possible to use remote or hybrid work in the future.

The research tool used was a standardised questionnaire consisting of closed questions and statements. A Likert scale (the so-called Likert scaling technique) was used for the responses, which makes it possible to determine the relative intensity of the different responses (Babbie, 2004, p. 192). The form of established and specified conditions allows for a reliable and quick analysis of the collected material, their uniformity and ease of development (Churchill 2009). The research tool (questionnaire) was prepared by the author and was formulated by the members of the research team - the employees of the Department of Applied Sociology and Human Resource Management, Faculty of Management, Częstochowa University of Technology.

STATISTICA software was used in the process of compiling the research results. In order to assess the significance of the differences in the analysed variables, the non-parametric ANOVA Kruskal-Wallis (AKW) test was used. For the purposes of analysing the results of the study, a number of statistical hypotheses was adopted relating to the occurrence of significant differences in the respondents' statements due to their characteristics and experience in the area of work, remote learning and remote work. It was assumed that H0 is a hypothesis stating that there are no differences due to the grouping variable, while H1 is an alternative hypothesis stating that there are such differences. These hypotheses were verified by means of the aforementioned statistical test which allowed for the rejection of the null hypothesis about the lack of significant differences and the adoption of an alternative hypothesis about the existence of significance of differences. The study presents the relationships verified with statistical tests, which authorise the conclusion about the regularities in the studied group.

In the research were formulated two general hypotheses:

1. Remote work has positive influence on knowledge sharing in an organization.
2. Remote work does not influence counterproductive behaviours in organization.

6. Findings

226 students participated in the study. In the light of the literature, the representatives of generation Z are most often described as people born after 1995, although researchers include those born in 1990 as their representatives, and in other approaches only those born in 2000 and later. In line with the above criteria, the distribution of respondents in the studied group is presented in Table 1.

Table 1: The distribution of the studied group according to the definition categories of generation Z.

	Born in 1990 and later %	**Born in 1995 and later %**	**Born in 2000 and later %**
Generation Z	89.82	83.19	29.20

Others	10.18	16.81	70.80
Total	100.00	100.00	100.00

Source: Authors' own compilation

Since the most common division into generations in the literature indicates 1995 or 1990 as the year from which one may talk about generation Z, in the analysis of the results of the research it was assumed that the dominant population in the study group was gen Z. Due to the fact that statistical tests did not reveal statistically significant differences (table 3) in the opinions of representatives of gen Z and other respondents regarding the analysed issues, the description and analysis of the research results will present the overall results without distinguishing between generation Z and the older generation Y respondents.

50.44% women and 48.23% men participated in the study. Among the respondents, 86.72% indicated having experience in the area of remote learning, and 12.83% did not have such experience (one person did not express their opinion in this area). With regard to professional experience, the majority of the respondents - 86.28% confirmed such experience, and 13.27% denied having it (one person did not make any indications). Among the respondents, 48.67% of them had experience in the area of remote work, 50.88% did not experience this form of work (one person did not express their opinion in this area). When asked about their preferences regarding the form of work in the future, the respondents most often chose a hybrid form of work - 50.00%, followed by stationary work 35.40%, remote work was indicated as preferred by only 12.39% of respondents (2.21% did not express their opinion in this area).

7. Analysis of the frequency

At this stage, the distribution of answers to questions relevant to the research problem posed, i.e. the issue of counterproductivity in learning and remote work, will be analysed.

Respondents pointed out that both in professional work and learning, remote contacts make non-professional contacts more difficult between employees. 68.3% responded 'I agree' and 'I strongly agree'.

On the other hand, remote work and remote learning will hinder the emergence of conflict situations in work teams. 39.2% of respondents provided such answers. This trend is not as clear as in the previous variable, but it allows to draw the conclusion that at least remote work does not favour the emergence of conflicts.

This conclusion could seem trivial if it were not for the distribution of answers to the next question regarding the impact of remote work on the difficulties in understanding the transmitted commands and tasks. In this case, 46.4% of respondents indicated such difficulties. Nevertheless, remote work does not contribute to the emergence of conflicts.

A clear tendency can be observed in the case of answers to the question about the occurrence of various types of distractions (barking dog, children, noise on the train...) during remote work and remote learning. 71.6% of the respondents agreed with such thesis. Thus, both remote work and remote learning require a much higher level of concentration than their stationary counterparts. This may impact counterproductivity.

Respondents also indicated an increasing sense of isolation caused by remote work. 62.3% of respondents indicated such a trend. The sense of isolation indicates an unmet need for belonging. This may have a direct impact on the phenomenon of knowledge sharing, which is very difficult in the absence of face-to-face contact and the feeling of loneliness caused by it.

53.5% of the respondents indicated that remote work makes mutual motivation of employees more difficult. Employees who are deprived of direct contact with each other do not have the opportunity to influence each other, especially when it comes to positive influence. Isolation, to which workers performing remote work are condemned, requires a significant level of self-motivation and self-organisation. This conclusion is concurrent with the answers obtained to the question relating to difficulties in contact between employees. 49.4% indicated such difficulties. Therefore, it is a significant problem from the point of view of the phenomenon of counterproductivity.

Difficulties in building emotional bonds in the work environment are a problem with an even stronger impact on the phenomenon of counterproductivity. 60.2% of respondents indicated the existence of such difficulties. As

one may know, a significant part of time is spent at work, and remote work significantly hinders the formation of emotional bonds.

Another problem resulting from remote work and affecting the productivity of employees is the adaptation of employees to new work. As many as 58.8% of respondents indicated that remote work makes it much more difficult to adapt, which may directly affect the phenomenon of counterproductivity.

A significant group of respondents also indicated disturbances in the rhythm of day and night in remote work. This problem was indicated by 44.1% of respondents. Such disorders can cause employees' productivity to decline with prolonged periods of remote work or remote learning. This is due to the fact that you do not have to leave your home for work and be back at a certain time. You can perform your duties properly at any time of the day or night.

Correlations: independent variable – having professional experience

Among the independent variables, the "having professional experience" variable was selected. This variable quite significantly differentiates the answers to questions related to dependent variables. Those relationships were selected, in which a statistically significant relationship measured with the Kruskal-Wallis test was demonstrated.

1. Respondents with professional experience mostly (61.5%) indicated that remote work does not contribute to maintaining work readiness. The results of the Kruskal-Wallis test ($p = 0.0511$), with the assumed level of significance ($\alpha = 0.05$), indicate the lack of grounds for rejecting the verified null hypothesis. This means a noticeable decrease in the level of motivation in the case of remote work.
2. People with professional experience (60.0%) more often indicated the occurrence of various types of distractors (barking dog, children at home, etc.) than respondents without such experience. The results of the Kruskal-Wallis test ($p = 0.0448$), with the assumed level of significance ($\alpha = 0.05$), indicate rejection of the verified null hypothesis. This can be understood as
3. The respondents having remote work experience (66.7%) also indicated difficulties in cooperating with colleagues at work. The results of the Kruskal-Wallis test ($p = 0.0127$), with the assumed level of significance ($\alpha = 0.05$), indicate rejection of the verified null hypothesis. Contacts with colleagues are an important element of teamwork. Respondents with no experience in remote work underestimated this type of difficulties.
4. The distribution of answers in the case of the question about the negative impact of remote work on the effectiveness of the employee team is as follows. In this case, people without professional experience in remote work (70.0%) claimed that remote work does not adversely affect the efficiency of the work team. The results of the Kruskal-Wallis test ($p = 0.0195$), with the assumed level of significance ($\alpha = 0.05$), indicate rejection of the verified null hypothesis.
5. This makes it difficult to understand commands/tasks. The results of the Kruskal-Wallis test ($p = 0.0005$), with the assumed level of significance ($\alpha = 0.05$), indicate rejection of the verified null hypothesis. Employees who prefer stationary work more often point to the fact that in remote work it is more difficult to explain the tasks and commands provided. In stationary work, however, it is much easier to do it on an ongoing basis. When working remotely, such explanations require the exchange of additional information using electronic means of communication.

The presented research results indicate numerous regularities regarding the phenomenon of counterproductivity in remote work. Nevertheless, remote work has many advantages, the most important being: reducing costs, the possibility of cooperation regardless of the place of residence. Nevertheless, research has evidenced several factors that also have a negative impact of this form of work organisation on its effectiveness. This impact is particularly relevant to the phenomenon of counterproductivity, which is a serious problem in any organisation.

8. Discussion and conclusions

When analysing the obtained data, the following should be stated:

1. Remote work makes non-professional contacts between employees more difficult, thus preventing the creation of informal bonds. Such bonds (if they do not take pathological forms) play a very positive role

in the life of the organisation. They particularly affect the shaping of a positive organisational climate. Remote work promotes the creation of a sense of loneliness and isolation.

2. When working remotely, it is more difficult to focus on a given task. Employees are subject to many distracting and deconcentrating factors. When work is done at one's home, the employee is exposed to many stimuli, the source of which is family life. This type of disturbance does not occur when you perform your duties in the workplace.
3. On the other hand, remote work has a smaller impact on the emergence of conflict situations compared to stationary work. This is understandable as employees rarely interact with one another directly. However, it should be remembered that when responding to these answers, the respondents most likely meant conflicts initiated directly during the interaction. It should be assumed that deeper conflicts resulting from conflicting interests or bad communication can only be postponed. This conclusion is consistent with the results presented by the team composed of: Becker W.J., Belkin L.Y., Tuskey S.E., Conroy S.A. (2022).
4. Remote work also makes mutual motivation of employees more difficult. There are no positive stimuli that are only transmitted during face-to-face interactions. Employees do not inspire each other, do not share tacit knowledge, and do not have a mobilizing influence when implementing tasks. Managing a team while working remotely is much more difficult but not entirely impossible.
5. When working remotely, the processes of building emotional bonds between employees are also hindered. Emotional bonds play a large role in the creation of employee relationships, which cannot be reduced only to functional relationships. This aspect of employee relations has already been highlighted by the creator of the Human Relation concept – Elton Mayo (Muldoon 2020).
6. Remote work also hinders the adaptation process. It takes much longer for the employees to adapt to the culture of a new organisation and achieve the stage of full productivity later. Such a situation may result from a lack of the appropriate information flow regarding an employee's productivity. In remote work, feedback is significantly hindered and impoverished.
7. In remote work, the day rhythm is also disturbed. The distinction between day and night is disturbed. Most tasks can be performed at any time. Employees do not go to work and often, they do not have regular working hours. This negatively affects the physiological rhythm of human functioning, thus hindering effective rest.
8. In remote work, the level of readiness for work also decreases. Employees may be ready to work at any time, which means they are almost never fully ready. This results in work in a state of incomplete mobilization, which is also associated with the achievement of unsatisfactory results.

9. Implications from theoretical and practical aspects of the study

1. Employee who are going to work in remote mode should be trained in order to avoid problems indicated above.
2. For this purpose special coaching programme should be prepared.
3. Remote work is very different from stationary work, and for this reason there is a need not only for special coaching, but also for detailed research taking into account the risk of counterproductive behavior.

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The Relationship Between Remote Work, Knowledge Sharing and Knowledge Hiding

Daniela Firmino Cidade[1], Mário Bissani[1] and Mírian Oliveira[1, 2]
[1]Pontifícia Universidade Católica do Rio Grande do Sul, Porto Alegre, Brazil
[2]Universidade de Lisboa - Advance/CSG, ISEG, Lisbon, Portugal
dfcidade@gmail.com
mario.bissani@gmail.com
miriano@pucrs.br

Abstract: Communication and the professionals working with it are playing an increasingly important role in organizations, expanding their scope of operations and influencing decision making and strategies. Hiding knowledge can hinder good performance in the communication process, as it prevents knowledge from reaching those who request it. This study analyses the influence of remote work on knowledge sharing and on the motivations for knowledge hiding from the perspective of company communication managers. To do so, an exploratory survey was undertaken with relevant data being collected during interviews with 20 communication managers, 17 of whom are communication managers of large companies in different business sectors and 3 are managers in communication consultancies. The interviews lasted an average of 23 minutes and the transcribed interviews were subjected to content analysis. In the perception of the interviewees, knowledge sharing is fundamental for the work of communication professionals. The interviewees perceived that remote work has both positive aspects, such as greater productivity and quality of life, and negative aspects, such as lack of face-to-face contact and fatigue due to excessive online exposure. it is worth remembering that for these interviewees remote work was a response to the Covid-19 pandemic, being characterized by one interviewee as an emergency measure. In addition, most respondents believe knowledge hiding has increased due to the widespread adoption of remote work practices by companies in response to the Covid-19 pandemic. According to most of the interviewees, the intention behind such knowledge hiding is related to the lack of a sharing culture, insecurity, digital burnout and distrust. These reasons, although they may also explain knowledge hiding in face-to-face environments, gain greater relevance due to the lack of informal face-to-face meetings (coffee time, lunch breaks, etc.), which could generate proximity and trust. The research paves the way for more detailed investigations into knowledge sharing and knowledge hiding in the communication processes.

Keywords: knowledge hiding; knowledge sharing; remote work; face-to-face work, Covid-19

1. Introduction

Within an organization, efficient knowledge management contributes towards securing a sustainable competitive advantage, which differentiates it from its competitors (Mahdi *et al*., 2019). One of the characteristics of efficient knowledge management is the knowledge sharing (Wang *et al*., 2014), as the creation and acquisition of knowledge are insufficient, it must be shared among individuals so that the organization obtains greater benefit. The shared knowledge can be either tacit, i.e. held in people's minds and therefore more difficult to share, or explicit, i.e. documented, and recorded in manuals, standards and procedures (Nonaka, 1994). The benefits of knowledge sharing (KS) are seen in the form of innovation and the development of new products, processes and services (Tseng, 2010), as well as business process efficiency (Ahmad and Karim, 2019).

Although KS is voluntary within organizations, the involvement of senior management usually means it is more likely to occur (Choudhary and Mishra, 2021). Despite the perceived benefits and the conscious attempts by employers to encourage KS, many employees are unwilling to share their knowledge and intentionally withhold knowledge (Connelly *et al*., 2019). Knowledge hiding (KHi) is defined as "an attempt by an individual to withhold or conceal knowledge that has been requested by another person" (Connelly *et al*., 2012, p. 65).

Several negative effects can arise from this behavior, such as diminished creativity due to limited interaction (Černe *et al*., 2014), a breakdown of trust among employees (Connelly *et al*., 2012). When knowledge, especially tacit knowledge, is not properly shared due to concealment behaviors, and employees leaving the organization for whatever reason and taking their knowledge with them (Serenko, 2016). In addition, hiding knowledge has

other harmful effects on the organization's environment, such as rework and mistrust, as other employees will need knowledge that some employees do not want to share.

Within an organization, KHi can be a problem in the various departments, and become more accentuated during remote work (Choudhary and Mishra, 2021). According to Choudhary and Mishra (2021), this may be because hiding is easier or there is more digital burnout during remote work.

It is understood that some company departments need greater interaction with other departments to carry out their activities. This is, for example, the case of communication, which also relates to the external environment. Given the above and the increasing importance of the area of communication in companies (Riel, 1995), this research presents the following research questions:
Q1. What is the importance and benefits of KS according to communication managers?
Q2. How does remote work positively or negatively influence KS according to communication managers?
Q3. What are the main motivations for KHi during remote work according to communication managers?

Hence, the general objective of this research is to analyze the influence of remote work on KS and on the motivations for hiding knowledge according to communication managers in companies. This study could contribute both to the theoretical field and to communication departments practice in companies. In the theoretical field, few studies into KS have considered anything other than the instrumental aspect of communication departments, focusing particularly on information and communication technologies (ICTs). In practice, the work of a communication department is based on the integration between its members, with the other areas of the company and with its various external audiences. Therefore, understanding the difficulties involved in KS and the reasons why KHi in the Communication department can be a differential for Communication managers concerned with obtaining the best performance from their teams in generating value for organizations.

2. Literature review

2.1 Knowledge sharing and knowledge hiding

KHi can be said to occur when a person who receives a request for knowledge they have, refuses to provide that knowledge to the person requesting it (Oliveira *et al*., 2020). This is one form of lack of KS, the other form being when the person does not have the knowledge and therefore cannot share what they do not know.

KHi is divided into three dimensions (Connelly *et al*., 2012): a) playing dumb - the person claims not to have the requested knowledge; evasive hiding – the person says they will provide it later, which will not happen or provides only a part of what was requested; and, rationalized hiding – in this case, a justification is offered for not providing the knowledge, that is, the person falsely states they are prevented from providing the knowledge by a third party.

A number of authors have sought to understand the motivations for hiding knowledge. In their literature review, Jafari-Sadeghi *et al*. (2022) identified 51 factors determining the increased occurrence of KHi, such as: workplace ostracism; job insecurity; abusive supervision; perceived time pressure; distrust; competitive work environment; lack of reciprocation; personality traits; etc. These motivations were identified in different contexts, for example, service companies, and universities, among others. However, the only study looking at the context of remote work, from Choudhary and Mishra (2021), identified the following motivations for KHi in a remote work environment by consultants: competition, conflict, poor personal relations, insecurity, organizational politics, distrust, ease of hiding, lack of informal communication, digital burnout, and loss of control. Distrust being an example of a motivation identified in both remote and face-to-face work.

2.2 The remote work environment

The emergence of Covid-19 in December 2019 (WHO, 2020) accelerated the adoption of a work model that had already been evolving due to the development of technological innovations in information technology and telecommunications, remote work. According to Jämsen, Sivunen and Blomqvist (2022, p. 2), remote work "illustrates a form of work that employees perform outside the physical premises of the organization by utilizing communication technology.". One type of remote work is Work From Home (WFH), where the employee performs his work at home with the support of ICTs. The Covid-19 pandemic exposed most professionals to remote work (De *et al*., 2020).

Remote work, in its various nuances, allows for increased flexibility or mobility of workers (Yang *et al*., 2022). There are several advantages related to remote work, such as: cost reduction - savings in travel expenses and hiring employees at lower cost locations (Morrison-Smith and Ruiz, 2020); retaining talent - by offering employees more flexible working hours, which can increase motivation and productivity (Morrison-Smith and Ruiz, 2020). On the other hand, there are also disadvantages, such as: challenges in balancing work and personal life, as individuals may work longer hours or have difficulty separating personal and professional life during the day (Cho, 2020); asynchronous communication to the detriment of synchronous communication can hamper the transmission and processing of information among workers, decrease knowledge transfer and the quality of the work produced (Soda *et al*., 2021).

2.3 Corporate communication

With their increasing impact on business, particularly since the 1990s, communication departments within organizations have been gaining in importance, (Riel, 1995). In recent years, especially due to the spread of digitization processes in society, communication departments have seen a significant increase in the range of tasks and functions they undertake (Brockhaus and Zerfass, 2022). The communication departments are responsible for leading several important organizational processes such as image crisis management, internal communication and employee engagement, and Corporate Social Responsibility (CSR) reports, in addition to relationship initiatives with various audiences through the organizations' digital channels, among others. Communication professionals have come to play a strategic role in companies (Koehler and Ansgar, 2019).

In January 2022, a search using the expressions "Corporate Communication" and "Knowledge Hiding" conducted on the Web of Science and Scopus platforms found no articles. Saladrigas *et al.* (2016) propose a conceptual relationship between Communication and Knowledge Management. These authors suggest there is a convergence between the areas due to their social nature and the need for interaction between people, among other factors. Nevertheless, Saladrigas *et al.* (2016, p. 3) recognize that "the relationship between the disciplines of Institutional Communication Management and Knowledge Management are rarely mentioned and much less studied" (2016). Although Information and Communication Technology (ICT) is widely related with knowledge management or knowledge sharing, the area of Institutional Communication is not usually involved in the researches. Lemos and Barbosa (2021) emphasize that the integration between KM and communication is based on internal communication, which is a part of the organizations communicational process, but it does not encompass all fronts of Institutional Communication. Pizzaia *et al*. (2018, p. 62) discuss aspects of communication present in seven knowledge management models and conclude that "such models have paid little attention to communication, which is essential for the information gains fluency within the organization and generates useful knowledge".

3. Research Methods

3.1 Classification

This research is classified according to Saunders, Lewis and Thornhill (2019) as: a) interpretivist philosophy, as it focuses on perception, based on a small sample; b) inductive approach, collecting data to explore the phenomenon; c) qualitative method, because it aims to understand the phenomenon; d) exploratory strategy, considering there is still a need for a better understanding of the topic; and e) cross-sectional time horizon, since the data were collected at one point in time. These options are in agreement with Anand, Offergelt and Anand (2021), among others, who point out that more qualitative research is needed to understand KHi.

The unit of analysis and the respondents are one and the same, that is, communication managers in companies. This profile was defined considering the relevance of their communication departments for companies and the lack of research considering KHi. In addition, the option for the profile of communicators interviewed is in line with the latest survey "What to expect from Organizational Communication in Brazil", carried out by the Brazilian Association for Business Communication (Aberje), the main association of the Institutional Communication area in the country. According to the survey, middle managers in general (43%) is the predominant hierarchical level of the professional responsible for the participants' Communication area. Then we have the level of Management in 27% of the participants and Superintendence/Vice Presidency in 11%. During the Covid-19 pandemic, professionals began working remotely by government determination, which may have favored KHi.

3.2 Data collection

Data were collected during individual interviews held between November 2021 and January 2022. The semi-structured interview script was adapted from Choudhary and Mishra (2019), and consists of four parts: 1) characterization of the respondents; 2) importance and benefits of KS; 3) differences between remote and face-to-face work; 4) motivations for KHi. Choudhary and Mishra's (2019) interview script was translated into Portuguese and adapted. Subsequently, the script was reviewed by two specialists on the subject (content validation) and by a professional with the same profile as the interviewees (face validation). The suggested modifications were applied to the data collection final instrument.

Professionals were selected interview according to the following criteria: a) having worked remotely for at least 6 months during the Covid-19 pandemic; b) being a communication manager in a company operating in Brazil; c) having at least 5 years of experience in their field of work. These professionals were identified from a list of members of the Brazilian Association of Business Communication. The invitation was made via WhatsApp, where the research objective and the researcher responsible for the interviews were identified.

Saturation was applied to determine the number of interviews, as recommended by Saunders *et al*. (2019). According to Guest *et al*. (2006), in homogeneous groups saturation is usually reached with 12 interviews. Saturation in this research was obtained with the eighteenth interview, considering that no new ideas were identified in the two subsequent interviews. Table 1 presents the data related to the 20 interviewees and the interviews carried out.

Table 1: Data related to the interviewees and interview

Interviewee	Gender	Educational background	Time with the company	Time in the position	Length of Interview (min)	Number of pages transcribed
1	F	Journalism	3 years	1 year	41	9
2	F	Journalism	10 years	3 years	28	6
3	M	Journalism	2 years	2 years	28	6
4	F	Journalism	4 years	4 years	24	5
5	M	Journalism	1 year and 6 months	6 months	28	6
6	F	Journalism	4 years	2 years	17	4
7	F	Public Relations	2 years and 8 months	1 year and 6 months	14	3
8	F	Journalism	3 years	3 years	31	7
9	F	Journalism	13 years	8 years	21	4
10	F	Journalism	4 years	4 years	16	4
11	F	Public Relations	14 years	14 years	27	6
12	F	Journalism	2 years	2 years	18	4
13	M	Journalism	14 years	5 years	41	7
14	F	Public Relations	1 month	1 month	14	3
15	F	Public Relations	10 years	6 years	14	3
16	F	Journalism	10 years	6 years	21	4
17	F	Pedagogy/ Marketing/	3 years and 6 months	3 years	35	6

Interviewee	Gender	Educational background	Time with the company	Time in the position	Length of Interview (min)	Number of pages transcribed
		Communication				
18	F	Public Relations	9 years and 8 months	5 years	8	2
19	F	Public Relations	4 years and 4 months	2 years	17	4
20	F	Public Relations	10 years	2 years	15	3

Legend: F – female; M – male.

Prior to beginning the interviews, authorization was requested to record the interviews. The recorded interviews were transcribed to facilitate data analysis.

3.3 Data analysis

The data were analyzed after each interview, thus making it possible to identify when saturation occurred. The content analysis was applied as proposed by Bardin (2009). It involves systematic procedures for the content description, using qualitative or quantitative indicators (Bardin, 2009; Krippendorff, 1980). The open coding involved separating the data based on the interpretation of its content and was followed by axial coding in which the open codes were grouped into categories, allowing comparisons between the interviews. The codes emerged from the interviewees' speech.

One researcher carried out the interviews, and two researchers simultaneously analyzed the data obtained. Any differences found between the respective analyses were discussed by the researchers until they reached a consensus, thus, verifying reliability according to Krippendorff (1980).

4. Analysis and Discussion of the Results

4.1 The Importance and Benefits of KS

The importance of investigating KS is a point of unanimous agreement among the communication leaders interviewed. The terms mentioned by the interviewees to represent the importance of KS were: fundamental (9 interviewees), important (5 interviewees), essential (3 interviewees), vital (1 interviewee), gigantic (1 interviewee) and sharing requirement (1 interviewee). This is in line with Wang *et al*. (2014) who consider KS necessary in order for the company to obtain sustainable competitive advantage.

The benefits generated by KS in remote work mentioned by the interviewees were: increased agility; reduced interruptions; creation of documentation; ease of accessing people; improved employee engagement; increased collaborative work. These benefits are in line with Ahmad and Karim (2019), who point out that KS impacts business process efficiency. None of the interviewees highlighted the relationship between KS and innovation in the communication department, which may in part be due to the functions of the communication department. On the other hand, some interviewees talked about the difficulties encountered with KS during remote work. For Interviewee 3, the biggest obstacle to KS is insecurity: "it is not clear to people which information is shareable and which is not". In the relationship between KS and remote work, some interviewees gave examples of how the face-to-face mode can be important for better KS. Interviewee 14, for example, stated that "today I went to a face-to-face meeting because the business was confidential, I needed to be there, you understand, it couldn't be online".

4.2 Differences between remote and face-to-face work

Respondents indicated both positive (12 respondents) and negative (15 respondents) aspects to remote work. Regarding the main differences perceived by the interviewees, two negative aspects of remote work were the most cited: the lack of face-to-face contact and the fatigue produced by excessive exposure to the screen. The lack of face-to-face contact can be identified, for example, in the speech from Interviewee 17: "Whoever is in communication has some very antennas connected because that is how we learned to get information from people, so this loss was big, I think of about 80%". Interviewee 19 mentions that remote work "imposes several relationship challenges, I think that communication work is very relationship-based and this relationship is much

more difficult to establish online". The interviewee's perception is linked to Wolton's idea, emphasizing that "to communicate is less and less to do with transmitting, rarely to sharing, being more and more to do with negotiating and, finally, to living together" (Wolton, 2010, p. 62).

On the other hand, the two positive aspects most mentioned by the interviewees were: greater focus, generating more productivity, and increased quality of life, because of the extended length of time spent at home, giving the employee greater flexibility. Interviewee 18 exemplifies the improvement in people's quality of life: "working remotely meant I didn't have to make a poker face, if there was a moment when I was not (...) ok, I could arrange my schedule better". The idea of freedom to reschedule appointments may be associated with the hierarchical level and also the family situation of each individual, as studies have also pointed out the constant pressure on workers in remote work: "It can be expected that the dark side of virtual work and gig work, will raise questions of stress, presenteeism, work overload, surveillance, and monitoring. New and severe forms of digital surveillance will have to be understood and their implications gauged" (De *et al*., 2020, p. 4).

Table 2 presents the positive and negative aspects of remote work in relation to face-to-face work listed by the interviewees. It is important to highlight that some interviewees pointed out not one, but various differences, which is why the final number in the table does not match the number of interviews.

Table 2: Positive and negative aspects of remote work compared to face-to-face work

Aspect	Number of Interviewees
Negative for remote work:	
Harm arising from lack of face-to-face contact	8
Fatigue from excessive time online	6
Distractions in the home	2
Challenge of understanding and appropriating knowledge	1
Distance from the business	1
Positive for remote work:	
More focus generating greater productivity	5
More quality of life	4
Learning from the changes	3
Greater autonomy	2
More recorded knowledge	2
Less corridor gossip	1

The range of positive and negative aspects mentioned by the interviewees, as shown in Table 2, points to very individualized reasons for choosing the best working method. In addition, it also explains the maturity of this process in different organizations. Accordingly, Interviewee 13 points out: "When you adopt remote work in an emergency, as it was, it is not remote work, it is emergency work, within the emergency there is a lack of planning, after all no one in their right mind planned Covid-19 to be able to prepare for it." Similarly, interviewee 12 suggests: "we have to learn to work in this other way, right? For 18 years, things worked the other way, so it's still a learning experience, you know?". DE *et al*. (2020) raised 14 important aspects for research and practice on the impact of digitization during the Covid-19 pandemic. Five of the items relate directly or indirectly to remote work.

4.3 Motivations for KHi

Most of the interviewees (12) believe that KHi has increased or may have increased with remote work. "It is easier for those with bad intentions to find the subterfuge not to share online" argued Interviewee 1. For Interviewee 2, "if they do not want to share, it is easier for staff not to respond to emails or WhatsApp/text messages". Only one interviewee believed KHi may have decreased with remote work, whereas seven perceived no relationship between KHi and remote work. This is in line with the results obtained by Choudhary and Mishra (2021, p. 9), who explain the perceived increase in KHi by the fact the "knowledge hider does not see the knowledge seeker physically as face to face confrontation does not happen".

For Interviewee 19, "the communication area occupies a very strategic position, closely linked to decision-making […], so only very rarely when we seek information do people refuse to pass it on". This idea is compatible

with the position of Brockhaus and Zerfass (2022, p. 3), "communicative positioning supports the strategic positioning of businesses (corporate positioning), brands (brand positioning), people (CEO positioning) or ideas (issue positioning) in the public sphere".

Regarding the reasons for KHi, (shown in Table 3) seven respondents believe that, regardless of the work mode, the decision to hide knowledge is associated with power. In the words of Interviewee 3: "this knowledge can, for some reason, provide status power, even if unconsciously, it is the maintenance of privileges within the organizational structure". The definition of power, according to the interviewees, is linked with issues related to ego, vanity, nature, character, fear of losing a job. According to Rechberg (2020), companies where "knowledge is power" face difficulties with sharing knowledge.

Table 3: Motivations for KHi

Motivations for KHi	Number of interviewees
Lack of a sharing culture – knowledge as power, maintenance of privileges, etc.	7
Insecurity - absence of structured KS processes, what can and cannot be shared (protecting themselves)	5
Digital burnout - fatigue linked to remote work	5
Unable to identify the motives for KHi.	3

Five interviewees associate KHi with insecurity among staff, usually related to insecurity regarding whether they should or can share knowledge. Another five believe put the failure to share knowledge down to fatigue and forgetfulness related to the exhausting routine of remote work: "I will limit myself to saying that, and I have no availability, willingness, or desire to be online longer than half an hour, 40 minutes", argues Interviewee 15, as an explanation for not sharing knowledge. Three respondents, although believing KHi has increased with remote work, do not understand the reasons why that would be the case.

When questioned about whether they themselves had previously concealed knowledge, 7 respondents admitted having done so. The reasons given being: 1) insecurity – lack of a structured KS process, fear of losing recognition for their knowledge, protecting themselves (3 interviewees); 2) digital burnout – tiredness, lack of time, to avoid generating more work (3 interviewees); 3) distrust – not knowing people well, not knowing who to trust (1 interviewee). These findings considering communication managers in companies in Brazil were also identified by Choudhary and Mishra (2021) in relation to employees in consulting companies in India.

5. Conclusion, Limitations and Future Research

This study fully achieved its objectives. First, by identifying the importance of KS for the communication managers in companies in Brazil interviewed herein. For these managers, the benefits of KS are associated with increased process efficiency, considering access to knowledge through documentation or access to people, as well as greater agility. They perceived that remote work has both positive aspects, such as greater productivity and quality of life, and negative aspects, such as lack of face-to-face contact and fatigue due to excessive online exposure. However, it is worth remembering that for these interviewees remote work was a response to the Covid-19 pandemic, being characterized by one interviewee as an emergency measure. Most of the interviewees believe that remote work has increased KHi, the reasons being: the absence of face-to-face encounters, lack of a sharing culture, digital burnout, insecurity or distrust.

This study contributes to academic knowledge in three main ways. First, by exploring KHi in a poorly researched context, i.e., communication managers and remote work. Second, the study findings extend the knowledge on remote work and its relationship with KHi, showing its influence on both KS and KHi. Finally, this study analyzes the motivations for KHi in a remote work context. Figure 1 presents a summary of the contributions.

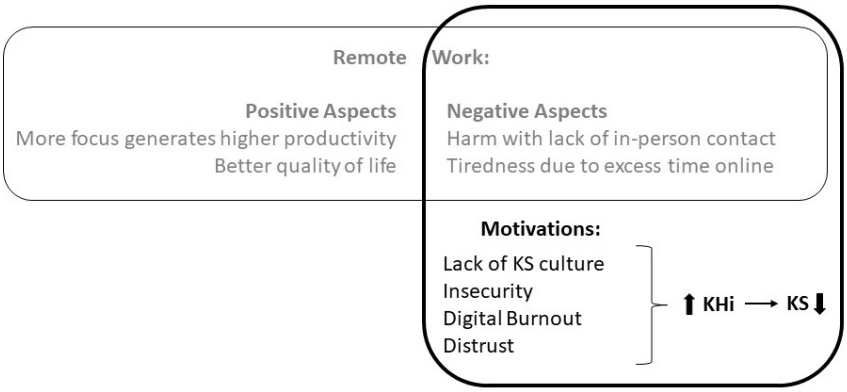


Figure 1: Summary of the academic contributions

The awareness that KHi has increased with the adoption of remote work can help communication managers prioritize ways to mitigate KHi, one of them being the adoption of hybrid work, whereby employees work in the company's office some days and outside the office others. Hybrid work could reduce the opportunities for KHI that arise with remote work while providing greater face-to-face contact. Digital burnout could also decrease with hybrid work, while still maintaining the flexible schedules and increased productivity cited by respondents as positives.

The lack of KS culture, insecurity and lack of trust are motivations to which managers should also pay particular attention. The lack of a culture of KS could be addressed by managers through the adoption of mechanisms such as knowledge repositories, knowledge networks and work groups where the importance of KS and the benefits that its adoption brings to them became clear to employees and for the organization. The insecurity and lack of trust of employees could be addressed by managers through the establishment of clear rules of what can and cannot be shared. In this way, the risk for employees is considerably reduced, as sometimes KHi behavior occurs due to a lack of knowledge of what can and cannot be shared, what risks are involved and what behaviors are expected by the organization. Butt *et al.* (2021) found that personal relationships can increase trust and consequently diminish KHi. The authors suggest informal get-together between employees within organizations to increase personal relationships, which is more complicated but not impossible during remote work. Butt and Ahmad (2021) indicate the interdependency to create a sense of reciprocity, which can mitigate KHi. This could be used more easily than incentivizing personal relationship during remote work.

This study has two limitations. First, the interviews were conducted solely with communication managers, hence the perceptions of other employees in the and outside the department were not considered. Extending this study to include other staff in the communication department, as well as other departments would provide greater insights into company culture. In addition to expanding the scope of the research, it would be important because it will allow to identify different motivations that could lead to KHi behavior. The second limitation concerns the interview as the sole means of collecting data. Future research would benefit by employing other forms of data collection to complement our understanding of the motivations for hiding knowledge. A quantitative survey could increase the number of responding companies and employees, in addition to opening possibilities for other research questions related to the topic.

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Knowledge Management for Smart Tourism: an exploratory survey in Abruzzo region

Simone Cifolelli, Andrea Ziruolo and Marco Berardi
Department of Management and Business Administration, "G. d'Annunzio" University, Pescara, Italy
simone.cifolelli@unich.it
andrea.ziruolo@unich.it
marco.berardi@unich.it

Abstract: Research on Knowledge Management has seen a growing interest in Smart Tourism in recent years due to the need of effectively managing knowledge for sustainable and digital tourism competitiveness. In this sense, literature simultaneously suggests open data as the *black gold* of the new millennium, and the *missed link* for the smartness of tourism destinations. Nonetheless, in contrast to the global trend of leading countries to Tourism 4.0, Italy has been experiencing a weak tourist dynamism, witnessed by the eighth place in the report on the "Travel & Tourism Competitiveness Index" (WEF, 2020) achieved in the face of a predominant share of the worldwide cultural heritage located in its territory. Therefore, based on these premises we intend to provide an academic contribution to fill the literature gap on Knowledge Management in the context of Smart Tourism, highlighting how much the sharing information systems among stakeholders can promote the emergence of a virtuous collaborative *intertwining* between public and private tourist actors. The present case study concerns the planning and implementation of a tourist digital platform by the Abruzzo Region (Italy), according to the principles of Smart Governance, as one of the first practical reactions to the Italian lack of a widespread digital transition. Thus, this work aims to exploit the information previously collected through surveys administered by the managers of the Abruzzo Offices for "Information and Tourist Reception". This is regarding Knowledge Management structural limits and added value, in order to analyze Smart Tourism benefits and to provide future research agenda about regional tourism competitiveness.

Keywords: Knowledge Management, Open Data, Smart Governance, Smart Tourism, Tourism Competitiveness

1. Introduction

Knowledge has become one of the most relevant intangible assets for organisations to achieve long-term advantage in the current turbulent competitive environment (Nevis et al., 1995; Hicks et al., 2007). Knowledge Management (KM from now on) is mostly meant by literature as an important competitive lever with a view to a *smart* tourism transition (Dameri & Rosenthal, 2014; Del Chiappa & Baggio, 2015). In this context, in the recent decades *data* has been more and more widely considered the "black gold" of the new millennium. Managing with this wealth of knowledge generally entails to deal with *open data*, tackling the openness of governments and public administrations (Coglianese, 2009).

Therefore, the purpose of the present work is to analyze the evolution towards *open governance* in its operational declination in the Italian tourism sector. Indeed, Italy has been experiencing a weak tourist dynamism, witnessed by the eighth place in the report on the "Travel & Tourism Competitiveness Index" (Calderwood & Soshkin, 2019) achieved in the face of a predominant share of the worldwide cultural heritage located in its territory. In this context, the choice for focusing on the Abruzzo region experience depends mainly onto two reasons: firstly, in 2017 it was one of the very practical reactions to the Italian lack of a widespread digital transition (Vial, 2019). Secondly, the ITR offices represent a concrete response to the need for a dialogic approach in the context of the improvement of integrated, multi-professional and tourism-centered services, as previously explored following the present theoretical framework (Doolin et al., 2002; Tovar & Lockwood, 2008; Dimitrovski et al., 2012).

In particular, the ITRs are offices for "Information and Tourist Reception". The present case study evaluates the impact of the Destination Management System (DMS) introduction and dissemination in all 33 tourist operational units of the main Abruzzo localities.

This involves both the managers and the top coordination figures in the local reference bodies, comparing then the results with the tourism directors' opinions at the provincial and regional level.

DMS is the digital platform designed to allow 33 important tourist resorts in Abruzzo to interact among them, integrating information between the coastal and the internal areas (Presenza, 2008). In fact, this work aims to be the first attempt in mapping the level of knowledge transfer and tourism competitiveness on a regional scale (Pesce et al., 2019; Shafiee et al., 2019). Thus, the research questions at the basis of the present investigation are the following:

1. How is considered the Knowledge Management literature within Tourism Management context?
2. What is the impact that DMS introduction and dissemination had had on the Abruzzo tourism competitiveness?

The relative answers, reported in Section 4 of the present work, could inform academics and practitioners about the state of the art of this *open* KM case study, which are also discussed in Section 5, in order to trace the trajectories and to 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

Firstly, an important premise must be explained about a recurring feature alongside the word 'tourism' throughout the whole project: the concept of *smartness*. The reference point in the literature on *smart cities* (Al Nuaimi et al., 2015; Kousis & Tjortjis, 2021) is represented by the "terminology analysis" reported by Dameri & Rosenthal (2014).

The meaning clarification of the lexical item serves to avoid misunderstanding, since the concept of *smart city* is often confused with the one of *digital city*. The first refers to a well-defined geographical area, where high technologies -such as ICT- cooperate to create benefits for citizenships, in terms of well-being, inclusion, participation and environmental quality. The government is driven by a group of subjects, who state rules and policy for the development of the city (Caragliu et al., 2011; Dameri, 2013). The latter, instead, is defined as an open, complex, and adaptive system based on computer network and urban information resources, which forms a virtual digital space for a city (Shao-fu et al., 2001; Yovanof et al., 2009). Therefore, according to the digital perspective, the role of people or citizens is less proactive, and the idea of improving the citizenship quality of life is not explicitly set. Otherwise, the *smartness* emerges when the ICT plays a pivotal role, but it is still closely related with other aspects, such as cooperation, inclusion, and participation (Dameri & Rosenthal, 2014). The *smartness* of the Abruzzo Region DMS, subject of the case study, lies in these aspects, and it depends on how much the sharing of information systems among the various stakeholders can promote the emergence of a virtuous collaborative intertwining between public and private tourist actors (Boes et al., 2016).

Moreover, from a theoretical point of view, this work focuses on the insights deriving from Knowledge Management (KM) research line applied to Tourism Management (TM), in order to evolve it towards the so-called "Smart Tourism" (Buhalis & Amaranggana, 2013; Li et al., 2017). Hence, literature is based on a fundamental assumption, according to which the smart tourism destination should be specially designed and managed to encourage the *growth of knowledge* (Edvinsson, 2006; Roche & Rajabifard, 2012). However, in the literature, the concept of tourism destination has evolved only in recent time towards a *smart* perspective, as shown in the Table 1 here below (Shafiee et al., 2019; Habeeb & Weli, 2020), concerning the efficient knowledge sharing and the reduction of information asymmetries between the various stakeholders (Gretzel et al., 2015).

Table 1: Evolution of tourism destination definition (Adaptation from Jovicic, 2019)

Traditional Tourism Destination Concept	**Systemic Approach to Tourism Destination**	**Smart Tourism Destination**
It includes the gathering of places and services of interest, the lack of cooperation in destination and the role of tourists in destination.	It involves the interaction among tourists, service providers and local people in destination; continuous contact with the macro-environment and links between stakeholders are first mentioned within this approach.	Combining digital and real fields, public private consumer cooperation, government involvement, efficient knowledge sharing, value creation and personalized services are among the characteristics of smart destinations

Thus, the case study focuses on the DMS introduction and dissemination in the Abruzzo Region to analyze the *growth of knowledge* in terms of interconnectivity and portability, which are two general drivers of value creation through open data. They are respectively defined as the capacity to connect data, leading to new insights formed, and to transfer digitized data from one operational context to another (Malgonde &

Bhattacherjee, 2014; Günther et al., 2017; Pesce et al., 2019). The DMS, in fact, is the digital platform that, through a central Data Base, integrates booking, Customer Relationship Management and Content Management systems, allowing 33 important Abruzzo tourist resorts. This is aimed at incorporating information between the coast and the internal areas (Presenza, 2008). The literature has extensively debated the topic, and the milestones of this contribution are grouped by research items, as shown in the following Table 2.

Table 2: Research items theoretical references

Research Items	References
1. Digitization, connectivity, and human capital	(Heeks, 2002), (Carter & Belanger, 2005), (Caio, 2014), (Vial, 2019), (Lombardi et al., 2020), (Faraj et al., 2021).
2. Transfer, sharing, and management of knowledge	(Kanter, 1999), (Reinhardt et al., 2001), (O'Leary, 2001), (Quintas, 2005) (Malgonde & Bhattacherjee, 2014), (Del Chiappa & Baggio, 2015), (Günther et al., 2017), (Liu et al., 2017) (Pesce et al., 2019).
3. Competitiveness of the tourist destination	(Dameri, & Rosenthal,2014), (Gretzel et al., 2015), (Boes et al., 2016), (Tomor et al., 2019), (Shafiee et al., 2019), (Fernández et al., 2020), (Hamid et al., 2021).

In addition, it must be highlighted the link that merges KM and TM (Otowicz et al., 2022), and which constitutes the real added value in the mission to increase the tourist competitiveness. Literature has given to the concept of KM several definitions, which fit well in tourism organizations. For example, the *Outcome Perspective* (Kanter, 1999) analyzes how KM is used within an organization to gain competitive advantage and enhance innovation and success; while the *Intellectual Capital Perspective* (Reinhardt et al, 2001) describes KM as the systematic attempt to employ knowledge within an organization to transform its ability to improve performance. However, the definitions of KM that describe at the role of the DMS in a smart and competitive TM at its best, are provided by the *Information Technology Perspective* (O'Leary, 2001). It considers KM as the capture, access, and reuse of knowledge, using information technology to improve human performances; indeed, according to Liu et al. (2017), the KM is meant as the process capable of both managing tangible content, and getting information from the raw data available on organization.

DMS competitive advantage must be considered in a holistic sense, and not as a mere sum of the previous elements. Thus, interconnectivity and portability of the information exchanged between the Abruzzo ITR offices and the various stakeholders in that area can generate the enhancement of the tourism sector players performance and the significant improvement of the Abruzzo tourist competitiveness on a national and international scale (Tomor et al., 2019; Hamid et al., 2021).

3. Methods

Between October 2021 and February 2022, the research questionnaires were sent via email to all subjects involved in the process of managing the DMS platform designed by the Abruzzo Region, i.e. the managers of the ITR offices and the public top figures responsible for managing the tourism function of the following Abruzzo tourist resorts: Alba Adriatica (TE), Capestrano (AQ), Caramanico Terme (AQ), Chieti, Fossacesia (CH), Francavilla Al Mare (CH), Giulianova (TE), Lanciano (CH), L'Aquila, Loreto Aprutino (PE), Martinsicuro (TE), Massa D'albe (AQ), Montesilvano (PE), Navelli (AQ), Ortona (CH), Ovindoli (AQ)), Pescara, Pescasseroli (AQ), Pescocostanzo (AQ), Pineto (TE), Rivisondoli (AQ), Roccamorice (PE), Roccaraso (AQ), Roseto degli Abruzzi (TE), San Salvo (CH), Scanno (AQ), Silvi Marina (TE), Sulmona (AQ), Tagliacozzo (AQ), Teramo, Tortoreto (TE), Vasto (CH), Villetta Barrea (AQ). In summary, the locations involved were thirty-three, for sixty-six questionnaires sent and fourty responses received. However, considering that 13 ITR offices have only seasonal opening, the response rate to the questionnaire is satisfactory, and exceeds 75% (40/53) of the subjects currently active in the area.

The methodology of the present study follows the approach used by Saris & Gallhofer (2014), focusing on the preliminary reflections required to design a survey regarding:

1. Choice of a Topic
2. Choice of the Most Important Variables
3. Choice of Data Collection Method
4. Choice of Operationalization
5. Test of the Quality of the Questionnaire
6. Formulation of the Final Questionnaire
7. Choice of Population and Sample Design.

Firstly, the *Choice of the Topic* immediately determines a very specific direction to follow. This direction led us to provide surveys for explanatory and non-experimental purposes, in order to determine the degree of adequacy, usefulness, and satisfaction perceived by the "Information and Tourist Reception" (ITR) managers of the main Abruzzo tourist resorts, and by the tourist decision-makers in the territorial administrations connected to them. In this regard, this case study aims to exploit the information previously collected through the surveys, to analyze Smart Tourism benefits and to provide future research agenda about regional tourism competitiveness. This objective was operationally achieved by investigating the Abruzzo tourism offer, from a Knowledge Management viewpoint according to the three main research items:

1. Digitization, connectivity, and human capital
2. Transfer, sharing, and management of knowledge
3. Competitiveness of the tourist destination.

Secondly, these aforementioned items (Table 2) constitute the *Most Important Variables* of the present research, and their identification was crucial to develop a preliminary model that indicates the relationships among the variables of interest. Thus, the relationships among the possible causes of the delay in the dissemination of better practices in the field of Smart Tourism had been firstly investigated along the digital and connectivity limits of the Abruzzo ITR offices, to verify the progress of the "Digital Transformation" (Vial, 2019) within the tourist information structures. Then, we have moved on, to attest the state of the art of knowledge transfer, sharing, and management process (Del Chiappa & Baggio, 2015) evaluating the perception of the synergistic effects which derives from the introduction of a DMS tool, given the competitiveness enhancement of the tourist destination (Fernández et al., 2020).

Thirdly, the *Choice of Data Collection Method* involve considerations related to costs, question formulation, and quality of data (Dillman, 2000). To complete effectively and efficiently the survey, we had decided to proceed towards web Surveys, which would have allowed the interviewees to respond quickly and easily by their smartphone or laptop to the nine set questions, in an estimated response time of two minutes. Then, the *Choice of Operationalization* concerns several decisions related to the subject and dimension for the evaluation of the research lines, the questions formulation, and the response categories. The *Formulation of the Final Questionnaire* phase is intended to ensure the interviewees' understanding of questions, providing details to clarify any potential doubts.

This whole process led to the creation of the final survey structure, set with nine closed- ended questions, measured using a Likert scale from 1 to 6. The reason was to identify a set of variables, assessing the impact of the introduction and dissemination of the DMS on the Abruzzo tourist offer and responding to the three research strands, set according to the Likert Scale (Joshi et al., 2015), as described below in the Table 3. The answers are, then, analyzed in Section 4 and compared for a broader understanding of the state of the DMS platform in Abruzzo. The opinions are collected in the 45 minutes semi-structured interviews, carried out in February 2022 by phone with the four main tourism coordination figures at the regional and provincial level.

Table 3: The Final Questionnaire

Question	Response Category	Strand of Research
1. How adequate do you think are the knowledge and digital skills of the employees of the ITR Office?	Likert Scale (Adequacy from 1 to 6).	Digitization, connectivity, and human capital.
2. How adequate do you think is the overall level of connectivity and digitization of the ITR Office?	Likert Scale (Adequacy from 1 to 6).	Digitization, connectivity, and human capital.
3. Given the amount of work required using the Destination MS, how much do you consider adequate from a quantitative point of view the human capital available to the ITR Office?	Likert Scale (Adequacy from 1 to 6).	Digitization, connectivity, and human capital.
4. How useful do you think the introduction and dissemination of the DMS have been to ensure a smarter more accessible sharing of information between the ITR Office and the tourist?	Likert Scale (Usefulness from 1 to 6).	Transfer, sharing and management of knowledge.

Question	Response Category	Strand of Research
5. How useful do you think the introduction and dissemination of the DMS have been to allow the individual ITR Office to create and offer tourist experiences with high added value?	Likert Scale (Usefulness from 1 to 6).	Competitiveness of the tourist destination.
6. How useful do you think the introduction and dissemination of the DMS have been for the development of an integrated local tourism offer with respect to the needs of private operators in the sector?	Likert Scale (Usefulness from 1 to 6).	Competitiveness of the tourist destination.
7. How satisfactory do you consider the transfer and sharing of information following the introduction and dissemination of the DMS?	Likert Scale (Satisfaction from 1 to 6).	Transfer, sharing and management of knowledge.
8. How satisfactory do you consider the management of the information assets of the ITR Office following the introduction and dissemination of the DMS?	Likert Scale (Satisfaction from 1 to 6).	Transfer, sharing and management of knowledge
9. How satisfactory do you consider the competitive advancement of the local tourist offer following the introduction and dissemination of the DMS?	Likert Scale (Satisfaction from 1 to 6).	Competitiveness of the tourist destination

Moreover, the *Test of the Quality of the Questionnaire* is a relevant moment in checking validity and control of the routing in the questionnaire, and it was estimated before and during the administration of the survey itself, to avoid any wrong direction or missed response. Finally, as regards the last step of the survey design, the *Choice of Population and Sample Design*, we had decided to investigate the effects of the introduction and diffusion of the DMS in the Abruzzo ITR subgroup, as one of the first practical reactions to the Italian lack of a widespread digital transition in the tourism field. The perceptions of this subgroup regarding the subject of the analysis were then investigated without further sampling: the questionnaire was sent via email to all thirty-three ITR managers of the main Abruzzo localities and to the public decision-makers to whom these structures refer.

4. Results

Firstly, the basic definition of KM within TM that emerges from this paper can be sum up as the capture, access, and reuse of knowledge using information technology to improve human performances (O'Leary, 2001), or as the process capable of both managing tangible content and getting information from raw data available in organization (Liu et al., 2017). Therefore, starting from this definition, are described the main characteristics of KM analyzed in this work in the tourism field, and within the DMS tool. We refer to the ability to improve human performances within an organization by *smartly* managing all the aspects related to the transfer and sharing of knowledge (Dameri & Rosenthal, 2014; Del Chiappa & Baggio, 2015). The concept of the sharing of knowledge is a key to the effectiveness of many tourism organisations (Hjalager, 2002), and in this sense DMS portability and interconnectivity potential constitute a high informative power, capable of generating the performance enhancement of the tourism sector players and the improvement of the Abruzzo tourist competitiveness (Tomor et al., 2019; Hamid et al., 2021).

Secondly, through the questionnaires, we tried to estimate the impact that the introduction and dissemination of the DMS has had on the Abruzzo tourism competitiveness. The statistical analysis is shown in the following Table 4.

Table 4: Surveys Statistical Analysis

Question	Strand of Research	Respondents	Invalid answers	Mean	Mode	Median	Standard deviation	Standard error
1	1	40	0	4,3/6	5	5	1,418	0,448
2	1	40	0	2,8/6	2	2,5	1,619	0,512
3	1	40	0	3,4/6	2	3	1,430	0,452
4	2	40	0	3,7/6	4	4	1,567	0,496
5	3	40	0	3,8/6	5	4,5	1,687	0,533
6	3	40	0	3,7/6	5	4	1,636	0,517
7	2	40	0	3,7/6	4	4	1,337	0,423
8	2	40	0	3,9/6	4	4	1,370	0,433
9	3	40	0	2,9/6	3	3	1,101	0,348

From this Table, it is immediately clear that the standard deviation (how the values differ from the average value) and the standard error (the reliability of the proportion, how much the calculated proportion approaches the true proportion of the population) are high enough for almost all questions. It is due to a strong asymmetry of data, and it indicates that the statistical units have very different values. In these cases, is recommended the use of the median as the statistical mean of reference (Leys et al., 2013; Wan et al., 2014).

In this sense, we proceed to comment on the results of the survey, following the order of the three research items, identified in the design phase. For the first strand of research (digitization, connectivity, and human capital) we have asymmetrical results. This shows the fact that the participants consider on the one hand "adequate" the knowledge and digital skills of the employees of the ITR Office, and on the other hand "inadequate" or “neither adequate nor inadequate” the human capital and the overall level of connectivity and digitization of the ITR Office (Heeks, 2002; Carter & Belanger, 2005; Vial, 2019).

However, for the second research line (transfer, sharing, and management of knowledge), we find a recurring median equal to 4/6, which means that the introduction and dissemination of the DMS were positively evaluated as "quite useful" for ensuring a more accessible and smart sharing of information between the ITR offices and the tourists. Furthermore, even the management, transfer, and the sharing of information of the ITR Office were ex-post evaluated as "quite satisfactory" (Malgonde & Bhattacherjee, 2014; Del Chiappa & Baggio, 2015).

Finally, for the third one (competitiveness of the tourist destination) we also have asymmetrical median value among the three different questions. Specifically, the introduction and dissemination of the DMS were rated "quite useful" and "very useful" to create a local tourism offer with high added value, and consistent with the needs of private operators in the sector. However, the state of the competitive advancement of the local tourist offer is still considered by the main players in the sector to be “neither satisfactory nor unsatisfactory” (Gretzel et al., 2015; Boes et al., 2016).

These results are partly confirmed by the opinions gathered through the semi-structured interviews that concerned the four main tourism coordination figures at the regional and provincial levels. At the provincial tourism management level, the introduction and dissemination of the DMS were evaluated more than positively. These experts believe "the switch in mind that occurred thanks to the DMS on the operation of the ITR offices is very useful and satisfactory, despite the missing of a widespread level of digitalization and the interconnectivity and portability level that should be further enhanced".

Still, this satisfaction analysis of the DMS in Abruzzo does not only report favorable judgments. At the regional level, the coordinators specify how one of the recurring problems of the ITRs is their seasonality, and the changes that are made year by year at the level of employees hired. This continuous turnover and the need to start from scratch every year with DMS training "considerably slow down the full implementation of the Abruzzo DMS and the creation of an integrated, continuous and competitive tourist offer". For this reason, the results of this analysis on the introduction and dissemination of the DMS in Abruzzo only partially reflect the parameters identified by the theoretical reference framework and highlight that the Abruzzo region cannot yet be considered a *smart tourism destination* (Shafiee et al., 2019; Habeeb & Weli, 2020). This is due to a level of digitalization, interconnectivity, and continuity of the human capital employed in the tourism sector not yet sufficient to guarantee the growth of knowledge (Edvinsson, 2006; Roche & Rajabifard, 2012), the enhancement of human performances by using information technology (O'Leary, 2001), and the progress of tourism competitiveness (Fernández et al., 2020).

5. Discussion and conclusions

The scientific debate on Knowledge Management and smart tourism destinations has been growing over the last decades. Although this contribution is based on a fundamental assumption that the smart tourism destination should be specially designed and managed to encourage the growth of knowledge (Edvinsson, 2006; Roche & Rajabifard, 2012), the investigation defines how smart tourism destination works are still in progress. This is particularly clear when the process of knowledge transfer is analyzed and described in the state of the art of KM literature, within the TM in response to the project's RQ1 (Shaw & Williams, 2009).

The need for growth of knowledge highlighted by the theoretical framework was also confirmed within this case study. Moreover, in the semi-structured interviews released in the past months, the regional managers specified

that the main obstacle for the tourism competitiveness enhancement lies precisely in the difficulties of knowledge transfer at the level of ITR offices, related to the continuous turnover from part of the employees. Thus, unlike the hypothesis in the preliminary stages of the research project, from the empirical analysis emerges that the delay in terms of smart tourism and competitiveness by the Abruzzo Region largely depends on an inefficient transfer of knowledge by human capital at the ITR level (Del Chiappa & Baggio, 2015; Günther et al., 2017).

Furthermore, the following Figure 1 shows the trend of tourist presences 2010-2021 in the Abruzzo Region compared with the Italian average.

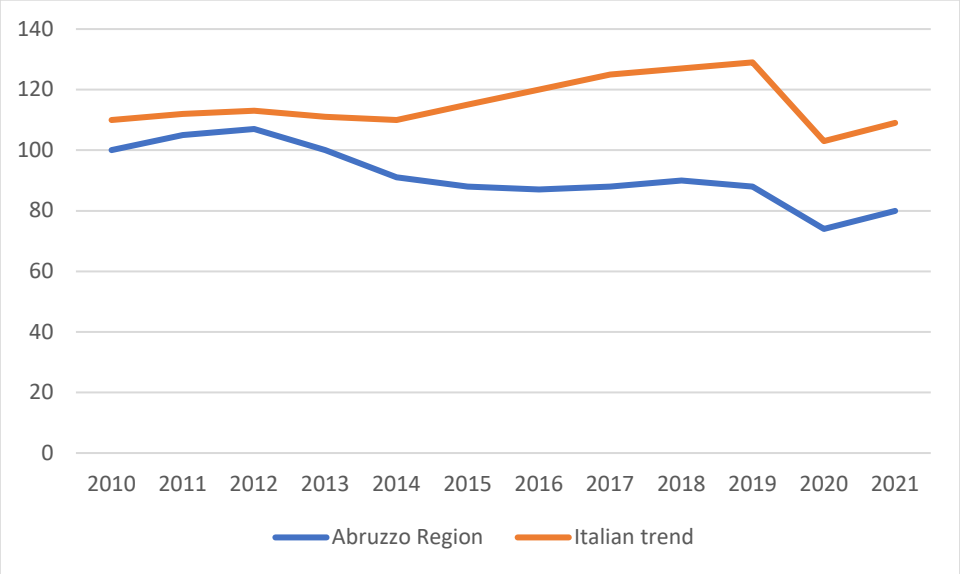


Figure 1: Tourist presences in the Italian districts and in Abruzzo- adaptation from ISTAT data (2021)

As it can be seen from the graph, the access to national and regional tourist facilities saw a marked decline between 2013 and 2014. The spread of the DMS is chronologically linked to the phase of recession in the tourism sector, and to the need for redrawing its boundaries. In Abruzzo, the DMS platform introduced in 2017 had not been able to limit the collapse in tourist numbers due to the pandemics. Then, so far, the regional tourism executives detect a modest level of satisfaction regarding this kind of innovation in regional tourism competitiveness. Satisfaction is flanked by the belief that there is a need for continuous training of tourist players, in order to make Abruzzo a smart tourism destination, demonstrated by the frequent DMS-themed training activities organized for ITR employees in recent months.

In conclusion, to provide an answer to RQ2, we noted that the impact produced by the introduction and dissemination of the DMS on the Abruzzo tourism competitiveness was modest, certainly not enough for a *smart tourism* transition (Shafiee et al., 2019; Habeeb & Weli, 2020). The current process of the sharing information among tourism actors is not encouraging the *growth of knowledge* (Edvinsson, 2006; Roche & Rajabifard, 2012). Even the interviewees, in spite of an average high level of satisfaction, admit that the continuous turnover at the level of ITR offices undermines the full use of the DMS, and the consequent growth of the Abruzzo tourist offer.

In this sense, the challenges faced by the Abruzzo tourism managers are in line with those identified by Gretzel et al. (2015), who outlined a research agenda for smart tourism regarding innovation capacity, human resources implications, coordination mechanisms, infrastructure requirements, and information governance. Furthermore, the latter topic described in the present work shows a clear need to improve the transfer and the sharing of information among the players in the Abruzzo tourism sector, to boost the transition from mere *open governance* (Coglianese, 2009) to *smart governance* (Gretzel, 2018) and to enhance the tourism competitiveness (Fernández et al., 2020).

Lastly, this study goes through some further limitations and strengths. Firstly, according to Gretzel et al. (2015), research in the smart tourism area is usually limited to case studies of existing projects and focused on the

consumer perspective with a very optimistic and uncritical approach. Even though this work is based on a project launched in 2017, it uses a critical approach for the analysis conducted from the point of view of decision-makers at the various hierarchical levels of the Abruzzo tourism sector. Secondly, part of the literature considers the research on the regional case study to be of little interest, but here, a first complete mapping of the progress of the Abruzzo DMS has been outlined as one of the first practical reactions on a regional scale to the Italian lack of a widespread digital transition (Vial, 2019).

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Tacit Knowledge Transfer in Family Firms During Generational Succession

Concetta Lucia Cristofaro[1], Sabrina Bonomi[1], Rocco Reina[2] and Marzia Ventura[2]
[1]University Ecampus, Novedrate, Italy
[2]University Magna Graecia, Catanzaro, Italy

Abstract:

Keywords:

1. Introduction

2. Theoretical Framework

2.1 The role of Knowledge in the process of generational succession

2.2 Tacit Knowledge in the generational succession

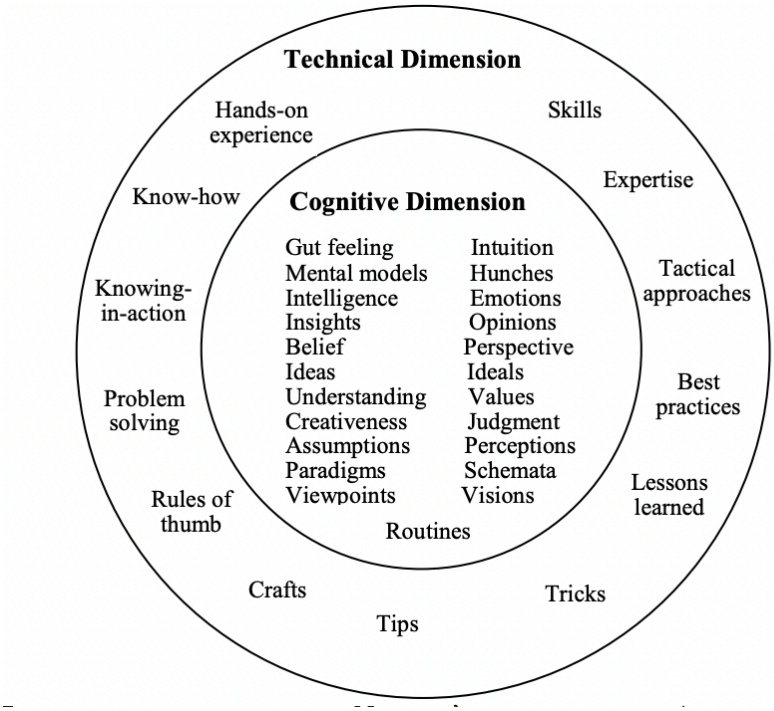


Figure 1

Source

3. Case study

3.1 Methodology

3.2 Cases description

4. Analysis and results

1
2
3
4
5

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

5. Limits

2

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 Firms in different Italian regions.

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[2] [redacted]

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Osalubi@uwc.ac.za

[redacted] Knowledge Management has developed over the years into a mainstream organisational necessity to achieve success and organisational effectiveness. Religious organisations are one of the most producers of knowledge. In many parts of Africa, several Pentecostal churches are established regularly, especially in crowded informal settlements. The knowledge conversion model was utilised to assess the knowledge management practices at a Pentecostal church in an informal settlement in Cape Town, South Africa. The objectives of the study were to examine the awareness and uptake of KM in the religious organisations, determine the level of openness of the members and leaders to knowledge sharing and conversion as well as assess how religious organisations leverage knowledge conversion and KM practices in achieving their goals in spreading the gospel and to enhance their community services. The church leadership and adult members of the church constituted the study population. The findings of this study revealed that the level of awareness and uptake of KM was very low because there was no documented training as well as responsible individuals responsible for the management of knowledge. Tacit knowledge is being shared informally through dialogue communication and religious meetings. However, this knowledge is not formally extracted, documented, or converted into explicit knowledge for organisational productivity, further sharing and future reuse. Although some of the leaders were not keen on knowing explicitly managed and shared in the organisation, religious members thought it is very important for knowledge to be documented and shared. Furthermore, as knowledge sharing is not prioritised within the organisation, the goal of spreading the gospel and to enhance their community services was found to be sluggish. The study developed a conceptual model for implementing knowledge management in Pentecostal religious organisations.

[redacted] : Knowledge Management, Knowledge conversion, Knowledge sharing, Religious organisations, Pentecostal Church,

1 [redacted]

Knowledge management (KM) has been studied for many years in various types of organisations, however, literature on KM in religious organisations is scanty, especially in South Africa. The focus of this study is the assessment of KM in religious organisations. More specifically, this study will examine knowledge management and sharing practices within a Pentecostal church. According to Fairchild (2019), currently, Pentecostals are a global cogency and have distinctively eight of the world's largest congregations because they are the fastest-growing religious movement, yet despite this development, very few studies have been conducted on KM in religious organisations (Freeburg 2018). Religion is a very important aspect of African societies and therefore religious organisations need to be managed effectively. Religion matters not only to believers and practitioners of faith but also to an entire nation because in many African societies, religion defines nations, shapes worldview, and influences daily behaviour and life projects among millions of communities (Torry 2014).

Lin (2015) states that organisations are facing extreme pressure due to intense competition, globalisation, and innovation, but when KM is applied it contributes to the success of businesses and is very prominent for the long-term survival of companies. KM also enables the creation and development of a sustainable competitive edge. Hence, the uptake of KM practices has spread among businesses, governments, academic institutions, and Non-Governmental Organisations (Mphahlele (2010). KM is viewed as a systematic tool for managing an organisation's knowledge assets for value creation and the provision of support for decision-making and innovation within organisations. KM is all about managing the knowledge needed for an organisation to succeed by systematically capturing, describing, organising, and sharing knowledge (Girard & Girard 2015).

KM researchers emphasise the vitality of developing new knowledge for organisations to deliver improved products and services and achieve goals. Armaghan and Renaud (2017) did a study at an Iranian research organisation. They found that although KM in the organisation is running properly, there are five factors identified that affect knowledge sharing. These factors include trust, commitment, job satisfaction, learning and

organisational communication. They also found that during the implementation of KM there was a lot of resistance and that no adequate preparation was done in terms of knowledge sharing and KM. Heggli (2011) did a study to investigate to what extent a non-profit organisation such as the World Bank applies tools to manage their knowledge effectively. KM was also studied in the public sector of government in South Africa to facilitate service delivery, especially to facilitate the Batho Pele principles (Mphahlele, 2010).

However, very little literature on KM studies in religious organisations is available. Freeburg (2015) stated that the acceptance of KM concepts is met with resistance due to the cultural environment that churches create. There are studies conducted that speak about the church and the need to change with the demanding developments within society. Oosthuizen and Lategan (2016) stated that the church as a faith-based organisation needs to change and adapt to the global economic, political, and social environment. Additionally, these authors stated that for the church to adapt faster, it needs to change to a more open, and systematic approach to managing it effectively. One of these ways would be to study how KM can be employed within churches as a systematic tool and management approach to create organisational effectiveness. It is a quite common trend that religious organisations have mostly been studied from a spiritual perspective, meaning their beliefs, rituals, and the impact of religion on society; also make up an entire organisation that has various operational functions, alongside strategic goals (Oosthuizen & Lategan, 2016). Therefore, this study is set out to assess the various aspects of a religious organisation: particularly, Christian Faith Revival Ministries, South Africa, which is a Pentecostal church to get a clear understanding of their current operations, systems, and tools that are in place to perform operational functions to reach organisational objectives. Furthermore, this study seeks the evaluate the KM and sharing practices within the Pentecostal church. According to Torry (2014), even though religious organisations are distinct from other organisations in various sectors, it is important to note that the management of external relationships with these organisations is crucial. This is because political, social, and environmental aspects influence religious organisations. Therefore, religious organisations need to have critical knowledge for decision-making.

This study will be conducted at a Pentecostal church based in Cape Town, South Africa. The church, Christian Faith Revival Ministries Church of South Africa. The church is registered in South Africa as a church denomination. The purpose of the church is to "preach the gospel of Jesus Christ, to spread the good news that Jesus Christ saves, heals, delivers and sanctifies irrespective of the circumstances you find yourselves in". The prophecy of the church is: the church will be a bible school training centre for its congregation as well community members. Membership requires that you be "born again and baptised in full immersion in water, in the name of the Father, Son and Holy Spirit who subscribe to its senates of faith and agrees to be governed by its constitution and rules". The church has an executive council of five members and the general church council consists of eight members which add up to 13 members for the entire council. It has a total of approximately one hundred and twenty church members. The different structures of the church include the Praise and worship team, Sunday school, Youth services, Women ministries, Brothers' fellowship, Community outreach, administration, a fundraising, and events planning committee and lastly, the executive leaders. The church structure and its aims would be ideal to investigate how the church is currently performing in tasks to reach its overall organisational goals.

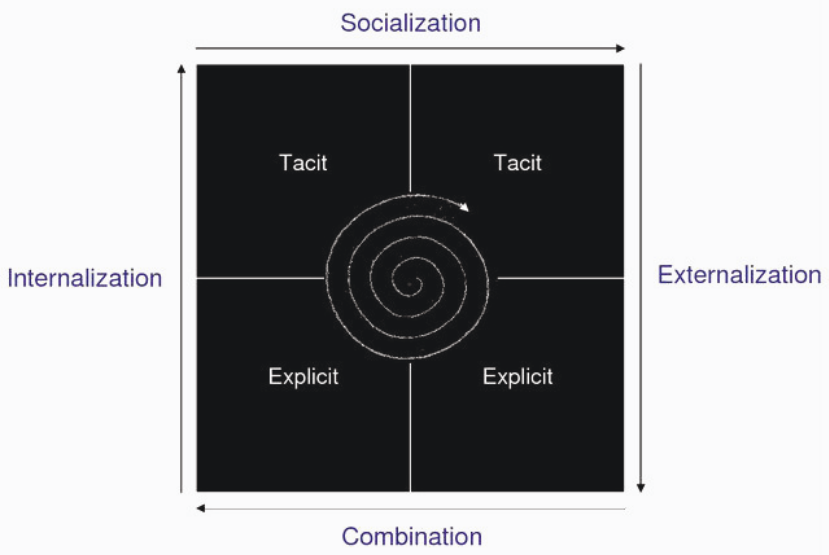
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Tacit knowledge resides in the minds of people regardless of the type of organisation they belong to; this includes members within religious organisations. Therefore, the tacit knowledge that church members possess should be extracted, documented, and converted into explicit knowledge, as this will enable the sharing and creation of new knowledge, facilitating KM, organisational learning, and human capital development practices within religious organisations. Pentecostal Churches globally and locally are spreading, and membership increasing. These churches have been reported to be the fastest-growing religious movement not only in South Africa but all over the world (Fairchild, 2019). Furthermore, religious organisations are intended to be driven for the greater good of society. Therefore, churches are just as important and need to function effectively and successfully to serve the community's needs and make a positive impact on society. The effective and proper management of knowledge in these organisations would therefore help in achieving this purpose. There are skilled, qualified members and experts within church communities possessing valuable knowledge. These skills and tacit knowledge can be extracted and managed to further develop, grow, and maintain the church to reach its goals of spreading the gospel and improving community services. One of the justifications of this study is that it is a response to the need to address the gap in KM practices in religious organisations as it has been observed

that very few studies focus on KM in religious organisations, especially Pentecostal churches within South Africa. As identified from South African literature, few studies have been done on KM focusing on religious organisations. Previous studies on KM have been on corporate, academic and government institutions (Milano et al., 2015; Niu, 2010; Mphahlele, 2010; Kassim et al., 2016; Vasconcelos et al., 2005; Corfield et al., 2013). Therefore, this study focused on a Pentecostal church in South Africa to gain insight into how KM can be applied within the church to contribute to organisational effectiveness through knowledge sharing, organisational learning, and human capital development. The study will not only how KM can be introduced in religious organisations but also provide guidelines for church leaders to use as a starting point for the setup a KM system to create, share and extract tacit knowledge that church members and leaders can use for decision making, to improve service delivery and the overall performance of the organisation.

3

The Knowledge Conversion Model proposed by Nonaka and Von Krogh (1994) informs the conceptual framework and orientation for this research. According to the proponents, organizational knowledge creation as a higher-order construct comprises four knowledge conversion processes: socialization, externalization, combination, and internalization (SECI). According to this model, knowledge creation is considered the source of continuous innovation and continuous innovation is the source of sustained competitive advantage. According to Nonaka and Von Krogh (1994), four modes of knowledge conversion are created when tacit and explicit knowledge intermingle. Socialization which interacts tacit to tacit is everyday proof of converting new tacit knowledge through experiences that have been shared. Externalisation processes tacit knowledge into explicit form to aid knowledge sharing for the creation of new knowledge. The combination is explicit to explicit knowledge interaction and this processes explicit knowledge from within or outside the organisation to bring about a new systematic and more complex knowledge that is shared within the organisation. The Internalization variable interacts from explicit to tacit within the organisation. This is the application of the tacit knowledge that has been consumed explicitly.



1: Knowledge Conversion Model by Nonaka and Von Krogh (1994)

The combination of the variables in the model: socialization, externalization, combination, and internalization aims to keep the organisational knowledge updated and aligned to improve effective service delivery (Lindner & Wald 2011). "When organizations innovate, they do not simply process information, from the outside in, to solve existing problems and adapt to a changing environment. They create new knowledge and information, from the inside out, to redefine both problems and solutions and, in the process, to re-create their environment" (Von Krogh, Nonaka, & Rechsteiner 2012). The Knowledge conversion model was utilised as the main aim is the interrelations between organisational knowledge and the individuals inside the organisation: in this case the members of the Pentecostal church. A thorough understanding of KM theories regarding knowledge creation and sharing practices was needed in understanding and evaluating KM at the Christian Faith Revival Ministries Church of South Africa.

4

The aim of this study is to assess KM practices and organisational learning within religious organisations, in particular, a Pentecostal Church. The objectives of the study specifically are to:

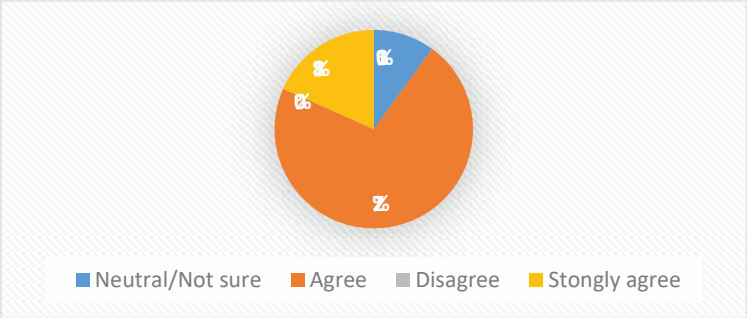
1. To examine the awareness and uptake of KM, and how knowledge is being managed within Christian Faith Revival Ministries of South Africa.
2. Determine Christian Faith Revival Ministries of South Africa's openness to organisational learning and towards contributing to human capital development within the organisation.
3. Assess how Christian Faith Revival Ministries of South Africa could leverage KM practices and organisational learning in achieving its goals of spreading the gospel and enhancing its community services.

5

The approach for this study's research inquiry was a case study which utilised both qualitative and quantitative methods of data collection from a population of 70 (including 20 church leaders) adult church members at the Christian Faith Revival Ministries South Africa. As the church has a total of 120 members with 70 adult members, Total enumeration sampling was used to determine the sample size since children and those below 18 years were not included in the study. Questionnaires were used to collect data from church members while the church leaders were interviewed. Out of the about 70 adult members of the Church, 62 (88.6%) responded by completing the questionnaire but two (2) of the questionnaires were excluded as they were unusable. 10 (50%) of the 20 leaders participated in the interview. Quantitative data was analysed descriptively while the qualitative data was analysed using content analysis. This was used to supplement the quantitative results in the discussion. The study was approved by the Human and Social Sciences Research Ethics Committee (HSSREC) of the University of the Western Cape.

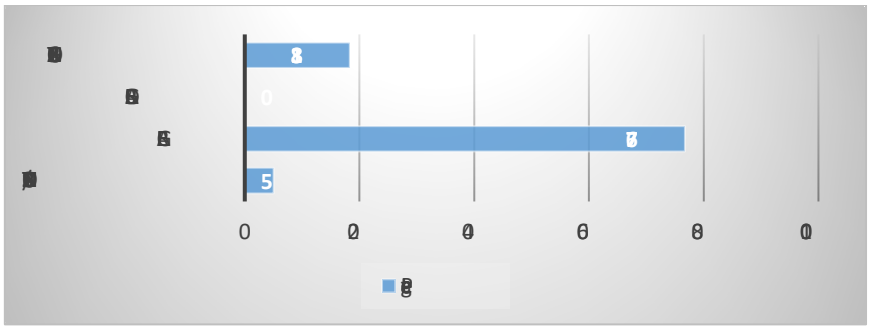
6

To examine the level of awareness and uptake of KM as well as the management of knowledge within Christian Faith Revival Ministries of South Africa, the below quantitative results are related to documented knowledge at the church. This is accompanied by qualitative data in the form of quotations from the research participants. From Figure 1 below, 43 (71.7%) of the respondents agreed that church meetings/services/training is documented, and 6 participants (10%) reported that they are not sure. It is very interesting to note that none of the participants disagreed.



2: Documentation of church /meetings/services/trainings

However, these responses contradict the interview responses where most of the leaders who were interviewed, reported that currently, there is no documentation of church meetings/services. "It is not that these training are documented but that is very important" [Interview Participant 1]. An evangelism leader noted that "in my department, there is not really trainings taking place… but if there would be… trainings should be documented in both print and electronic format" [Interview Participant 3]. Another participant who is a deacon and in the music section added that "there is no formal training and rehearsals for both the deacons as well as the music division, but if there should be such training and rehearsals… it would have been documented in printed format for people to have access to these training, but someone must be appointed to do this work and to share it with whosoever needs it" [Interview Participant 4]. Respondents also pointed out the need for documentation to take place noting that training "must be documented… we need to appoint someone to do this work and to provide access to these documents" [Interview Participant 9]. This contradiction in responses could be due to



KM concepts is met with resistance due to the cultural environment that churches create. These differences could be a result of several factors including organisational climate in addition to nature and nurture.

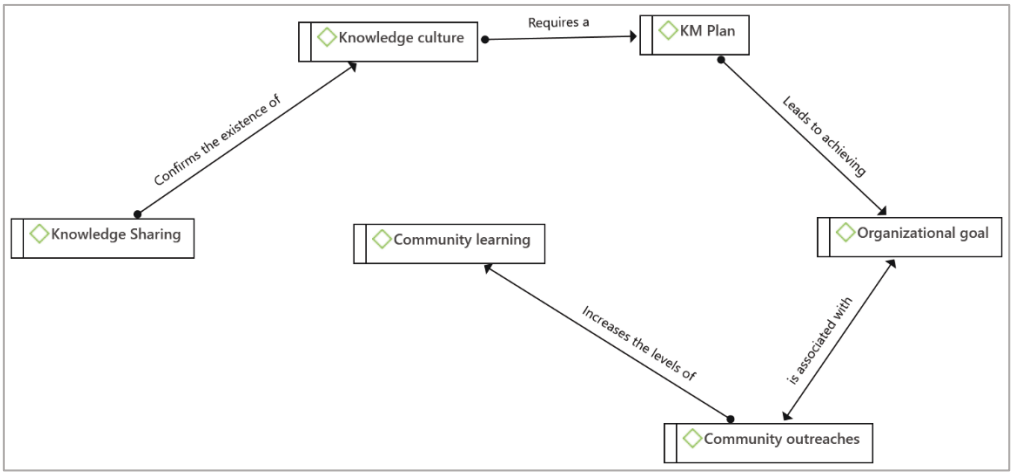
The final research objective was to assess how Christian Faith Revival Ministries of South Africa could leverage KM practices and organisational learning in achieving its goals of spreading the gospel and enhancing its community services. The qualitative data revealed that evangelism is the most prominent means of knowledge-sharing engagement between the church and the community. One of the respondents noted that "I think there should be held campaigns like door-to-door must be put in place for sharing information and knowledge about the gospel. The method we use currently to reach the community is through open-air services" [Interview Participant 10]

On giving to the needs of the community, one of the leaders stated that "We do not get donations, but I also encourage them to make voluntary contributions for the feeding scheme; to go out into informal settlements to provide food and minister the word of God" [Interview Participant 1]. Furthermore, the leader acknowledged that "there is a lot of things such as data capturing, and administrative work which still needs to be put in place to document, preserve information, knowledge and skills…This will ensure that we are more successful in our vision. However, I can certainly see that our church has grown through sharing knowledge, through learning, skills development, and mentoring" [Interview Participant 1]. According to a study by Reddy (2019), there are various communication types to spread the gospel such as print, radio, television, the internet, and social media to reach a wider audience.

For Pentecostal churches to reach their organisational goals, the church needs to determine what the current organisational knowledge is, and then analyse the knowledge gaps. Many organisations have made investments in KM with failed attempts with the most prominent reason being the lack of alignment between the organisational strategy and the KM plan (Pour, Matin, Yazdani, and Zadeh 2019). Organisational learning has been reported to add value to organisations and institutions because it fosters the achievement of goals (Castaneda, Manrique & Cuellar, 2018).

7

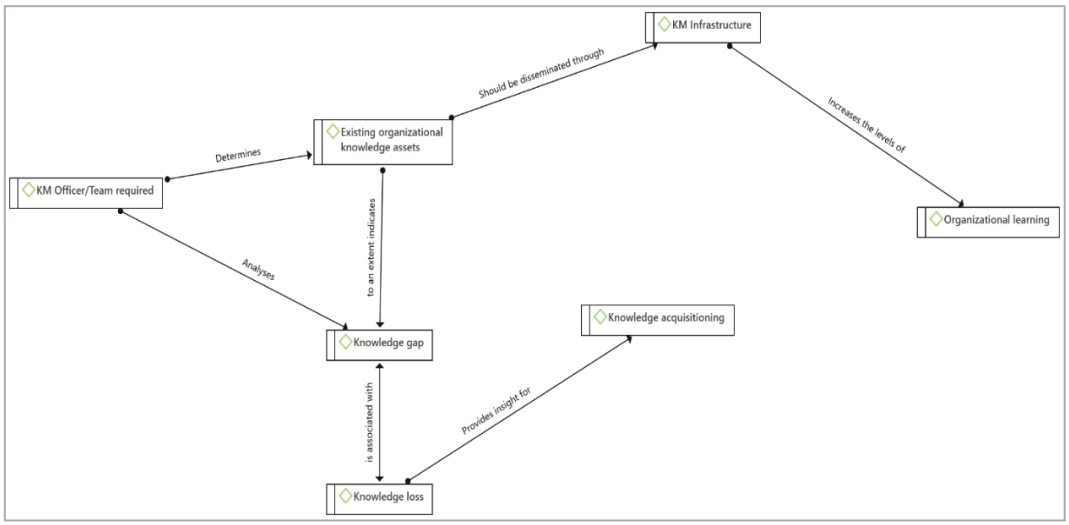
This study aims to assess KM practices and organisational learning within religious organisations, in particular, a Pentecostal Church. The results from the study reveal there are no structured KM practices at the Pentecostal church, however, the Church is willing to engage in KM practices. The majority of the church members together with the leaders agree that organisational learning is very important for contributing to the knowledge and skills of its congregational members. Knowledge sharing aimed at empowering and uplifting the community, using community learning as a teaching and learning approach can be adopted. However, all of the needs to be highlighted within a KM plan and organisational strategy of the Pentecostal church must be presented.



4: Knowledge sharing at Pentecostal Churches

The Pentecostal church is very much involved in tacit knowledge-sharing practices, but not at the stage of systematically using this as a tool to create organisational effectiveness. This was revealed from the study to be the lack of four constructs that make up the SECI KM processes which are to create explicit knowledge, organise

knowledge, store knowledge and apply knowledge. A KM plan can be based on either a codification or human-centric approach to share, extract, organise and store knowledge for later use. The KM plan is linked to or built on the organisational strategy. Gourova, Antonova, and Todorova (2009) explain that a knowledge audit forms a firm foundation for the goals of a knowledge strategy (or KM plan) and simultaneously, identifies the awareness and KM attitudes in organisations. In utilising KM practices to achieve the organisational goal, the knowledge already in existence within the Pentecostal church should be processed through an established KM infrastructure because this will increase the levels of organisational learning related to how the church's organisational goals can be achieved.



5: Using KM for goal achievement in Pentecostal Churches

To gain a deeper insight into how organisational learning and organisational goals are linked together as illustrated in Figure 5, the organisational strategy should be the centre of organisational learning to enhance organisational goals and achievement. The organisational strategy of the Pentecostal church is tied to all the important aspects of KM practices which facilitate organisational learning.

8

The results and conclusion of the study should be considered in light of the following limitations. The limitations of the study are that due to it being a case study, the findings cannot be generalised to all religious organisations and Pentecostal churches. Also, the study on KM practices in Pentecostal churches might not address all the issues that religious organisations face in reaching their organisational goals and effectiveness.

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aleksandra.czarnecka@pcz.pl

: The purpose of this paper is to present the opinions of young people in the area of information exchange in a remote work system. The COVID-19 pandemic has forced companies to make massive use of remote work opportunities. This phenomenon made employers confront all the advantages and disadvantages of this form of work. It also revealed how many problems in terms of work organisation and organisation of information exchange are caused by this form of work. In order to investigate this issue, a study was carried out, the aim of which was to find out about the opinions of young people regarding remote work. The research was conducted in December 2021 on a sample of young people from Generation Z. For the research purposes a Likert scale-based questionnaire was used. The following tests were used for the purpose of the data analysis in the STATISTICA software: the Kruskal-Wallis ANOVA on ranks test, the Mann-Whitney test and the Pearson's chi-square test. The strength of correlations between the variables was evaluated by means of Spearman's rank correlation coefficient. The results of the research reveal the relations in the area of information exchange in remote working conditions, and the preferences and experiences of young people in relation to remote learning and remote work. The COVID-19 pandemic has shown that the organisation of information exchange is an important factor determining the effectiveness of remote work. The expectations of Generation Z in this respect allow for better organisation of the information flow.

: knowledge, information, remote work, Generation Z

1

The management process in each organisation, regardless of its type or objectives, can be characterized by indicating four basic activities: planning, organising, leading and controlling. Management is a process undertaken by one or more people to coordinate the actions of others to achieve results that are not achievable for a person acting alone. It is important to achieve the set goals efficiently and effectively, while efficiency is understood as a favourable ratio of expenditures to results, and effectiveness as the implementation of planned activities, thanks to which the goals are achieved (Ivancevich et al., 1989).

Each organisation uses its resources in the management process. They can generally be divided into four types: human, material, financial, informational. And although all resources are important and necessary for the functioning of the organisation, people are definitely the most important resource. Human resources are all members of the organisation, all employees and their potential, knowledge, experience, skills or talents. Therefore, it is not surprising that nowadays, in addition to the material and financial resources available to the organisation, information resources, i.e. all information and knowledge (both at the organisational and individual level) are listed as key resources. Some of them, such as: computer data, documents, reports, summaries, analyses can be recorded and stored, while others remain primarily at the employees' disposal – in each of their types of memory (Baddeley, 2021).

The degree to which information and knowledge (and thus communication) fill the content of the work differentiates both groups of professions/tasks and groups of employees. In organisations, we distinguish such work processes in which personal relationships are strongly focused, but also those that are not. In some types of work, the exchange of thoughts, opinions, knowledge and even information about the implementation of individual stages of tasks are necessary. In this type of work, language and interaction become a tool with a variable intensity of its direct and indirect use for cooperation. Activities of employees, the manner of precision of their performance, the time of implementation or the level of maintaining communication checking particular stages of the implementation of tasks become an area of employee assessment and building their own image in the eyes of superiors and colleagues (Budnik, 2019, p.20).

The objective of this study is to present fragmentary results of research presenting the opinions of young people in Poland on selected aspects of work organisation with regard to the exchange of knowledge and information in remote type of work.

2

The issues of work organization and knowledge exchange seem to be particularly important in relation to the issues of remote work, the important dimension of which is information and knowledge exchange. Remote work understood as work performed outside the workplace, usually at home, using an Internet connection with company servers (Nilles, 2003, p. 21) occurred on a mass scale in the organisational reality as a result of the Covid-19 pandemic. Although it should be noted that remote work is also a consequence of: replacing physical work with mental work (due to technological progress), the transition from production as the dominant branch of the economy towards services and, in connection with increasing globalisation, the possibility of performing work in places other than the workplace more and more often.

In the light of research on generational differences, it seems to be a solution created even for Generation Z (Rodriguez et al. 2019; Bencsik et al. 2016; Bencsik and Machova 2016; Goh and Lee 2018; Kirchmayer and Fratricova 2018; Dries et al. 2008, Lazanyi and Bilan 2017; Bejtkovsky 2016; Hejnova 2015), which includes people born after 1995, although some researchers include its representatives born in 1990, and even in 2000 and later. According to mentioned studies the representatives of Generation Y (the generation preceding Gen Z) challenge the knowledge possessed by colleagues representing older generations, the representatives of Generation Z show concerns about contact with older colleagues related primarily to lack of interpersonal skills. Representatives of both generations stress the key role of the supervisor as the person responsible for creating a social work environment, organising work and transferring knowledge and information. At the same time, members of Gen Z exhibit significantly higher expectations for managers, requiring them to behave in the workplace similarly to their parents – that is, not to put pressure on them, to take care of them and to be carers, partners rather than supervisors of the tasks carried out (Toczyska, 2022). They also do not show much willingness to initiate relationships with representatives of older generations in order to acquire knowledge and information necessary to perform tasks that for older employees constitute routine activities.

With regard to the key issue of this paper, i.e. the exchange of knowledge and information, the Universal Encyclopaedia gives the following meaning of the concept of "knowledge": in a narrower sense, knowledge is all reliable information about reality together with the ability to use it. In this sense, knowledge is mainly scientific (although not only); in a broad sense, knowledge is any set of information, beliefs, etc., to which cognitive and/or practical value is attributed. In this sense, knowledge may have nothing to do with science-(Nowa encyklopedia powszechna, 1997, p.733). Data is the basic concept related to knowledge. According to Davenport and Prusak (Davenport and Prusak, 2000, p.2), data only allows for describing what happened, but it does not say anything about it, whether it is good or bad, but are necessary to carry out such an assessment. It has to therefore be said that the data has no inherent meaning. In this study, the information will be understood as a message. In this approach, two elements are important: the sender and the recipient of the message. In this sense, “information as data that makes a difference” (Davenport and Prusak, 2000, p.3). As opposed to data, the information is characterized by relevance and purpose. Following Davenport and Prusak (Davenport and Prusak, 2000, p. 5), it can be stated that knowledge is a shaped set of experiences, values, information referring to the context and knowledge of experts, which is the basis for assessing and acquiring new experiences and information. This process is initiated and takes place in the human minds. In the organisation, knowledge is found not only in documents or special databases, but also in organisational routines, processes, practices and standards.

The two main strategies related to knowledge exchange processes in organisations can be found in the literature. The first is a codification strategy that is based on globalization processes and the inclusion of electronic media in the processes of knowledge management (its collection, storage, sharing and processing of information) and the treatment of these electronic tools as a factor determining the connections between employees and the creation of new social networks (Patrick and Dotsika 2007, pp. 395-406). The second strategy, namely the personification strategy, on the other hand, assumes that (Davenport and Prusak 2000, p. 24):

- knowledge is born and placed in people's minds;
- knowledge is exchanged based on the category of trust;
- new technologies only serve to create behaviours contributing to knowledge exchange;

- • knowledge-sharing processes must be supported and rewarded by the organisation just as behaviours that improve the effectiveness and efficiency of employees;
- • knowledge exchange should be stimulated and developed in many non-typical and unconventional ways.
- According to author, currently, mainly due to social and technical changes, but also changes in the area of the organisation of new business models (e.g. e-commerce), we are observing processes verifying the assumptions existing in the literature regarding the exchange of knowledge and shaping new challenges in this area:
- the importance of individual, informal, tacit knowledge and automation of work processes and codification of organisational knowledge;
- the importance of interpersonal relations and trust for the implementation of knowledge and information exchange processes as well as the transition to remote and hybrid work;
- problems of the society getting older and the threat of permanent loss of unique organisational knowledge;
- the need to capture knowledge of experienced employees in order to pass it on to young employees in the face of high rates of rotation of this group of employees.

Due to the presented circumstances, the following is a valid question: how will the processes of knowledge exchange be implemented in organisations? Knowledge exchange between employees can be analysed on two levels (Słocińska, 2011). The first one focuses on the acquisition and reproduction of knowledge possessed by employees and encoding it in a way allowing its subsequent use by other members of the organisation. The second level focuses on the very processes of knowledge exchange aimed at and resulting with mutual stimulation of creativity and opening up new possibilities for using knowledge, what also entails the creation of new knowledge. Both dimensions of knowledge exchange are important, and they not only occur simultaneously, but in a sense they are dependent on one another. The added value of the knowledge exchange processes, regardless of the intentions of the people stimulating a given process, is the fact that they cause the transformation, development and evolution of all participants of the exchange processes (employees) and, in extension, also the development and evolution of the organisation (Miś 2005, pp. 43-56). This is because people do not acquire knowledge passively, but they interpret, experience and adapt it to their own situation and perspective (Nonaka, Takeuchi 2000, p. 33). Therefore, it should not be surprising that the issue described here is analysed by both theoreticians and management practitioners in the context of shaping organisational effectiveness and personnel management.

An important problem observed in the processes of knowledge exchange, especially with regard to remote work, is the transformation of the tacit knowledge (also implicit knowledge) into explicit knowledge (often of a formal nature) available to other employees (Albrychiewicz-Słocińska, 2020; Czarnecka, Słocińska, 2010, pp. 287-296). Ways to stimulate the transformation of tacit knowledge into explicit knowledge depend on the knowledge management strategy adopted by the organisation. We are talking about the personalisation and codification (Albrychiewicz-Słocińska, 2021) strategy which reflect certain philosophies regarding the perception of the processes of knowledge exchange between employees.

Regardless of the knowledge management strategy adopted, two years of experience related to remote work on a mass scale and Generation Z entering the labour market proved that the exchange of knowledge is conditioned (Słocińska, 2013):

- creating an appropriate work environment (in the physical and social dimension), which influences establishing contacts, including intergenerational contacts;
- developing an organisational language which, on the one hand, is so imprecise (comparisons, labels, analogies, metaphors) that it enables the expression of tacit knowledge, on the other hand, is understandable to other members of the organisation and is adjusted to their interpersonal skills;
- creating an atmosphere of freedom, openness and trust in presenting ideas, which are especially important for the representatives of Generation Z;
- establishing communication nodes where the exchange of knowledge takes place and where it is most available (locating knowledge “librarians” (Słocińska, 2011), which means, entities with not only specific knowledge, but also those who know ("who may know") or who are oriented on where the section of knowledge necessary to solve a specific problem or task performance, beyond the available explicit

knowledge); for Gen Z it is particularly important as it allows them to be guided through the meanders of the organisational network.

3 [illegible]

The research results presented in the study constitute a part of a quantitative survey conducted among young people (Generation Z and Generation Y) at the turn of 2021. The key problem of the research project related to the impact of the remote learning experiences on the preferences in the area of remote work among young people in terms of selected aspects: employee relations, knowledge, development and learning, motivation, communication, teamwork, creativity, work organisation and work-life balance.

The study presents a fragment of the research results on selected aspects of work organisation in relation to the exchange of knowledge and information in remote work.

The survey was conducted with the use of quantitative research methods which use the survey technique. The technique was chosen because of the possibility of a direct contact with the respondent. The study covered young people (representatives of Generation Z and Generation Y) being students of various fields of study, coming from the Silesian Voivodeship, because due to the acquired professional competences this social group it may perform professional tasks in the form of remote or hybrid work in the future.

The research tool used was a standardised questionnaire consisting of closed questions and statements. The 5-point Likert scale was used for the responses, which enables the relative intensity of the various responses to be determined (Babbie, 2004, p.192). The established and specified conditions allow for a reliable and quick analysis of the collected material, their uniformity and ease of preparation (Churchill, 2002, p. 309). The research tool (the questionnaire) is a proprietary tool and was formulated by the members of the research team - the employees of the Department of Applied Sociology and Human Resource Management, the Faculty of Management, the Częstochowa University of Technology.

STATISTICA software was used in the process of compiling the research results. To assess the significance of differences in the analysed 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). Spearman's rank correlation coefficient was used to assess the strength of correlations occurring between variables.

For the purposes of analysing the results of the study, a number of statistical hypotheses was adopted regarding the occurrence of significant differences in the respondents' statements due to their characteristics and experience in the field of work, remote learning and remote work. It was assumed that H0 is the hypothesis where there are no differences due to the grouping variable, while H1 is an alternative hypothesis about the occurrence of such differences. These hypotheses were verified by means of the aforementioned statistical tests which allowed for the rejection of the null hypothesis about the lack of significant differences and the adoption of an alternative hypothesis about the existence of significance of differences. The study presents the relationships verified with statistical tests, which authorize to draw conclusions about the regularities in the studied group.

4 [illegible]

226 students participated in the study. The structure of respondents due to: age (1); gender (2), having remote learning experience (3), having professional experience (4), having professional experience in remote work (5) and the preferred form of work (6) is presented in Table 1.

[illegible] : Characteristics of respondents

[illegible]	[illegible]
1. age*	
Generation Z (1990)	89.82
Others	10.18
Total	100.00
2. gender	
Female	50.44
Male	48.23

N/A	1.33
3. having remote learning experience	
Yes	86.72
No	12.83
N/A	0.45
4. having work experience	
Yes	86.28
No	13.27
N/A	0.45
5. having professional experience in remote work	
Yes	48.67
No	50.88
N/A	0.45
6. preferred form of work in the future	
At the workplace	35.40
Remote	12.39
Hybrid	50.00
N/A	2.21

* year of birth 1990
Source: research results

Because the most common division into generations present in the literature indicates 1995 or 1990 as the one from which one may discuss Generation Z in the analysis of the research results, it was assumed that Gen Z is the dominant population in the studied group. Due to the fact that the statistical tests did not reveal statistically significant differences in the opinions of representatives of Gen Z and other respondents regarding the analysed issues, the description and analysis of the research results will present comprehensive results without distinguishing between Generation Z and the older Generation Y respondents. Surprisingly, the lack of relationships with age was also noted in relation to the preferred form of work (Table 2). Only in relation to the division into generations, adopting 2000 as the first year of Generation Z, one of the tests (Chi-square NW) allows to reject the null hypothesis relating to the lack of differences. However, this is not an unambiguous regularity.

: Age and preferred form of work.

	%	%	%
NW Chi-2	p = 0.09956 (α = 0.05) Ch-2 = 6.26 df=3	p = 0.39911 (α = 0.05) Ch-2 = 2.95 df=3	p = 0.04021 (α = 0.05) Ch-2 = 8.30 df=3
Pearson's Chi-2	p = 0.09885 (α = 0.05) Ch-2 = 6.28 df=3	p = 0.38769 (α = 0.05) Ch-2 = 3.03 df=3	p = 0.05465 (α = 0.05) Ch-2 = 7.62 df=3

Source: research results

In relation to the issue analysed in the study, a group of five indicators was selected, which represent the respondents' opinions on selected aspects of information and knowledge exchange (table 3):

1. remote work is complicated/complex;
2. it allows for flexible time management;
3. it allows for faster implementation of tasks;
4. it enforces the necessity to organise own work;
5. it allows to work without direct supervision/control.
6. It allows to take on additional work
7. It makes it difficult for newly employed workers to adapt to work;
8. It allows to efficiently settle tasks.

: Percentages of answers in the area of knowledge exchange.

	%							
	A	B	C	D	E	F	G	H
N/A	4.87	4.87	4.87	3.98	4.42	4.42	3.98	5.31
1	17.26	3.54	4.42	0.88	1.33	5.31	7.52	5.31

	%							
	A	**B**	**C**	**D**	**E**	**F**	**G**	**H**
2	19.47	7.52	11.06	6.19	6.19	6.64	7.08	10.62
3	28.32	9.29	27.43	13.27	17.26	21.68	22.57	29.65
4	17.26	34.96	31.86	37.17	33.63	31.42	27.43	29.65
5	12.83	39.82	20.35	38.50	37.17	30.53	31.42	19.47
total	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

1 - strongly disagree; 2 - mostly disagree; 3 - neither agree nor disagree; 4 - mostly agree; 5 - strongly agree.
Source: research results

Regarding the issue of the complexity of working remotely, a comparable percentage of respondents agreed with this statement vs. they did not agree with it. An important group of nearly 30% were people who could not clearly determine their opinions. In relation to the statement that remote work allows for flexible management of time, the vast majority of respondents (more than 70%) agreed with such perception of the advantages of remote work. In relation to the statement that remote work also allows for faster completion of tasks, also most of the respondents (although this time only slightly over 52%) were of this opinion, while over 27% were unable to comment on this issue. Definitely more optimistic statements were observed in relation to the claim that remote work forces the need to organise own work. Again, over 70% of respondents expressed such an opinion. A similar percentage of respondents believe that this form of work allows for performing tasks without direct supervision/control, although in this respect a slightly higher percentage of respondents (over 17%) cannot clearly determine their opinions. The opinions of the respondents regarding the statement that remote work allows for taking up additional work are even more conservative in this respect. A similar percentage of respondents (about 60%) agree with the statement that remote work makes it difficult for new employees to adapt to work. It is interesting to see the structure of the respondents' indications showing that 50% of respondents believe that remote work allows for efficient settlement of tasks and at the same time nearly 30% of respondents cannot express their opinion on the analysed issue.

The presented indicators were analysed in terms of the differentiation of the respondents' statements with regard to independent variables. To assess the significance of the differences in the analysed variables, the Kruskal-Wallis ANOVA (AKW) and the Mann-Whitney U test (UMW) were used. The distribution of the results is presented in Table 4 - the table shows only statistically significant differences allowing for the rejection of the null hypothesis.

: The ANOVA Kruskal-Wallis test for independent variables and selected indicators

Independent variables AKW and UMW test at the accepted level of significance (α = 0.05)	Analysed indicators							
	A	B	C	D	E	F	G	H
1	-	-	-	-	-	-	-	-
2	-	p = 0.0191	p = 0.0233	-	-	-	-	-
3	-	-	-	-		p =.0398	-	-
4	-	-	-	-	-	-	-	-
5	-	-	-	-		-		
6	p =.0259	p =.0435	p =.0003	-	-	-	-	p =.0009

Source: research result

The most differentiating variable in the respondents' responses was the preferred form of work in the future, gender and remote learning experience. Analysis of bipartite tables revealed the following regularities confirmed by tests:

- women were much more likely than the surveyed men (over 80% of the surveyed women and about 64% of the surveyed men) to agree with the statement that remote work allows for flexible time management and that it allows for faster implementation of tasks (about 55% of women and 46% of men);

- people with remote learning experience (about 65% of this group) were more likely to agree that remote work allows you to take up additional work, than people without such experience (38%);
- among those who prefer remote work in the future, the largest percentage (nearly 70%) believe that remote work is neither complicated nor complex, at the same time in the group of people who prefer stationary work, nearly 40% are of the opposite opinion;
- among people declaring stationary work in the future, the largest percentage (nearly 19%) of respondents from this group do not agree with the fact that remote work allows for flexible time management, while 65% of people from this group are of the opposite opinion, among people declaring their willingness to work remotely in the future, this ratio looks as follows 0% to nearly 90%; in the group of people who prefer hybrid work, the distribution is significantly more diverse, although positive opinions prevail in the discussed area (about 78%);
- when it comes to the opinion that remote work allows for faster implementation of tasks, the distribution of responses in relation to the forms of work in the future was as follows: about 40% of affirmative statements in the group preferring stationary work; about 53% in the group preferring hybrid work and 82% of the group preferring remote work;
- from the group of people who prefer remote work, the largest percentage agrees with the opinion that remote work allows for efficient settlement of tasks, in the group of people preferring hybrid work this percentage was about 52% and in the group preferring remote work - 36%.

At the same time, the results of the study indicate that the preferred form of work in the future was more influenced by the experience of remote work (NW Chi-square ($p = 0.0036$), ($\alpha = 0.05$); Pearson's Chi-square ($p = 0$), ($\alpha = 0.05$)) than the remote learning experience (NW Chi-square ($p = 0.06292$), ($\alpha = 0.05$); Pearson's chi-square ($p = 0$), ($\alpha = 0.05$)).

In the analysed area, attempts were also made to observe regularities related to the recognition of differences between information and knowledge by the respondents (Table 5).

Table 5: Spearman's rank order correlation for selected variables at $p < 0.001$

A			0.2672	0.3007	0.2915
B					
C	0.2353				
D					
E					
F					
G				0.2648	
H	0.3358	0.2760			

Source: research results

When examining the results of the correlation of the Spearman's rank order between the indicators, it was noted that the respondents who indicated that remote work contributed to the exchange of knowledge were also convinced that it was a form of work that allowed to complete tasks and their settlement faster. Positive opinions on the impact of remote work on the speed of information exchange correlated with opinions that remote work allows for efficient settlement of tasks. Respondents convinced that remote work makes it difficult to understand the information provided at the same time believed that remote work is complicated and complex. Indications regarding affirmative opinions that remote work leads to overloading of information were most often met with positive claims about the complexity of remote work and the problems that this form of work creates for newly hired employees. On the other hand, affirmative indications regarding the opinion that remote work makes it difficult to assess the authenticity of the information received were met with affirmative opinions on the complexity of remote work.

5 [illegible]

When analysing the research results, it should be noted that certain limitations have to be taken into account. First of all, the study is a pilot study, and therefore does not present the opinion of a representative sample of the surveyed population in Poland, narrowing it down only to those residing in the Silesia Voivodeship. Secondly, as in other studies relating to Generation Z, the use of year-of-birth criteria is still disputed. Thirdly, due to its pilot nature, the study covered many different areas of employees' functioning at work, and finally, in the area of the problem covered by the subject of this study, the drawn conclusions are an indirect result of the respondents' opinions in areas closely related to the analysed problem. Despite the aforementioned limitations, the presented research results provide an insight into the analysed issue and point to some interesting dependencies.

Due to the fact that as a result of the COVID-19 pandemic (2020, 2021), young people around the world experienced a mass transition to the mode of learning and remote work, the consequences of this phenomenon are only subject to research processes now. Therefore, there are no comparative research results in this area, and the results before the pandemic seem to be inadequate because remote work before this period was treated as a form of reward, an additional benefit for employees and not as the basic form of providing work even work that was not very complicated.

6 [illegible]

The most interesting observations resulting from the analysis of the research results regard a relatively positive opinion in the area of work organisation in selected aspects of remote work. The opinions of women who emphasize the beneficial impact of remote work on the work-life balance are also interesting. It is somewhat surprising that the perception of knowledge and information exchange in the area of work organization was much greater than the experience of remote learning from the remote work experience. This also means that among the Gen Z respondents, despite their young age and the first steps in the professional sphere, so many of them faced the performance of duties and tasks in a remote form. It also seems that this experience has shaped the image of remote work as a complex and complicated work among the respondents (this may also apply to the very specificity of work – participation in projects, teamwork, multi-faceted work). The more difficult in its complexity the work is, the more negative opinions of the respondents in terms of the quality and amount of information exchanged will be. The results of the research also indicated the problem of information overload in relation to newly employed employees, who are obliged to conduct independent inquiries in the scope of performed tasks, shaping the rules of their own work organisation and self-motivation in remote work. The lack of direct contact with colleagues is a barrier to the process of social and occupational adaptation. It is also interesting to note the regularity in the light of which positive opinions on the impact of remote work on the exchange of knowledge and information correlate with positive opinions on the efficient settlement of tasks in remote work. Undoubtedly, this should be combined with feedback on the tasks performed, which in this form of work occurs quickly and efficiently, although it depends on the manager. It is also a signal that in the extra-coordinated working conditions during the pandemic, many employers quickly acquired knowledge about the problems and challenges associated with remote work and tried to eliminate errors and prevent the negative effects (both organisational and psychosocial) of isolation from the work environment.

7 [illegible]

When analysing the literature guidelines in the area of work environment organisation and work processes, to encourage the exchange of knowledge and information, it should be noted that they are consistent with the guidelines for the organisation of remote work processes. In both cases, the role of relationships in the workplace is emphasized, creating specific working conditions and maintaining communication processes with particular emphasis on feedback. It seems that the most important fact in the conclusions drawn from the analysed research is the one that despite the generally positive assessment of remote work and the aspects of knowledge and information exchange in this form of work, such a large part of the respondents (50%) indicated hybrid work as the preferred one in the future. It seems that respondents during the pandemic period had the opportunity to confront their own ideas in the area of remote work (which seems to be an ideal form for the representatives of Gen Z) with its realities and indicate hybrid work as the one that combines the benefits of remote work and stationary work while eliminating their disadvantages. There are no doubts that the issue discussed in the study is interesting and deserves in-depth research in the future.

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Corporate Social Responsibility and Intellectual Capital in Sports and Leisure: The case of a Golf Club

Francesca Dal Mas[1], William Jupp[2], Maurizio Massaro[1], Carlo Bagnoli[1] and Giuseppe Roberto Marseglia[3]
[1]Department of Management, Ca' Foscari University, Venice, Italy
[2]Department of Management, Lincoln International Business School, University of Lincoln, Lincoln, UK
[3]Department of Civil Engineering and Architecture, University of Pavia, Pavia, Italy
francesca.dalmas@unive.it
16663608@students.lincoln.ac.uk
maurizio.massaro@unive.it
bagnoli@unive.it
groberto.marseglia@gmail.com

Abstract: Golf is becoming an increasingly popular sport, and golf clubs have, therefore, a growing social and environmental impact, with several stakeholders engaged in the activities. While the press and the media have reported countless initiatives conducted by golf clubs worldwide that highlight how environmentally and socially conscious and supportive the golf industry is, little has been said in academia. The paper aims to investigate the topic of Corporate Social Responsibility (CSR) in golf clubs, and how golf clubs' Intellectual Capital (IC) may foster CSR initiative. The paper employs a case study methodology, analyzing one Golf Club in the United Kingdom, using semi-structured interviews. Results underline the great potential of the relationship between the clubs and their stakeholders, especially the customers, to create an influential cycle of CSR in the local communities. Relational capital stands as a central IC element to foster CSR in golf clubs. Moreover, findings highlight the need to develop new business models that can merge the need to be compliant with a strong CSR philosophy ensuring, at the same time, financial sustainability. The paper is one of the firsts to investigate an increasingly popular sport which CSR can be fostered by relational capital, with a relevant impact on its customers, employees, and communities.

Keywords: Sports and leisure • Golf • Intellectual Capital • Relational Capital • Corporate Social Responsibility Initiatives • Clubs

1. Introduction

Golf stands today as one of the most popular sports. At the end of 2018, there were 38,864 golf courses in 209 of the world's 249 countries, with a global diffusion rate for the sport of 84 per cent. With golf becoming an increasingly popular sport, these golf clubs' impacts on social and environmental matters are growing.

Therefore, Corporate Social Responsibility (CSR) is particularly important for golf clubs to demonstrate the social value golf brings to society, whether it be demonstrating responsibility to the wider community or being environmentally responsible (Golf Business International, 2021). Golf clubs have shown they can positively impact the surrounding environment by playing a role in protecting local biodiversity and natural resources and providing a good living environment to local residents (Hammond and Hudson, 2007). Still, their contributions to the environment and society have not been studied in depth yet.

Today, organizations of all industries have a fundamental responsibility to act in a manner that positively contributes to their stakeholders and the communities in which they exist (Reynolds *et al.*, 2018; Vuorio *et al.*, 2018). Companies' Intellectual Capital (IC) as seen in its fifth stage, embraces a wider dimension of worth, which includes sustainability (Dal Mas, 2019; Edvinsson *et al.*, 2022; Massaro *et al.*, 2018). These dynamics are important also for companies active in the sports and leisure business (Ratten and Babiak, 2010). CSR principles are core standards that motivate organisational decision-making, behaviours, and actions (Malbašić *et al.*, 2015; Vallaster *et al.*, 2019). An organisation's ability to engage in their CSR's are affected by several factors. Moreover, businesses not only have the responsibility of producing profit, but they must go beyond that and provide a lasting benefit for both their company and the larger community where they are located (Sheth and Babiak, 2010; Trendafiova *et al.*, 2017).

CSR has become a prevalent expectation of society, and so the focus lies with organisations to fulfil them. This is where golf clubs can offer the opportunity to create an influential cycle of CSR across society, leveraging on their intellectual resources. Due to golf being considered a recreational activity, customers perceive golf clubs in a more personable light compared to larger, corporate organisations. So, the emphasis lies on golf clubs to

create an influential relationship between them and society and hopefully implement a more significant concern for these CSR matters.

Starting from these premises, the article aims to deepen the CSR dynamics in golf clubs and how IC can contribute to them, employing a single case study.

2. Literature review

The topics of sustainability and CSR in the sports and leisure fields are pretty recent, as most contributions started to be developed after 2009 (Sheth and Babiak, 2010). Filizöz and Fişne (2011) have identified a shift from CSR efforts within a corporate context into the context of sports organisations. Upon further investigation, the implementation of CSR can be a significant strategy for teams and clubs to adopt, as it enables the teams and the communities in which they play, many benefits (Breitbarth and Harris, 2008), whether it be brand exposure or creating an emotional link with consumers. Furthermore, there is a vast array of literature that has identified the impacts CSR initiatives have on the financial performance of professional teams (as organisations), in addition to how society perceives the sporting sector differently in terms of CSR (Godfrey, 2009; Moyo *et al*, 2020). Reporting initiatives appear relevant to engage the stakeholders towards CSR-related actions (Hickman and Cote, 2019).

A large part of the CSR in sports and leisure literature underlines the aspects related to philanthropic initiatives and charity, meaning giving donations of money, time and/or knowledge into the social sector. Indeed, it emerges how society is more willing to donate money to support sports teams' causes, due to perceiving them as capable of helping the cause (Giulianotti, 2015; Inoue *et al*, 2013). Because sports teams can be perceived as non-corporate and therefore not-for-profit, in some cases, donators may feel a greater incentive for donating. This may be due to the donator believing that the cause is more genuine, and so their philanthropic acts may have an increased chance of inducing a positive impact, as opposed to donating to a corporate organisation where the donations may be used in an unethical or for-profit manner (Uhlig *et al*, 2020). Therefore, charity and philanthropic initiatives represent one of the major topics when analyzing CSR in sports (Anagnostopoulos *et al*, 2017; Hwang *et al*, 2020; Ratten and Babiak, 2010; Tainsky and Babiak, 2011; Yang and Babiak, 2021).

For sports and leisure organizations, philanthropy has the intention of giving back to wider society, which in turn has knock-on advantages to the organisation. In this perspective, CSR-related initiatives have the clear intention of benefitting not only the wider society (externally) but also the business itself (internally) (Yang and Babiak, 2021). Still, there is a high level of societal expectations for CSR evolving in a way such that companies are urged to be part of positive social/environmental change in their actual business practices rather than being limited to backing external causes (Kim and Austin, 2020). There has been a clear change in society's expectations as they shift from acts of corporate philanthropy to a greater focus on improving actual business practices (CSR) whilst still maintaining these concerns for philanthropic activities.

In such a perspective, sustainability and CSR seem to fit the research stream of the fifth stage of IC (Edvinsson *et al*, 2022; Massaro *et al*, 2018), which sees the need for organisations to go beyond the concept of economic value for the company itself to embrace a vision of worth, which includes the need to provide a vast number of stakeholders with sustainability achievements. Organisations of all kinds have so the ethical duty to ensure that sustainability is considered in the business. Human capital, relational capital, and structural capital resources should all contribute to this aim.

However, a financial perspective often emerges, as the literature highlights the need to find enough resources to run the business first, before engaging in sustainability and CSR-related activities (Kang and Wood, 1995). In sports, while bigger clubs and organisations have the financial power of carrying on comprehensive CSR and philanthropic initiatives, also thanks to the vast number of fans, sponsors, and partners worldwide (Anagnostopoulos *et al*, 2017; Yang and Babiak, 2021), smaller companies often struggle to run their everyday business and generate profits (Wagner-Tsukamoto, 2019).

Shifting from the corporate side of social responsibility within the sporting sector to literature-based specific to CSR in golf clubs, it emerges as there are very few contributions regarding CSR within golf clubs. Over time, there have been many philanthropic ventures taken by golf clubs and non-profit golf organisations across the world (International Golf Federation, 2021). Regarding social responsibility, the press and the media report many cases

of charity fundraising within the golfing sector as well (Children with Cancer UK, 2021; Save the Children, 2021). Golf Foundation (2021) has also been offering many opportunities for the surrounding communities.

The evidence provided by these golf-related organisations suggests that CSR in golf is a very prevalent matter to explore. Since there appears to be an abundance of practical cases exploring CSR within the golf industry, yet a lack of literature discussing CSR in golf clubs themselves and how IC can contribute to it, there seems to be a knowledge gap that requires further exploration.

3. Methodology

In order to appropriately investigate the research question, a qualitative case study approach has been applied. Qualitative research includes representing the views and perspectives of the participants in a study, in addition to explicitly attending to and accounting for real-world contextual conditions (Yin, 2014). According to Silverman (2013) qualitative interviews provide access to social worlds as evidence both of what happens within them and how individuals make sense of themselves, their experiences, and their place within these social worlds. Literature by Ebneyamini and Sadeghi Moghadam (2018, p. 4) has highlighted how a case study methodology is appropriate when aiming to answer 'how and why?' questions. To ensure clarity of the research conditions and the gathering of data and analysis procedures, the following sections explore the research context and the data collection and analysis processes (Massaro *et al.*, 2019).

The case study is about a best golf course in Kent. The club has an estimated total of 852 members, which reaches a total of 38,000-42,000 rounds played per year by non-members and members. The club also hosts a region of 300 golf days of various sizes, 20 club matches, and 50 non-golf functions.

The collection of data were structured around various internal stakeholders representing different hierarchical levels of the Golf Club. Potential candidates were contacted via email by one of the investigators (WJ).

Seven semi-structured interviews were carried out via online calls due to the social distancing requirements of the COVID-19 pandemic (Massaro *et al.*, 2021; WHO, 2019) to generate results for the study, as reported in Table 1.

Table 1: Data collection process

Methodology	Object
Semi-structured Interviews	One Membership Manager
	One General Manager
	One Bar Assistant
	One Head Greenkeeper
	One Front of House Manager
	Two Team Leaders
Qualitative and Content Analysis	The Golf Club's official website

These interviews consisted of twelve questions gathered from the literature, particularly from studies about CSR following the same methodology (Hickman and Cote, 2019; Moyo *et al.*, 2020). The interviews took place between the period of February 2021 – March 2021. Additional information that has been made public via the golf club's website was utilised for data analysis. The questions for the semi-structured interviews are reported in Table 2.

Table 2: Research protocol and semi-structured interview questions

#	Question	Possible Answers	Related Authors
1	What is your position at the golf club?	1.General manager 2.Bar assistant 3.Head Greenkeeper 5. Front of House Manager 6. Team Leader 7. Other	
2	Do relevant do you think CSR is in golf clubs?	A Likert five-point scale where 1= extremely relevant 5= not at all relevant	
3	Why?	OPEN QUESTION	

#	Question	Possible Answers	Related Authors
4	What CSR initiatives has your organisation engaged in?	OPEN QUESTION	Moyo et al. (2020)
5	How do leadership, policy, and economics affect your organization's CSR activities?	OPEN QUESTION	
6	Would you consider your organization to be reactive or proactive in CSR policy making?	1)Reactive 2)Proactive	
7	Why?	OPEN QUESTION	
8	Has the perspective of management continued to be an important influence on the firm's CSR activities?	Likert scale of 5 1 = very important 5 = not at all important	Hickman, L.E. and Cote, J. (2019) Anagnostopoulus et al. (2017)
9	Why?	OPEN QUESTION	Hickman, L.E. and Cote, J. (2019) Anagnostopoulus et al. (2017)
10	How would you describe your organization's CSR strategy?	OPEN QUESTION	Anagnostopoulus et al. (2017)
11	Do your organization's current CSR policies support or conflict with its prevailing business practices; that is, do the daily decisions, practices, and activities support its CSR policies?	1)Support 2)Conflict	Anagnostopoulus et al. (2017)
12	How?	OPEN QUESTION	

Interviews were recorded, transcripted, and analysed using a content analysis methodology. First, a computer-aided word cloud was used to select the most important concepts provided by the interviews. Those concepts were then used to develop the first map of a Nvivo code (Krippendorff, 2013).

4. Findings

Table 3 reports the analysis of the common trends and themes that participants provided while answering the questions.

Table 3: Analysis of Common Themes

#	Interview Question	Common Theme
2	How relevant do you think CSR is in golf clubs?	All respondents perceived CSR in golf clubs to be either very relevant or extremely relevant
4	What CSR initiatives has your organisation engaged in?	All respondents were aware about a specific initiative; however, some could not provide any more than that
5	How do leadership, policy, and economics affect your organization's CSR activities?	All respondents recognised economic factors for having the most significant effect on the clubs CSR activities
6	Would you consider your organization to be reactive or proactive in CSR policy making?	The club was proactive in CSR policy-making
8	Has the perspective of management continued to be an important influence on the firm's CSR activities?	The perspective of management was considered to have a very important influence on the clubs CSR activities
10	How would you describe your organization's CSR strategy?	The golf clubs CSR strategies were good whilst continuously improving
11	Do your organization's current CSR policies support or conflict with its prevailing business practices; that is, do the daily decisions, practices, and activities support its CSR policies?	More than half of the respondents believed that the clubs current CSR policies supported its prevailing business practices. Those who adopted a contrasting viewpoint were either not knowledgeable of the clubs CSR policies, or that some areas were supporting and other areas not.

All interviewees selected CSR as either very relevant or extremely relevant in golf clubs. After being asked why they had adopted this viewpoint, three groups appeared. The first group of respondents presented a concern for the golf clubs impact on its surrounding environment. The second group represented that CSR should be

relevant in all business types, regardless of how much impact they have or do not have on the environment. The third group stressed the importance of supporting the local community.

Regarding the awareness of the CSR initiatives that the golf club had taken part in, four participants could only recount one specific episode, with three respondents being able to provide further examples of CSR-dedicated actions.

The three respondents that provided more than one example of CSR initiatives were in other departments of the organization, whereas the four participants that could not provide any further examples were all from the same department. They gave the reasoning that they had not been made aware of any other initiatives by the club. The three that were able to identify more than one initiative were all in positions of management and had provided extensive examples of past CSR actions.

The perceived effect that leadership, policy, and economics have on the golf club's CSR activities were measured using a word cloud, enabling the selection of the most prominent words that were used by respondents to identify the perceived effect that the above factors have on the club's CSR activities. The font sizes of the text dimension are proportional and depict frequencies of the occurrences in question five of the interview. The highest frequency words reported by respondents were "financial," "cost," and "economics."

The highest frequency words clearly indicate that economic factors affect the club's CSR initiatives the most. Six respondents also highlighted how top management had a significant influence on such activities, providing why they were the ultimate deciding factor for whether such actions were to be engaged with.

Five participants indicated that their organisation was proactive in CSR policy-making. Out of the remaining employees, one believed their organisation to be reactive, and the other specified that their organization was both reactive and proactive.

Four participants indicated that the golf club were organically proactive in CSR policy-making and that they were subconsciously creating CRS policies. Furthermore, one believed that due to the club being affiliated to the castle, the influences for such policies and practices to be proactive originate from the castle itself, and so the golf club merely follows its directive. Another respondent indicated that the club was both reactive and proactive because, at the time, the club was going through a transition phase from reactive to becoming more proactive in its CSR policy-making. The remaining participant identified the club as reactive, as they believed that the club would wait for the instance to occur and then took action to enforce such policies.

The respondents were asked how important management's influence was on the club's CSR activities. Two participants considered management to have an 'extremely important' influence, while one participant recognised their influence as being very important, and the rest of the respondents selected somewhat important.

The one respondent that selected very important as opposed to extremely important was due to the mid-level managers not receiving exact directives from top management. However, the respondent also added that there was a form of communication between the two hierarchies and therefore their influence was still considered very important. The two participants that chose extremely important believed that the influence to engage in such activities solely originated from top management and that it slowly diffused down the hierarchical levels of the organisation. The remaining respondents believed management's influence to be somewhat important due to being the decisive body of the business, and that factors such as economics were regarded higher than pursuing CSR.

For question ten, the participants were asked to describe the golf club's CSR strategy. To analyse the results for this question, a word cloud technique was adopted to identify how the employees perceived their organization's strategies for CSR. Six out of seven respondents believed their club's CSR strategy to be effective and going in a positive direction. The remaining participant concluded that the club's strategies were poor, due to not being informed of such strategies. Two of the six interviewees had stated that they had not directly been informed about the golf clubs' strategies towards CSR, despite this fact, they still believed the organisation's approach to be good.

Four repondents believed that the club's policies were supporting its prevailing practices, while two were unsure. The remaining participant thought that they were conflicting.

The one respondent that believed the club's prevailing practices and current policies were conflicting with one another was due to not being informed about what the club's policies were. Therefore, it was probably more appropriate to choose conflict over support as it resembled weak CSR practice. The two that had chosen unsure, decided that some areas of the club's policies were supporting their prevailing practices and that other areas were not, so they could not come to a fair judgement. Of the remaining four participants, one thought that they must support each other as it is essential for smaller organisations to do so. One respondent felt that because they were made aware of the club's practices and had been actively involved with them, the clubs' practices were surely supporting its prevailing policies. Another individual adopted the opinion that the club had always adhered to being ethically correct in all its practices, and so, the club practices would always be in line with its policies. A certain participant adopted the supporting viewpoint because the top management was always maintaining a strong brand image, and so their practices would always be aligned with its policies to develop the club's reputation.

5. Discussion

The frequency of specific words has highlighted a correlation between the literature and the answers provided, stressing the importance of holding a greater concern for profitability over any other factor, so that the club can survive. From the answers, each respondent identified the clear importance of financial support and the effect it has on the golf club's ability to engage in its CSRs.

On the other hand, literature has also evaluated how by placing economic responsibilities before ethical and legal responsibilities, the latter components may not be considered. The results finalised with most of the participants being able to recount only one CSR initiative and only few being able to identify more than one. The club values economic factors over CSR activities i.e., ethical responsibilities. Hence why most of the respondents were only able to identify one CSR initiative, as the club holds a greater concern for economic factors. Considering all CSR actions, which range from preserving the natural environment and support society, charity ones are widely known and recognized by all the participants, stressing, one more time, the link between sports and recreational fields and philanthropy (Ratten and Babiak, 2010; Tainsky and Babiak, 2011).

Numerous studies have provided reasoning as to why a greater concern for economic responsibilities, as opposed to legal and ethical ones, will be more beneficial for the survival of organisations. A recent work by Wagner-Tsukamoto (2019) suggests that the economic responsibilities of any business should be a pressing matter and that legal and ethical ones are merely subsidiaries to any financial concerns. Without holding a greater concern for economic responsibilities, the other commitments will not be able to be fulfilled. The results from the golf club were able to confirm its utmost importance of finance and how, by achieving this fundamental dimension, other responsibilities can be fulfilled. The golf club has clear intentions of improving its engagement with CSR activities. However, without fulfilling the fundamental dimension of economics, the golf club is unable to pursue these acts of CSR. The economic factor holds the most crucial impact upon the golf club and can ultimately have a knock-on effect on how it can accomplish the ethical, legal, and philanthropic dimensions.

The contrast between the interest in engaging with CSR practices, and the need to fulfil the pure financial dimension first, can find a solution only when trying to cope with the identification of a new business model (Bagnoli *et al.*, 2018; Osterwalder and Pigneur, 2010), aiming it to be sustainable (Dal Mas *et al.*, 2020). One of the participants declared:



When looking to identify how successfully CSR is implemented into the operations of a business, the literature stated the imperativeness for any socially responsible organisation to be including social and environmental concerns across the entirety of a business. The answers from the interviews directly correlate with the literature. In a question asking whether the golf club's current CSR policies support or conflict with its prevailing business practices. From the results, most of participants believed the golf club's policies were in support of its prevailing

practices, with a further 100% of participants being able to identify a minimum of one CSR initiative. Multiple respondents were also able to provide reasoning of how the club actions were corresponding with the literature:

[redacted]

Greater emphasis was placed on the sense of community and the type of stakeholders involved, highlighting great interest in relational capital. One associate stated:

[redacted]

Another participant stressed:

[redacted]

Therefore, among all its tangible and intangible resources, it seems clear that relational capital may stand as the most relevant IC element to allow golf clubs to fulfil their potential as socially responsible organisations, able to merge their economic interests along with sustainability ones. It looks crucial to ensure that all stakeholders within the golf club relationship network feel that they are involved in the social and environmental concerns of the club. In such a perspective, employees' role is vital (Kim *et al*, 2018; Wu *et al*, 2020), calling for dedicated practices for human capital.

6. Conclusion

This case study investigated a business within a niche sector. The conclusions were that industries such as leisure, sports, hospitality, and entertainment, especially if small, may lack sufficient resources to engage in CSR activities effectively. Therefore, employing alternative business models that can merge the need to be compliant with a CSR philosophy and, at the same time, ensure financial sustainability appears like the challenge and solution to fulfil the two dimensions, with relational capital being able to support and foster such dynamics.

Indeed, since golf clubs can be considered a unique type of company by falling under the recreational activity umbrella which clients are also members of the local community, they can play a significant role in a certain part of society. This study enables CSR to be seen by society from a different perspective compared to larger, blue-chip companies that use CSR in a more corporate context. This influences clients into the realisation that CSR is not used merely for improving the competitiveness of an organisation, but also as a genuine means for giving back and improving its surroundings, whether it be socially or environmentally, especially to the community to which the club and its initiatives have a direct impact. All in all, the concept of the fifth stage of IC seems to fit well the situation of such types of organisations.

The significance of this lies with the responsibility of golf clubs, and how they are perceived in more personable and trustworthy respects by their relational capital, especially clients and community members. The relationa capital between the clubs and their customers can, in turn, create an influential cycle of CSR. Through having this informal relationship with a large demographic of customers, in particular, business professionals of significant wealth, golf clubs hold the opportunity to influence these individuals into having a greater concern for the development of CSR. These professionals can then promote sustainability actions through their enterprises, and in turn, develop the awareness of CSR to wider society. Still, employees play a central role in supporting such dynamics.

The practical implications of this study have highlighted the importance of golf clubs to fulfil their responsibilities of educating and smoothly implementing CSR across the organisation, by leveraging mainly on their relational capital, accompanied by the development of CSR-aware human capital.

It is important to place a particular focus on smoothly incorporating CSR into the day-to-day operations of a golf club, which will enable employees to consider the impacts that CSR can have on the future of this sector and,

ultimately, society. Once this has been achieved, the responsibility of influencing CSR has now shifted to the employees themselves, who can spread the awareness to those they interact with on a regular basis (e.g., clients who are also members of the organization). Once the consumers have adopted the interests of the employees, they can continue to improve the awareness of CSR. Without smoothly incorporating CSR into its operations, employees will feel less obliged to promote the club's philosophies of CSR and, in turn, will have a limited effect on influencing this philosophy beyond that of the organisation.

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Shared Decision-making in Trauma and Emergency Surgery Settings: A Literature Review

Francesca Dal Mas[1], Maurizio Massaro[1], Sarah Woltz[2], Federico Ruta[3], Fausto Catena[4], Paola Fugazzola[5], Luca Ansaloni[5,6] and Lorenzo Cobianchi[5,6]
[1]Department of Management, Ca' Foscari University of Venice, Venice, Italy
[2]Department of Surgery, Spaarne Gasthuis, Hoofddorp, The Netherlands
[3]General Direction, ASL BAT (Health Agency), Andria, Italy
[4]Emergency and Trauma Surgery, Bufalini Hospital, Cesena, Italy
[5]General Surgery Department, IRCCS Policlinico San Matteo Foundation, Pavia, Italy
[6]Department of Clinical, Diagnostic and Pediatric Sciences, University of Pavia, Pavia, Italy
francesca.dalmas@unive.it
maurizio.massaro@unive.it
s.woltz@hotmail.com
federicorutabat@gmail.com
faustocatena@gmail.com
paola.fugazzola@gmail.com
luca.ansaloni@unipv.it
lorenzo.cobianchi@unipv.it

Abstract: Emergency teams are made up of professionals of different specialities, including emergency physicians, surgeons, anesthesiologists, and nurses. Such units are characterized by the need to face unexpected situations with little time to make clinical decisions. In trauma and emergency settings, clinicians must act in a coordinated way, ensuring, at the same time, proper knowledge transfer and sharing to reach the best possible result for the patient. While such dynamics must be explicit and clear within the team, involving the patient in the decision-making process may require additional tools and procedures. Indeed, the time to engage with the patient and the family to understand the patient's wishes and treatment preferences may be limited or absent at all. While the so-called shared decision-making (SDM) stands as one of the pillars of the modern patient-centric healthcare scenario, knowledge translation and transfer dynamics may appear particularly challenging in emergency settings. Starting from an investigation of the recent literature on SDM, the paper presents a literature review of the barriers, facilitators, and knowledge translation dynamics of SDM in trauma and emergency surgery. Results assess the importance, tools, and dynamics of SDM processes.

Keywords: Emergency teams, Patients' perspective, Surgery, Shared-decision Making, Knowledge translation

1. Introduction

Trauma and emergency surgery teams comprise a broad group of healthcare specialists who work together to deliver high-quality care under challenging circumstances, including emergency physicians, surgeons, anesthesiologists, and nurses. Knowledge management looks critical in trauma and emergency situations, with teams working under extreme stress and time pressures, with little awareness of the trauma's causes, the patient's identity, current circumstances or conditions, or care preferences (Cobianchi, Dal Mas, Massaro, Fugazzola, Catena, *et al.*, 2021). While team dynamics are crucial, knowledge translation and sharing processes appear strategic both within the team and in the relationship with the patients and their families (Cobianchi, Dal Mas, Massaro, Fugazzola, Coccolini, *et al.*, 2021). Trauma and emergency professionals may not have enough time to discuss with their patients about the treatment options, the current situation, or what they should expect in the short and long run (Stahel *et al.*, 2022).

The importance of shared decision-making (SDM) in patient-centred care is well acknowledged. SDM is a method in which healthcare providers and patients collaborate to make decisions based on the best available evidence while taking into account the patients' treatment preferences and values. SDM is expected to increase patient adherence to treatment and, as a result, health outcomes. In particular, SDM stands as the most promising option for preference-sensitive decisions. That is, decisions in which two or more similar treatment options exist and the optimum choice is based on how each patient values the risks and advantages of each treatment option (Mathijssen *et al.*, 2020). SDM stands as a pillar of patients' autonomy in contemporary health care. Therefore, physicians have the ethical and moral duty to support patients in making decisions that encompass their values

and priorities (Woltz *et al.*, 2018). Engaging in SDM means, for both physicians and patients, finding effective ways and tools of translating and sharing knowledge, despite their differences in terms of education, clinical mastery, feelings, and emotions (Graham *et al.*, 2006; Lemire *et al.*, 2013). The literature has underlined the importance of adequate tools to support such a process (Dal Mas, Garcia-Perez, *et al.*, 2020; Gibbon, 2011), especially the role of soft or non-technical skills to improve communication (Dal Mas *et al.*, 2021; Lepeley, 2021; Stahel *et al.*, 2022).

Recent studies have highlighted how, in trauma and emergency settings, the concept of SDM has proven to be complex to apply and measure in practice (Woltz *et al.*, 2018). While in some medical decisions, time pressure is so high to jeopardize the survival of the patients, other diagnoses may leave hours or more before the treatment starts, allowing physicians enough time to explain to the patients the various options, leading to an informed and shared decision about the next clinical steps.

The recent investigation by Woltz and colleagues (2018) through a survey in the Netherlands depicts how trauma surgeons generally recognize SDM as valuable for good patient care. Still, several participants show an evident lack of understanding of what SDM implies, with difficulties in accomplishing it.

Starting from investigating the recent literature on SDM in trauma and emergency surgery settings, the paper presents a literature review to explore the barriers, facilitators, and knowledge translation dynamics of SDM in trauma and emergency surgery.

2. Methodology

The paper employs a Structured Literature Review (SLR) approach, following the protocol developed by Massaro and colleagues (2016). SLRs offer a sound alternative to more "traditional" literature reviews such as systematic or bibliometric ones, as their findings stand more “defensible” and “replicable.”

A first preliminary research protocol was determined among the research team to describe the investigation process to make it reliable and reproducible for further research. Three main research questions (RQs) were identified:
RQ 1: What are the main features of the literature on SDM in trauma and emergency surgery?
RQ 2: What are the most frequent issues and themes of such literature?
RQ 3: What may be the possible research avenues?

The selection of academic sources was made from Scopus, namely one of the most prominent research datasets. The Scopus search was performed on January 9th, 2022, as "shared AND decision AND making AND healthcare AND emergency OR trauma AND surgery" in the Title, Abstract, or Keywords, leading to 21 results. We decided to limit the search to articles written in English, deleting sources like books, book chapters, and conference proceedings. 20 papers were selected. Two researchers (FD and LC) read all abstracts to select only articles related to the analyzed topics. A discussion between the researchers allowed us to determine which papers fitted the research agenda and which did not. Following the manual selection, 13 articles met the criteria defined in the research protocol. The 13 works were downloaded and coded through Nvivo. Figure 1 summarizes the selection process, while Table 1 reports the articles' details, including authors, title, and journal.

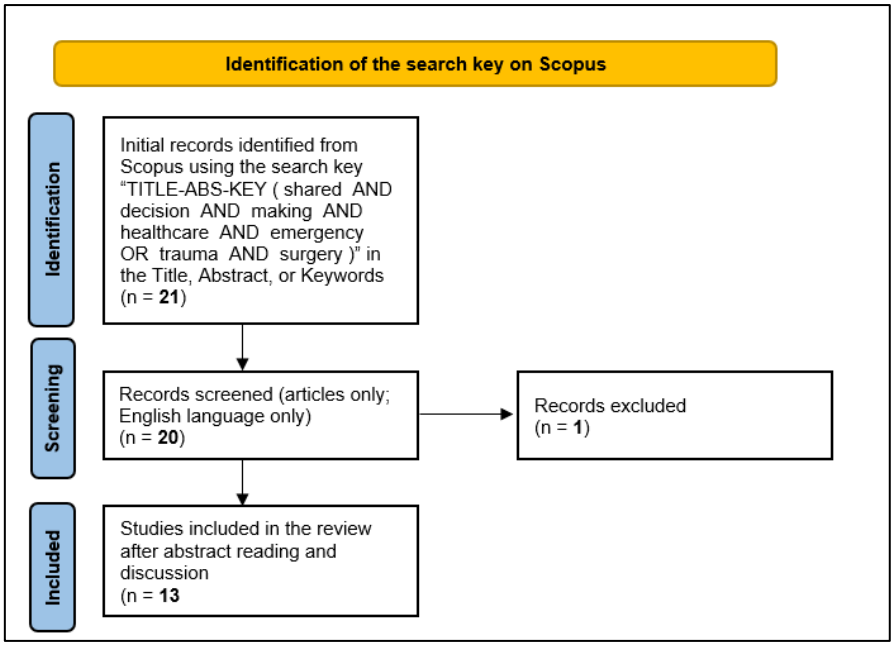


Figure 1: The selection process according to the SLR protocol (Massaro, Dumay, *et al.*, 2016) and PRISMA (Liberati *et al.*, 2009)

Table 1: The papers included in the study

#	Year	Authors	Title	Source title	Reference
1	2021	Abbasgholizadeh Rahimi, S., Rodriguez, C., Croteau, J., Sadeghpour, A., Navali, A.-M., Légaré, F.	Continuing professional education of Iranian healthcare professionals in shared decision-making: lessons learned	BMC Health Services Research	(Abbasgholizadeh Rahimi *et al.*, 2021)
2	2021	Brown, T.T., Hurley, V.B., Rodriguez, H.P.	Association of patient engagement strategies with utilisation and spending for musculoskeletal problems in the USA: a cross-sectional analysis of Medicare patients and physician practices	BMJ Open	(Brown *et al.*, 2021)
3	2021	Thunnissen, F.M., Drager, L.D., Braak, B., Drenth, J.P.H., Van Laarhoven, C.J.H.M., Schers, H.J., De Reuver, P.R.	Healthcare utilisation of patients with cholecystolithiasis in primary care: A multipractice comparative analysis	BMJ Open	(Thunnissen *et al.*, 2021)
4	2021	Nieuwstraten, J.A., van Doorn, L.P., Gebhardt, W.A., Hamming, J.F.	Stakeholder values and preferences in lower limb amputation for no-option chronic limb threatening ischemia	Patient Preference and Adherence	(Nieuwstraten *et al.*, 2021)
5	2020	Prachand, V.N., Milner, R., Angelos, P., Posner, M.C., Fung, J.J., Agrawal, N., Jeevanandam, V., Matthews, J.B.	Medically Necessary, Time-Sensitive Procedures: Scoring System to Ethically and Efficiently Manage Resource Scarcity and Provider Risk During the COVID-19 Pandemic	Journal of the American College of Surgeons	(Prachand *et al.*, 2020)
6	2019	Newcomb, A.B., Allred, C., Grove, C., Newcomb, H., Mohess, D., Griffen, M.M., Dort, J.	Surgeon Communication and Family Understanding of Patient Prognosis in Critically Ill Surgical Patients: A Qualitative Investigation Informs Resident Training	Journal of Surgical Education	(Newcomb *et al.*, 2019)

#	Year	Authors	Title	Source title	Reference
7	2019	Bottle, A., Parikh, S., Aylin, P., Loeffler, M.	Risk factors for early revision after total hip and knee arthroplasty: National observational study from a surgeon and population perspective	PLoS ONE	(Bottle *et al.*, 2019)
8	2018	Heiss, K.F., Raval, M.V.	Patient engagement to enhance recovery for children undergoing surgery	Seminars in Pediatric Surgery	(Heiss and Raval, 2018)
9	2016	Schalkers, I., Parsons, C.S., Bunders, J.F., Dedding, C.	Health professionals' perspectives on children's and young people's participation in health care: A qualitative multihospital study	Journal of Clinical Nursing	(Schalkers *et al.*, 2016)
10	2015	Janssen, S.J., Teunis, T., Guitton, T.G., Ring, D., Spoor, A.B., Chauhan, A., et al.	Do surgeons treat their patients like they would treat themselves?	Clinical Orthopaedics and Related Research	(Janssen *et al.*, 2015)
11	2015	Tighe, P., Buckenmaier, C.C., Boezaart, A.P., Carr, D.B., Clark, L.L., Herring, A.A., Kent, M., Mackey, S., Mariano, E.R., Polomano, R.C., Reisfield, G.M.	Acute Pain Medicine in the United States: A Status Report	Pain Medicine (United States)	(Tighe *et al.*, 2015)
12	2014	Parmar, A.D., Coutin, M.D., Vargas, G.M., Tamirisa, N.P., Sheffield, K.M., Riall, T.S.	Cost-Effectiveness of Elective Laparoscopic Cholecystectomy Versus Observation in Older Patients Presenting with Mild Biliary Disease	Journal of Gastrointestinal Surgery	(Parmar *et al.*, 2014)
13	2013	Lee, J.K., Keam, B., An, A.R., Kim, T.M., Lee, S.-H., Kim, D.-W., Heo, D.S.	Surrogate decision-making in Korean patients with advanced cancer: A longitudinal study	Supportive Care in Cancer	(Lee *et al.*, 2013)

One vital step in developing an SLR is setting the framework of analysis. In our study, the nodes used in the coding process are mainly inspired by previous SLR papers and adapted to the specific field of investigation.

The first category relates to the Author type, differentiating among academics, practitioners, or both, as recommended by other studies (Dal Mas *et al.*, 2019). Although academic surgeons are usually engaged in clinical activities, we thought measuring the degree of collaboration with non-academic parties would be worth it.

The second category refers to the location where the study is conducted (Massaro *et al.*, 2015; Massaro, Handley, *et al.*, 2016) to understand if there are some underinvestigated areas.

Considering SLRs tailored to the healthcare sector (Dal Mas, Garcia-Perez, *et al.*, 2020), the following three categories attempt to map the sector type (public vs private vs general), the specific medical speciality, and the diagnosis or disease reported in the articles. Such nodes were managed according to an open coding approach, adding new children codes when found in the analyzed paper.

The category that follows is about the research method (Dal Mas *et al.*, 2019; Massaro *et al.*, 2015; Massaro, Handley, *et al.*, 2016) to see which research methodologies are mostly employed by the authors.

Other nodes contemplate the features of the topic under investigation, namely the presence (or not) of a definition of SDM, the decision aids and knowledge translation tools recommended, the stakeholders involved, the type of impact recognized, and the eventual presence of facilitators and barriers in the SDM process.

Each article included in the list was coded following the framework as mentioned above. A discussion between two of the researchers (FD and LC) followed the initial coding to arrive at the list and results reported in Table 2.

Table 2: Coding framework and results of the coding

Node name	Files	%
01_Author type	13	
Scholars	10	76.92%
Both practictioners and scholars	2	15.38%
Practictioners	1	7.69%
02_Location of the study	13	
USA	6	46.15%
The Netherlands	3	23.08%
Korea	1	7.69%
The UK	1	7.69%
Iran	1	7.69%
No specific location	1	7.69%
03_Sector type	13	
Healthcare or surgery in general terms	7	53.85%
Public sector	6	46.15%
Private sector	0	0.00%
04_Healthcare sector	13	
General surgery	6	46.15%
Orthopedics	4	30.77%
Surgical oncology	1	7.69%
Acute pain medicine	1	7.69%
General practice	1	7.69%
05_Type of disease	13	
Hip and knee surgery	3	23.08%
Trauma surgery	2	15.38%
Pediatric surgery	2	15.38%
Cholecystolithiasis	2	15.38%
Poor prognosis in ICU	1	7.69%
Elective interventions	1	7.69%
Limb amputation for no option chronic ischemia	1	7.69%
Advanced cancer	1	7.69%
06_Research method	13	
Qualitative semi structured interviews	3	23.08%
Other quantitative - scoring	2	15.38%
Retrospective analysis of registry data	2	15.38%
Quantitative cross sectional	2	15.38%
Expert opinion	1	7.69%
Narrative review	1	7.69%
Logistic regression	1	7.69%
Observational quantitative study	1	7.69%
07_Definition of shared decision making	13	
No	11	84.62%
Yes	2	15.38%
08_Decision aids and knowledge translation tools	13	
Non-technical skills	*12*	
Empathy	3	23.08%
High quality communication	3	23.08%
Upfront and open communication	3	23.08%
Multidisciplinary collaboration	3	23.08%
Design elements	*5*	
Videos	3	23.08%
Clinical vignette	2	15.38%
Organizational and process tools	*3*	
Checklist including daily family updating	2	15.38%
Patient and Family Handbooks	1	7.69%
Scoring and clinical methods	*4*	
Scoring methods and open access datasets	2	15.38%
Evidence based treatments	1	7.69%
Pain passport	1	7.69%

Node name	Files	%
Human Resource-based methods	*2*	
Facilitators, eg play specialists for children	1	7.69%
Counseling	1	7.69%
09_Type of stakeholders	13	
Patients	11	84.62%
Healthcare professionals	11	84.62%
Hospitals	7	53.85%
Families	4	30.77%
Caregivers	2	15.38%
Private pharma companies	1	7.69%
10_Type of impact	13	
Better clinical outcomes	5	38.46%
Manage expectation	4	30.77%
Limit surgery	4	30.77%
Better patient management	4	30.77%
Stimulating patient centric care	3	23.08%
Patient empowerment and coproduction	3	23.08%
Better hospital experience for patients and families	2	15.38%
Aligning patients preferences with treatment options	1	7.69%
Cost reduction	1	7.69%
According to ethics and moral norms	1	7.69%
11_SDM Facilitators	13	
Yes	7	53.85%
Resource-based Tools	*11*	
Availability of resources	3	23.08%
Managerial support	3	23.08%
Training	3	23.08%
Availability of data	1	7.69%
Availability of time	1	7.69%
Non-technical skill-based Tools	*2*	
Personal beliefs and values	1	7.69%
Patients and healthcare professionals' motivation	1	7.69%
Process-based Tools	*2*	
Scoring system	1	7.69%
Consultations and second opinions	1	7.69%
No	6	46.15%
12_SDM Barriers	13	
01_Yes	8	61.54%
Non-technical skill-based Barriers	*10*	
Misunderstanding between patients and professionals	3	23.08%
Fear of unnecessarily frightening patients	2	15.38%
Lack of multidisciplinary collaboration	2	15.38%
Cultural issues and mindsets	2	15.38%
Fear of leading to distrust	1	7.69%
Resource-based Barriers	*9*	
Time constrains	3	23.08%
High patient load	3	23.08%
Lack of studies and training	2	15.38%
Lack of sleep	1	7.69%
Process-based Barriers	*1*	
Previous negative experience	1	7.69%
Situation-based Barriers	*2*	
COVID pandemic	1	7.69%
Conflicts of interest eg pharma companies	1	7.69%
No	5	38.46%

3. Findings, insights, and critique

The following section aims at answering the following RQs:
RQ 1: What are the main features of the literature on SDM in trauma and emergency surgery?

RQ 2: What are the most frequent issues and themes of such literature?

3.1 Author type

Most of the papers are written by academics. Still, a couple of works were co-authored along with practitioners.

3.2 Location of the study

There are just a few locations mentioned in the selected articles. Interesting enough, almost half of the studies were conducted in the USA (46%) and three of them in the Netherlands (23%).

3.3 Sector type, healthcare sector, and type of disease

No studies are specifically conducted in the private sector. All articles report the experience of public hospitals, or they discuss the topic in general terms. Said that, all the papers refer to hospital settings, and the different types of healthcare services (being it national like in most European countries or private as in the USA) should be taken into account.

Regarding the specific specialities, most contributions were developed within the context of general surgery (6 articles, equal to 46% of the sample) and orthopedics (4 articles, 30% of the sample).

Concerning the type of disease, several are mentioned, although hip and knee surgery are reported in three research pieces (Abbasgholizadeh Rahimi *et al.*, 2021; Bottle *et al.*, 2019; Brown *et al.*, 2021).

3.4 Research methods

The sample shows a variety of different research methodologies. The most common one is represented by qualitative semi-structured interviews with three papers. Other methods include scoring, retrospective analysis of registry data, quantitative cross-sectional, expert opinions, narrative reviews, quantitative logistic regression, and quantitative observational studies.

3.5 Definition of SDM

Only two papers define SDM as a concept, while all the remaining pieces give its definition for granted. The following Table 3 reports the definitions provided by the authors.

Table 3: Definitions of SDM

Definition of SDM	Reference
Shared decision making (SDM) is a collaborative process in which patients and healthcare professionals make healthcare decisions based on the best available evidence and on patients' priorities	(Abbasgholizadeh Rahimi *et al.*, 2021, p. 2)
Exploring patient values and preferences (shared goal-setting)	(Nieuwstraten *et al.*, 2021, p. 1051)

3.6 Decision aids and knowledge translation tools

All the papers included in the sample report some decision aids and tools to support the connection and understanding between medical staff and patients, allowing the effective translation of knowledge. The decision aids and knowledge translation tools have been divided into five categories: non-technical skills, design elements, organizational and process tools, scoring and clinical methods, and human resource-based methods. In agreement with the recent literature (Dal Mas, Garcia-Perez, *et al.*, 2020), several studies (3 items each) recommend using empathy, high-quality communication, upfront and open communication, and multidisciplinary collaborations. In all, non-technical or soft skills (Dal Mas *et al.*, 2021; Yule and Smink, 2020) stand as central elements to facilitate the effective exchange of knowledge to allow the patients to understand and co-decide the treatment path. Other meaningful tools come from design elements (Dal Mas, Biancuzzi, *et al.*, 2020), including videos (3 items) and clinical vignettes (2 items), which proved to be particularly useful in professional education (Abbasgholizadeh Rahimi *et al.*, 2021). More formal and technical instruments are also mentioned, including checklists, scoring methods and open-access datasets, and patient and family handbooks.

3.7 Type of stakeholders

Besides the clinical staff and patients, other stakeholders are mentioned, including patients' families and caregivers and hospitals, as SDM can contribute to costs reductions (Brown *et al.*, 2021).

3.8 Type of impact

The articles mention several different types of impact that SDM can bring. The following Table 4 reports such effects with some examples grabbed from the sample.

Table 4: Type of impact

Type of impact	#	Reference	Example
Better clinical outcomes	5	(Tighe *et al.*, 2015, p. 2)	SDM can "facilitate and enhance the quality of patient recovery after surgery, illness, or trauma."
Manage expectation	4	(Thunnissen *et al.*, 2021, p. 1)	"The mediocre outcome of cholecystectomy supports the need for better patient selection for surgery and to better inform patients in order to manage expectations."
Limit surgery	4	(Parmar *et al.*, 2014, p. 1616)	"An individualized shared decision-making strategy based on these data can increase elective cholecystectomy rates in patients at high risk for recurrent symptoms and minimize unnecessary cholecystectomy for patients unlikely to benefit."
Better patient management	4	(Heiss and Raval, 2018, p. 86)	SDM can facilitate "effective team function and focused oversight of patient flow through the system."
Stimulating patient-centric care	3	(Brown *et al.*, 2021, p. 1)	SDM can "support the provision of patient- centred care."
Patient empowerment and coproduction	3	(Janssen *et al.*, 2015, p. 3571)	SDM gives "patients more autonomy by letting them balance risks and benefits themselves."
Better hospital experience for patients and families	2	(Newcomb *et al.*, 2019, p. e84)	"Family members' descriptions of encounters with physicians suggest they exert significant influence on their experience of the hospital, stress level, and understanding of the patient's condition."
Aligning patients preferences with treatment options	1	(Brown *et al.*, 2021, p. 1)	SDM allows aligning "patients' preferences with treatment options."
Cost reduction	1	(Brown *et al.*, 2021, p. 1)	SDM allows potential reducing "spending."
According to ethics and moral norms	1	(Abbasgholizadeh Rahimi *et al.*, 2021, p. 5)	Practising SDM is "highly acceptable and in accordance with [Iranian] moral values (moral norm)."

3.9 Facilitators

The facilitators reported in the selected articles have been divided into the following categories: resource-based tools, non-technical skill-based tools, and process-based tools. Half of the articles (7 items, 53% of the sample) reports the usefulness of some facilitators or enablers to enhance the SDM process. Among the most common ones, we can mention the availability of resources, managerial support, and training (3 items each). Other facilitators include the availability of data, personal beliefs and values, the presence of a scoring system, the availability of time, consultations and second opinions by colleagues, and motivation of both personnel and patients.

3.10 Barriers

The barriers found in the selected papers have been categorised as follows: non-technical skill-based barriers, resource-based barriers, process-based barriers, and situation-based barriers. Eight papers out of 13 (61%) mention the presence of barriers to effective SDM. Among the most common ones, we can report the misunderstanding between patients and professionals, time constraints in managing the communication, and high patient loads by physicians (3 items each). Other issues include the fear of unnecessarily frightening patients, the lack of multidisciplinary collaboration, the lack of studies and training, and cultural issues and mindsets (2 items each). Some papers also mention the lack of sleep by surgeons, previous negative experiences in discussing with the patients, the fear of leading to distrust in the relationship between medical doctors and patients, conflicts of interest (like with pharma companies) and the emergencies brought by the recent COVID-19 pandemic (Cobianchi *et al.*, 2020; Romani *et al.*, 2021) (1 item each).

4. Discussion and conclusions

This section aims to discuss the findings and reply to RQ 3: What may be the possible research avenues?

Our investigation underlines the importance of SDM in the modern patient-centric healthcare system, in which discussing with the patient stands as an ethical and moral duty for the physicians involved. Still, not all medical specialities seem suitable for SDM. In trauma and emergency surgery, multidisciplinary teams must take care of patients in challenging situations, with a lack of information and often no time or chance to engage the patient in the clinical decision-making process. In such circumstances, knowledge translation and sharing dynamics appear crucial (Cobianchi, Dal Mas, Massaro, Fugazzola, Catena, *et al.*, 2021). The recent literature (Woltz *et al.*, 2018) has underlined several lacks for trauma and emergency surgeons to employ SDM with their patients, even when the time or diagnosis would allow them to do so. The study conducted by Woltz and colleagues (2018) called for training to educate surgeons about what SDM entailed.

Our literature search according to the SLR protocol allowed us to find a limited number of articles published in the field. Interesting enough, even with a little sample, some interesting insights could be defined, opening up to future research avenues.

Most papers are authored by academic professionals, calling for more cooperation with clinicians outside the academic environment or university hospitals. Some countries like the USA and the Netherlands are investigated, while many more global areas do not report any practical experiences. The research methods vary. However, many articles employ qualitative methodologies, which seem more suitable for describing in-depth cases. The hospital setting appears to be the preferred ambience in which investigating and measuring the SDM dynamics. Still, just a few papers describe emergencies with little time to engage with the patients. That is why the majority of articles refer to orthopaedics, in which physicians have more time before starting surgical intervention or other clinical options.

The decision aids and knowledge translation tools defined in the selected papers lead to some fascinating findings. In accordance with the recent literature (Dal Mas *et al.*, 2021; Dal Mas, Garcia-Perez, *et al.*, 2020), soft or non-technical skills are crucial to engaging with the patients, despite the differences in terms of education, medical knowledge, and feelings. Still, even technical and visual tools are mentioned, like checklists, which would remind the clinical staff, including residents, to refer to the patient or the family/caregivers about the current conditions and progress (Newcomb *et al.*, 2019). Notably, such more technical tools like checklists and scores are little related to modern technologies. New research avenues should investigate how web-based applications and other high-tech means may support and facilitate the relationship between medical doctors and patients, even in emergency settings.

Among the impacts, in agreement with the findings of Woltz et al. (2018), SDM is recognized as a very relevant element in ensuring the best possible clinical outcome, the patient-centric philosophy, and the co-production dynamics. Savings and cost reductions for hospitals and the national healthcare system are also generated, as an in-depth discussion with the patient may avoid the surgical option, especially when the clinical results are uncertain or particularly risky.

The identification of facilitators and barriers is also helpful to both academics and practitioners. While training stands as the most recommended strategy, time and resources constraints limit the possibility of the medical doctor in charge to discuss profitably with the patient. When the patient- and workload is high, the chance to devote time to the single patient needing to choose among various clinical options is limited. Counselling may represent a good facilitator for physicians to learn how to translate knowledge for their patients to manage their expectations and guide them in their informed choice.

In the end, while SDM is desirable in a patient-centric scenario, knowledge translation dynamics appear still difficult in trauma emergency settings, and clinicians should be provided with enough knowledge and technical resources to meet such an ethical duty as much as possible. Empirical investigations and best practices are needed to study the phennomenon further, leading to practical implications.

Like all pieces of research, our paper has limitations. Although SLRs are among the most rigorous literature review methodologies, our sample is modest, and the choice of the keywords may have excluded some valuable contributions. Moreover, excluding sources like books, book chapters, conference proceedings, or peer-reviewed articles in languages different from English may be questionable. Other search keys could be employed to enlarge the analyzed sources and the final results.

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FDI Spillover Channel and its Effect on Innovation

Raymond Darfo-Oduro and Jan Stejskal
Faculty of Economics and Administration University of Pardubice, Czech Republic
raymond.darfo-oduro@upce.cz
jan.stejskal@upce.cz

Abstract: In an increasingly globalized environment, one of the important aspects for knowledge development and usage has been the advantage of benefiting from knowledge spillover across international boundaries. The knowledge literature recognizes the importance of the combining internal and external knowledge in the innovation process. Knowledge spillover from abroad is an important channel of external knowledge needed to complement the innovation activities in the domestic economies of countries. However, the complementarities of external knowledge and domestic innovation activities also remains a thorny issue that remain unresolved in the knowledge literature. On one hand, there is a believe that combinatorial efforts of domestic and foreign knowledge activities are a good recipe for innovation. There are other strands of literature that are concerned that when foreign knowledge is not complementary with domestic innovation activities increased innovation may not be realized. Contrary to the widely held view of the positive impact of FDI on host economies, the literature shows a rather complex relationship between FDI and economic outcomes in V4 countries. OECD countries, being the main trading partners of V4 countries, the study therefore investigates the FDI channel for knowledge spillover from OECD countries and how such knowledge spillover complements V4 countries innovation activities to affect innovation outcomes. Data for the study is panel data on the V4 countries, spanning 2003 to 2012 which is sourced from the OECD database. The study applies panel regression analysis and controls for country and time fixed effect to determine the role of FDI knowledge spillover from OECD countries on innovation outcome in V4 countries. The findings of the study indicate that proportionate change in innovation is greater than a proportionate change in FDI knowledge spillover in the opposite direction. The results of the analysis show that knowledge spillover from FDI does not complement V4 countries' internal R&D activities to improve innovation. FDI knowledge spillover channel is not a good complement to domestic R&D activities to enhance V4 countries' innovation performance. It is concluded that, FDI knowledge spillover channel does not complement innovation activities to improve innovation outcome. The study provides useful practical implications and recommendations.

Keywords: FDI, Knowledge Spillover, Innovation, R&D intensity, Visegrad 4 countries

1. Introduction

The enormous channels of knowledge spillover and their role in innovation have not received the attention they require to be able to address the challenges of innovation performance in economies. There is consensus among authors that FDI provides an important channel through which knowledge from abroad is transferred to other economies (Kayani, et al., 2021). The Visegrad Four (V4) countries have relied so much on Foreign Direct Investment (FDI) as a channel to bring into their economies skilled intensive activities (Capik & Drahokoupil, 2011). The literature has been focused more on FDI projects with limited attention on the knowledge spillover that comes with FDI (Vojtovic, et al., 2019; Mallick & Zdražil, 2018). Considering the importance of innovation and the need to broaden the sources of innovation (hylinska, et al., 2020), it has become imperative to consider the foreign knowledge spillover channel to enhance innovation performance in the V4 countries. Technological diffusion has been linked to FDI to host country (Vojtovic, et al., 2019) making it important source of innovation for countries such as the V4 that are making effort to improve their innovation performance. As V4 countries continue to make efforts to transform their economies to knowledge driven economies, the current study provides new insights into how this objective can be realized by considering FDI knowledge spillover channel. In this study therefore, the role of FDI and its moderating effect on the relationship between R&D intensity and innovation performance is investigated.

2. Theoretical Background

2.1 Foreign Direct Investment and Innovation

Knowledge spillover from FDI is a source of knowledge transfer from foreign firms into domestic economies for innovation (Todo & Miyamoto, 2006). In a study by Hoang, et al.(2021) on the spillover effect of FDI on technology innovation in Vietnam, the authors used survey data on 3,166 enterprises in Vietnam. It has also been argued that the quality of human capital is important in determining the impact of FDI knowledge spillover on innovation performance of economies (Ali, et al., 2016). Several other factors have accounted for the effectiveness of FDI spillover. Branstetter (2006) has shown for example that in the USA, Japanese FDIs are aimed at exploiting technologies in the USA as strategy to stay competitive in their home country. Thus, the type of FDI

and the reasom for establishing a subsidiary in a foreign land is an important reason why some FDIs may not ensure knowledge spillover. Some other considerations for the effectiveness of FDI knowledge spillover have been cited in the literature. The posture of firms in the recipient towards inflow of FDI is an important determinant of the effect FDI knowledge spillover will have on the innovation performance of the recipient country. Hongling, et al. (2006), in their study to determine whether FDI inflows hamper technology development of host countries, the study revealed some pertinent issues worth highlighting. The findings of the study showed that host countries consider knowledge spillover from FDI as a substitute to domestic R&D effort. Diruptive technologies have been observed to conflict with dominant technologies of the host countries (Liu, et al., 2020). Thus, knowledge spillover from FDI channels will lead to innovation only when the foreign technology does not seek to replace but complement existing technologies.

In the context of V4 countries, there is empirical evidence of FDI Knowledge spillover. The main trading partners of the V4 countries, Russia, Ukraine, Italy, Great Britain, Germany, Austria, Romania and France (Babunek, 2012). The structural characteristics and location has positioned these 4 countries and given the capacity to attract Multinational Enterprises (MNE) (Altomonte & Guagliano, 2003). The low labour cost and high labour productivity in V4 countries have been the basis for increased FDI inflows (Jablonska, 2020). With increasing industrialisation of V4 countries, high R&D investment and efforts to increase knowledge transfers from the large MNE in the V4 countries, it is argued that increasing FDI knowledge spillover inflows can expalin changes in innovation performance in V4 countries. It is therefore postulated for testing the following hypothesis:
H_1: FDI knowledge spillover inflows to V4 countries is significantly related to changes in innovation performance

2.2 R&D Intensity and Innovation

Characteristically, contrary to countries where the literature focuses on, such as western developed countries and Asian countries where there are large firms which have better capacity to engage in and utilize R&D (Audretsch, 1988), the V4 countries have large SME sector. It is therefore important to access how the large SME sector can translate R&D activities into innovation outcome. There is generally an agreement among authors that engaging in R&D ensures increased innovation (Prokop & Stejskal, 2019). Countries that have shown commitment to R&D investments have seen rapid increase in innovation whilst those that have not witnessed very moderate, little or no innovation (Stejskal, et al., 2018).

In a study by Krammer (2009), the determinants of innovation was investigated based on data from sixteen Eastern European Countries including V4 countries. The findings of the study showed that the complementarity between national knowledge base and R&D is important in ensuring enhanced innovation performance. It is therefore clear at this point that R&D, even though, a cine quanon for innovation, it must be compatible with any other knowledge base within the economic system to ensure innovation.

Emprical findings that indicate positive relationship between R&D intensity and innovation dominates the literaure. In the league of these studies include Love and Mansury (2007) who showed that R&D is important conduit to improving innovation in US business services. In Visegrad 4 countries, there has been an increased investment in R&D (Jablonska, 2020) and related studies have shown that rising investment levels have enhanced innovation performance (Odei, et al., 2020). In this study, based on the position of the literature and as a necessary precursor to accessing the moderating effect of FDI knowledge spillover channel in the relationship between R&D intensity and innovation performance, the following hypothesis is stated for testing:
H_2: R&D intensity of Visegrad 4 countries is significantly related to their innovation performance

2.3 Moderating Effect of FDI Spillover Channel in the Relationship between R&D Intensity and Innovation

Even though there is evidence to suggest that R&D is an important determinant of innovation performance of countries, the literature also recognises that R&D of countries are not the only source of knowledge but other knowledge sources such as knowledge spillover from FDI combines with internal R&D to affect innovation (Prokop, et al., 2021; Akinwale, 2018). One of the reasons why countries have not been able to advance innovation despite increased inflow of imported knowledge through trade and FDI is the inability to assimilate imported knowledge (Akinwale, 2018). Knowledge inflows to domestic economies have been a major determinant of innovation performance in domestic economies alongside internal R&D efforts (Ali, et al., 2016). It has however, been shown that the compatibility and complementarity between foreign knowledge and internal R&D of the domestic economies is important in ensuring innovation performance (Qiua, et al., 2017). Wang and Wu (2016) in a study to assess how innovative activities of foreign firms influence innovation performance in the domestic economy, the findings of the study showed that FDI knowkedge spillover effect on

innovation in the domestic economy is positive and is reenforced by domestic innovative activities. Thus, the interaction between foreign knowledge spillover with innovation activities in the domestic economy to positively influence innovation.

The economic gains of Visegrad 4 countries have made them destination for FDI (Lomachynska, et al., 2020). Visegrad 4 countries have benenfted from inflows of FDI from its trading partners mainly the OECD countries with considerable amount of FDI knowledge spillover (Capik & Drahokoupil, 2011). Considering the high investment in R&D among the Visegrad 4 countries (Jablonska, 2020), the innovation process in Visegrad 4 countries must necessarily involve the combination of both internal R&D and FDI knowledge spillover. The study therefore tests the following hypothesis:
H_3: FDI moderates the relationship between R&D and innovation performance in V4 countries.

3. Data and Methodology

Data for the study is sourced from OECD database. The data is a panel data on Visegrad 4 countries of Czech, Republic, Hungary, Slovakia and Poland spanning from 2003 to 2012. The data is a country level data on patent count, trade openness, FDI knowledge spillover and R&D intensity. The heterogeneity of economic openness of these countries is recognized and taken advantage of by estimating the relationship based on panel data analysis and controlling for unobserved country fixed effect. In this study, besides controlling for unobserved fixed effect, being panel data, the cross-sectional nature of the data imposes some challenges on the performance of the regression models which requires remedy. To deal with cross sectional dependence to improve the consistency of the regression model, Seemingly Unrelated Regression (SUR) estimation using Feasible Generalised Least Square (FGLS) is employed. This is inspired by Zellner (1962) who argued that SUR estimation using FGLS is an important approach to dealing with cross-sectional dependence in panel regression model. Again, endogeneity of regressors is known to introduce biasness into regression model (Rehman, et al., 2020). To ensure the robustness of the regression model and to deal with the endogeneity in the regression model, Panel Two Stage Least Square (PTSLS) using the one lag period of the regressors and lag dependent variable as instruments. Panel Two Stage Least Square is inspired by Wooldridge, (2002) who touts the gains of PTSLS in addressing the challenges of endogeneity.

3.1 Empirical Model and Measures

The study links innovation to innovation activities such as R&D intensity and other determinants of innovation such as trade openness, technological capabilities of a country and a control for country specific fixed effect. The logic of this model is that R&D intensity, being a measure of research capability of countries, it is expected to translate into country's innovation performance. This agrees with empirical studies cited in the knowledge literature (Tsung-chun, et al., 2019). The link between technological capabilities of a country and innovation assumes that technological capabilities of a country is important in determining the extent of innovation in a country. Innovation is based on existing technological knowhow of a country (Schumpeter, 1947). Trade openness is a measure of the extent to which an economy is linked to other economies or opened to international trade (Hu, et al., 2021). This is considered as a channel through which external knowledge is imported into an economy. In this study knowledge spillover from Foreign Direct Investment (FDI) is considered as a moderator in the relationship between R&D intensity and innovation. Panel regression estimation technique is used to estimate the regression that links innovation to trade openness, technological progress and R&D intensity:

$$Inn_{it} = \beta_0 + \beta_1 logtrade_{it} + \beta_2 logtechprogress_{it} + \beta_3 Country_i + \beta_4 logR\&D_{it} + e_{it} \quad (1)$$

where logtrade is the natural log of trade openness, logtechprogress is natural log of technological progress, country is country specific fixed effect and logR&D is the natural log of R&D intensity whilst inn is innovation performance. The disturbance term is represented by e. Country and time dimensions of the panel data are represented by i and t respectively.

The study, recognising the cross sectional nature of the regression model, anticipates the possibility of the model being cross sectionally dependent. The study therefore tests for the presence of cross sectional dependence using Breusch Pagan LM test.

To correct for the presence of cross sectional dependence, equation 1 is re-estimated with Seemingly Unrelated Regression using Feasible Generalised Least Square. It is argued that the FGLS estimates are efficient in the presence of serially correlated error terms (Rao & Griliches, 1969; Bai, et al., 2021).

The study also investigates the effect of FDI Knowledge spillover channel on innovation of the Visegrad four countries innovation performance. The model is estimated using Panal Least Square and controlled for country specific fixed effect. The model is specified without R&D intensity for a good reason. The study aims to determine the moderating effect of FDI knowledge spillover channel on the relationship between R&D intensity and innovation. It is therefore important to determine the separate effect of R&D intensity and FDI knowledge spillover channel on innovation before estimating the moderating effect. Model 3 is therefore specified as follows:

$$Inn_{it}=\beta_0+\beta_1 Inn_{it}+\beta_2 logtrade_{it}+\beta_3 logtechprogress_{it}+\beta_4 Country_i+\beta_5 FDIspill_{it}+e_{it} \quad (2)$$

The study also contend with endogeneity in the regression model after subjecting the regression model to Wald test. Dynamic Panel Two Stage Least Square estimation is used. The model used one period lag of the regressors and one period lag dependent vatiable as instruments. This is consistent with (Serrasqueiro, et al., 2016; Reed, 2015) who showed that lags of dependent and expalanatory variables are important instruments for 2SLQ in dealing with endogeneity. The regression model for the Dynamic Panel Two Stage Least Square is specified as below in equation 3:

$$Inn_{it}=\beta_0+\beta_1 Innovation_{it-1}+\beta_2 logtrade_{it-1}+\beta_3 logtechprogress_{it-1}+\beta_4 Country_i+\beta_5 logR\&D_{it-1}+e_{it} \quad (3)$$

Equation 3 tests effect of technological progress and R&D intensity on innovation performance. The regression control for trade openness and country specific fixed effect.
In testing for the moderating effect of FDI knowledge spillover channel in the relationship between R&D intensity and innovation performance the study estimated another Panel Two Stage Least Squares in equation 4:

$$Inn_{it}=\beta_0+\beta_1 Inn_{it-1}+\beta_2 logtrade_{it-1}+\beta_3 logtechprogress_{it-1}+\beta_4 Country_i+\beta_5 logR\&D_{it-1}*FDIspill_{it}+e_{it} \quad (4)$$

Variables are mentioned in Table 1.
Equation 4 is re-estimated to control for the financial crisis of 2008 to 2012. The idea is to assess whether the global financial crisis have an effect on the moderating effect of FDI knowledge spill-over in the relationship between R&D intensity and innovation.

Table 1: Variables

Variables	Measures
Innovation	Patent application Count
R&D Intensity	Gross expenditure on R&D/GDP
FDI knowledge spillover	$(FDI\ inflows_i*R\&D_i)/GDP_j$ i=trading partners, j=host country
Trade openness	(import+export)/GDP
Technological progress	Labour productivity

Source: OECD Data Base

4. Results and Discussion

The results of the data analysis are presented in Tables 2 and 3. Table 2 presents three models. Model 1 estimates the relationship between R&D intensity and innovation performance using panel least square estimation technique. Model 2 is the same model as in model 1. However, model 2 is estimated using generalized least square to deal with the problem of cross-sectional dependence. Model 3 estimates the effect of FDI Knowledge spillover on innovation. The regression results from Table 2 links innovation to its key determinants, R&D intensity and trade openness and an important knowledge spillover channel, FDI knowledge spillover as an independent variable and a moderator.

Table 2: Relationship Between R&D intensity, trade openness, FDI Knowledge spillover channel and innovation

Variables	Model 1 (PLS) **Innovation**	Model 2 (FGLS Cross sec. SUR) **Innovation**	Model 3 (PLS) **Innovation**
Intercept	-28.22722** (12.09953)	-22.64573 (13.02418)	-15.75188* (8.309859)
Trade openness	0.611871***	0.595759***	1.365287***

Variables	Model 1 (PLS) **Innovation**	Model 2 (FGLS Cross sec. SUR) **Innovation**	Model 3 (PLS) **Innovation**
	(0.091712)	(0.093819)	(0.259356)
Techprogress	19.57754*** (5.628806)	17.16162*** (6.039463)	2.371955*** (0.900207)
Country dummy	yes	yes	yes

As expected, the findings of the analysis in model 1, estimated using panel least square estimation technique controlling for country fixed effect shows that the log of trade openness, the log of technological progress and the log of R&D intensity are significant at 1% significant level. The model is also significant at 1% significant level. Model 1 explains 97.7% of the variation. However, the Breusch Pagan LM test for cross sectional dependence in model 1 shows that the disturbance terms are correlated. Generalised least square estimation technique is employed to improve the performance of the regression in model 2. Model 2 presents similar results as model 1 but eliminates the cross-sectional dependence in the model. Model 2, however, fails the endogeneity test based on Wald test.

Table 2: Relationship Between R&D intensity, trade openness, FDI knowledge spillover channel and innovation

R&D Intensity	1.186394*** (0.163175	1.354034*** (0.115657)	
FDIspill			-0.543030*** (0.213622)
R-Squared	0.976683	0.970157	0.950517
Adjusted R Square	0.972443	0.964731	0.941520
F-Statistics (Prob)	230.3758***	178.7995***	105.6491***
Breusch Pagan LM Probability	7.860583 0.000000***	7.082562 0.3133	0.042207 0.979117
Durbin Watson	1.724383	2.011232	1.430873
Observation	40	40	40

Standard errors in parentheses; *P< 0.1, **P<0.05, ***P<0.01. Dependent variable is patent count. Both dependent and independent variables are in log

Model 3 tests hypothesis H_1 and confirms that there is a significant relationship between FDI knowledge spillover and innovation performance. The results from model 3 indicates that a proportionate change innovation performance is greater than a proportionate change in FDI knowledge spillover in the opposite direction. The model links FDI knowledge spillover to innovation performance. Model 3 is robust as it shows an insignificant Breusch Pagan LM test indicating the absence of cross-sectional dependence. Wald test also showed the absence of endogeneity. Panel 2 Stage Least Square (P2SLS) is employed to correct the endogeneity problem in model 2 as a basis for estimating model 4 in Table 3.

Table 3: Moderating effect of FDI Knowledge Spillover on the Relationship between R&D Intensity and Innovation

Variables	Model 4 (Panel 2SLS) **Innovation**	Model 5 (Panel 2SLS) **Innovation**	Model 6 Panel 2SLS **Innovation**
Intercept	-10.85543 (7.034803)	-7.517622 (6.995862)	-6.409163 (8.931965)
Logtradeopenness	0.65695*** (0.148624)	0.508967*** (0.163383)	0.547072* (0.281427)
Logtechprogress	2.901982*** (0.820126)	2.290876*** (0.820036)	2.370152** (1.015233)
Country dummy	yes	yes	yes
Log R&D Intensity	1.109385*** (0.220146)		
LogR&D intensity*FDIspill		-0.048993*** (0.009509)	-0.044691*** (0.010740)
Crisis Dummy			-0.000488 (0.096125)
R-squared	0.976136	0.976952	0.976533

Table 3: Moderating effect of FDI Knowledge Spillover on the Relationship between R&D Intensity and Innovation

Adjusted R-squared	0.971198	0.972183	0.970666
F-statistic(prob)	119.6677***	120.3156***	113.2724***
Breusch Pagan LM test		8.14885 0.2274	8.041283 0.5557
Jarque Bera stat Probability		0.104421 0.949129	0.052740 0.973975
Observation	36	36	36

Standard errors in parentheses; *P< 0.1, **P<0.05, ***P<0.01 Dependent variable is patent count. Both dependent and independent variables are in logs

Model 4 therefore presents a robust regression model, free of cross-sectional dependence and endogeneity problem. H_2 based on model 4 is confirmed. Thus, the log of R&D intensity is significantly related to the log of patent count at 1% significant level. A proportionate change in R&D intensity leads to a greater proportionate change in innovation in the same direction. Model 5 estimates the moderating effect of FDI in the relationship between R&D intensity and innovation using P2SLS to test H_3. The results confirm the hypothesis that FDI knowledge spillover moderates the relationship between R&D intensity and innovation. Model 6 is a replication of model 5 but controls for global financial crisis between 2008 and 2012. Model 6 produces similar results as model 5. This indicates that the global financial crisis has no effect on the moderating effect of FDI knowledge spillover on the relationship between R&D intensity and innovation. In both models, the moderation is not complementary. Increasing FDI knowledge spillover over has negative effect on the relationship between R&D intensity and innovation performance. It can be observed from model 4 that the log of R&D intensity is positive but the interaction between the log of R&D intensity and FDI knowledge spillover in model 5 is negative. Thus, H_3 is confirmed, however the results show that FDI knowledge spillover does not complement R&D intensity for innovation performance.

This is a mixed finding. Whereas the findings confirm the general position that R&D intensity is a good determinant of innovation performance, the outcome of the current study has also shown that FDI knowledge spillover channel is inimical to innovation performance. Contrary to the position of Wang and Wu (2016), the findings of the current study has shown that knowledge spillover from FDI does not complement knowledge generation activities in Visegrad 4 countries to enhance innovation performance. FDI inflows into V4 countries come from OECD countries which are wealthier, hence technologies from these OECD countries that spillover to the V4 countries are superior and are likely to be disruptive. Thus, the conflict between new technology from FDI and existing technology as opined by Liu, et al., (2020) may be important in explaining the inverse relationship between knowledge spillover from FDI and innovation. Again uncomplementarity between spillover knowledge from FDI inflows and R&D intensity in V4 countries can be explained by the superiority of knowledge from FDI inflows and disruptive nature of such knowledge. It has been argued that when foreign knowledge is superior there is a tendencies for the superior to replace the dominant technology with the consequence of reduing innovation performance temporarily. V4 countries, lag behind most of its OECD trading partners in terms of development. With the fear of being out competed, domestic firms may adopt a competitive posture rather than a corporative which is necessary to assimilate external knowledge for innovation. This is in agreement with (Hongling, et al., 2006) whose findings show that one of the reasons why knowledge spillover from FDI have not improved innovation is the competitive posturing of indigenous firms. Indegenous firms may feel threatened by the presence of Multinational Companies (MNC) hence, the chances that local firms will adopt competitive strategies which will not auger well for foreign knowledge adaptation is high.

One important process external knowledge go through before usage is assimilation. The findings of the study confirm Akinwale (2018) who argues that being able to assimilate external knowledge is an important step to ensuring that external sources of knowledge work to improve innovatioon performance of countries. The findings of the study could also be an indication of incompatibility of foreign knowledge and indigenous indigenous as indicated by (Qiua, et al., 2017). The widely held believe that FDI knowledge spillover ensures innovation performance cannot therefore be generalised.

5. Conclussions, implications and recommendations

The study is aimed at providing insight on the role of FDI Knowledge spillover in the relationship between R&D intensity and innovation performance of V4 countries. The study, based on its findings conclude that knowledge

spillover from FDI does not complement R&D intensity of V4 countries to improve innovation performance. Rather when V4 countries combine knowledge spillover from FDI with R&D activities the consequence is a reduction in innovation performance. However, when V4 countries apply on home grown R&D innovation performance is enhanced. FDI Knowledge spillover from FDI inflows into V4 countries is considered superior relative to the knowledge base of the economy and therefore disruptive and therefore can be viewed as an undesirable shock to the innovation process. The disruptive nature of the technology inflow could explain why knowledge spillover from FDI inflows from OECD countries have not been complementary with R&D intensity of V4 countries to enhance innovation performance.

From the findings of the study it is concluded that the effect of FDI knowledge spillover is dependent on the R&D activities of a country. The complementarity between knowledge spillover from FDI and R&D activities of the country is important to ensure enhanced innovation performance. It is therefore recommended that V4 countries to regulate the type of FDI inflow into their economies. V4 countries are encouraged to target only FDIs that complement domestic economies' R&D to improve innovation.

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Reconsidering Higher Education Organizations via ecosystem Thinking: Some Initial Thoughts

Zito de Boer[1], Daniel Dominguez van Tilburg[2], Jan Kamburg[3], Kyra Kronenberg[4], Max Kuppens[5], Emőke Takács[6] and Toon Abcouwer[7]
[1,2,3,4,5] Master students, [6,7] Academic staff, University of Amsterdam
zito.de.boer@student.uva.nl
daniel.dominguezvantilburg@student.uva.nl
jan.kamburg@student.uva.nl
kyra.kronenberg@student.uva.nl
max.kuppens@student.uva.nl
e.takacs@uva.nl
A.W.Abcouwer@uva.nl

Abstract: Providing optimal knowledge sharing has become increasingly important during the lockdown starting in early 2020. As a mechanism for sharing knowledge, education is also hugely impacted. Studying from home became feasible. On-campus learning had to change entirely to online within weeks. Besides preventing the spread of the virus, this shift allowed students to follow their courses anywhere. Physical distance to an institution is no longer a barrier to knowledge exchange. Online facilities offer students access to a broader field with an impact on the quality of education. The paper defines an ecosystem for higher education institutions (HEI) based on our own experiences with online learning, interviews, and literature reviews. The goal is to create a theorized environment where students can sign up for higher education (HE) classes, courses, programmes at different institutions across Europe. The ecosystem could create commonly shared quality standards from a decentralised perspective, potentially increasing learning quality and providing students with more freedom in their personal learning experiences. This paper does not serve as a full scientific proof but as a discussion. The proposed ecosystem foresees students to follow courses anywhere. It offers study-abroad programmes and inter-institutional collaborations with a centralised platform for knowledge management. Allowing students to choose classes institution-free would increase specialisation of those institutions and impact the quality of education. We will show that implementing a decentralised education system needs a bottom-up approach with a centrally formulated IT strategy to facilitate education exchange. Common quality standards, resilience, innovation, simplicity, inclusivity, maturity, and specificity are essential. For an adaptive system, governance, resistance, ownership, and communication ownership should adhere. Our proposed ecosystem of institution-free HE would benefit all parties involved. Students can tailor their learning experience and obtain the highest level of education possible. HEI benefit in improving the quality of their programmes due to added competition. They could also drop courses that students better take elsewhere, allowing for specialisation in specific fields. Such an ecosystem holds financial, administrative, and even legal limitations. However, institutions can implement step-by-step, giving affordance to the substantial bureaucracy that will inevitably ensue.

Keywords. Ecosystem thinking, higher education, decentralised education, digital collaboration, platform thinking

1. Introduction

Higher education Institutions, such as universities tend to be slower and more resistant to adopting change. The ongoing COVID-19 pandemic has shown how quickly and relatively seamlessly change can occur when the circumstances call for it. Institutions for which a fully on-campus learning environment was the only known method of operation, found themselves fully online within a matter of weeks, if not days. This rapid shift to online education allowed students to follow their courses in a manner that could help prevent the spread of the virus and follow their courses from anywhere in the world. It is this second aspect of online learning on which our proposed ecosystem is founded on, namely: an ecosystem of institution-free HE in the European Higher Education Area (EHEA).

Our proposed system sees EHEA students able to follow courses at anywhere within the ecosystem. Now, there are possibilities in EHEA to follow some courses at other institutions through study-abroad programmes, inter-institutional collaboration, and other similar directives. These possibilities are limited in their scope, typically to some pre-determined courses. The current system does allow students for a degree of freedom follow courses at another institution, but this is minute in comparison to the ecosystem outlined in this report. A fundamentally different concept, in which students would be able to tailor their learning experience through a centralized platform allow them to cherry pick courses from any EHEA institution. Because of online education, physical distance to an institution is no longer a barrier, giving students access to a higher level of education than possible

within the current system. It allows students to choose courses that certain institutions specialize, again resulting in a higher level of learning. Additionally, the increased competition for specific courses can increase the level of courses due to the added competition directly between courses, rather than at institutional level. In short, we hypothesize that such an ecosystem of institution-free HE can only increase the level of learning, as well as providing students with orders of magnitude more freedom in their personal learning experiences.

Currently, many students from universities can take classes from other educational institutions and have these count towards the completion of their current degree. The process of agreeing on this is not easy. The relevance of a new class to the degree needs to be checked and approved, requires a lot of administrative work and communication, in different languages between the institutions. To add to all this, most of the process is done manually by employees. This costs the institutions time and money that can be better spent on the education.

2. Related work

2.1 Decentralized education

To achieve the two goals of grounding design choices and forming the context for the functioning system we have chosen some themes: decentralized education, IT in universities and common quality standards in education. We further split the themes into segments to use in the ecosystem design. These three themes form a comprehensive base to understand the complexity of the proposed system.

2.1.1 Policy making

Policy making in education, the term decentralized is defined as any act in which a central institution formally cedes authority and power towards sub-national governance arrangements. Nudzor (2014), describes three types of decentralization to stimulate policy making:

1. *Administrative decentralization:* the relocation of branches from central to local
2. *Fiscal decentralization:* the transfer of financial power from central to local
3. *Political decentralization:* the transfer of power and resource to sub-national authorities

The article argues that although Ghana focuses on decentralized education systems, the traditional hierarchical top-down posture is difficult to transform. This causes educational decentralization structure that local governance operates in dual hierarchical and parallel structures. For this reason, to use a decentralized education system in Ghana, a bottom-up approach is recommended for policy making. Besides this, de-politicizing education policy needs to be put forth for using a decentralized education system regarding a policy making perspective. Although this paper is written based on the education system in Ghana, the authors strongly reverberate criticisms against centralized systems of educations and policy making in the sense that these systems do not support decentralization.

2.1.2 IT governance

Institutions such as universities are complex, and governance is shared broadly through different faculties, disciplines and administrative units. IT policies, development, implementations, and enforcement appear not to be straightforward, while that is crucial for IT governance (Krueger 2009).

The definition of IT governance is used in the paper of Kreuger (2009) as 'specifying the decision rights and accountability framework to encourage desirable behaviour in using IT'. IT governance for a distributed IT unit should thus be built on a framework based on an overarching strategy. It aims to ensure the alignment of IT-related activities with a firm's strategy (Turel, Liu, and Bart, 2019). Although regarding IT services, we can make a reference to an institution from a central perspective. As a result, an unproductive and false dichotomy among IT operations may appear preventing a common strategy is more difficult to maintain an organization. Creating an overarching IT governance strategy from a decentralized perspective contains four main aspects:

1. Simplicity (a structure for decision making)
2. Inclusively (an effective advisory structure that ensures communication between groups),
3. Maturity (an appropriate performance-measurement process)
4. Specificity (an integrated approach)

A successful IT governance strategy is centrally formulated, based on the four aspects, but managed decentrally. The reason for an overarching IT governance strategy is to prevent specific units developing their own IT

strategies that do not fit within an institution (Krueger, 2009). The stakeholders can use multiple mechanisms, structures, processes and relational instruments for developing the organisation's IT backbone.

2.1.3 Enterprise architecture

Higher Education Institutions will change drastically in the next couple of years because of the accelerated hybrid education ecosystem in COVID-19 pandemic. Not all institutions are prepared yet for the disruption as current Enterprise Architectures (EA) are not resilient or suitable for the future ecosystem. Researchers speculate that Enterprise Architectures will be the determining factor in the 21st century, the factor that separates the winner from loser, the success and failure, the acquiring from acquired, the survivors from others (Zachman, 1996).

According to Gong and Janssen (2019), EA are key to ensure a successful transformation to the future hybrid education ecosystem. This is important as a different form of EA and governance is needed for facilitating adaptable learning. Moreover, multiple challenges can arise when transforming EA in the education domain, management support and prior knowledge needed to support HEI with right IT tooling to become more resilient. Nevertheless, it is not realistic to expect that EA can deal with all enterprise aspects. It also does not reduce an organisations complexity and it is certainly not a one-time effort.

2.1.4 Collaboration of universities

The book *Mergers in Higher Education: Practices and Policies* contains a section in which Boer (2019) gives an overview on Dutch HE collaborations with varying degrees of success, and defines the different inter-organisational formations, which vary based on the level of integration between organisations. The first collaboration mode is cooperation, where fully independent organisations share information to support each other's organisational outcomes. Coordination is where independent organisations align activities and services that support mutually beneficial goals. Collaboration is when organisations give up some independence to realise a shared goal. These forms of integration are extended upon with acquisitions and mergers, in which organisations give up their autonomy to become a part of one of the existing ones or form a new organisation.

An excerpt from a journal by the same author, Boer (2019), looks at the possibilities of online learning, and the collaborations which were possible in the pre-COVID era. The article assumes the author's inclination toward online education, outlining the benefits while highlighting the barriers. Naturally the pandemic has expedited the goal which the Dutch ministry set to have all educational materials available online by 2025 but worries remain. Institutions that were pioneering online learning in the Netherlands in 2017 felt insecure about the possibilities and limitations regarding collaboration, which are still valid concerns. Laws as the 'One-third rule', state that a student must obtain only one-third of credits from an institution other than which is providing the degree place harsh restrictions on what would otherwise be seamless collaboration.

2.2 IT in universities

The organizations within the educational ecosystem process inputs and produce outputs related to the environment that the organization performs. Educational technology of partners is important in transferring knowledge and to use those tools as mediating technologies.

2.2.1 Resilience of universities

The role of information technology during the past decade has changed a lot as the educational ecosystem has had to adapt to its surroundings and circumstances. The technologies started off as an optional tool that could help actors if implemented according to their needs (Jackson et al., 2011). This changed drastically and the technologies became a necessity in the ecosystem rather than a choice or optional artifact (Ali, 2020). The necessity of technology also meant that technology tools had to be implemented regardless of the benefits or disadvantages. The resilience of institutions was tested, specifically social resilience, as they had to adapt to the sudden changes within the ecosystem.

2.2.2 Zero trust environments

Among others, building trust between ecosystem participants is one of the major challenges a data ecosystem has to overcome (Gelhaar and Otto, 2020). In highly digitized organisations, this can be manifested as the fear of revealing valuable or sensitive data. A potential solution to this challenge might involve crafting up legally binding contracts ensuring suitable collaboration from both parties. However, conventional contracts are complicated to set up, disconnected from ICT-systems and when conflicts occur, tracking their execution is restrictively slow (Norta et al., n.d.).

Overcoming such barriers is possible by using a combination of Block Chain Technology (BTC) and Multiple Agent Systems (MAS). This would enable contracts to be directly implemented into organisations' ICT-systems, resulting in automated and decentralized tracking of individual actors' actions conformity to said contract. Furthermore, implementation of smart contracts onto the blockchain can add automated execution of specific consequences when a contract is breached into the system. Ecosystems demanding high reliability, privacy preserving, immutable data repositories and smart contract execution have the potential to benefit from BCT implemented MAS (Calvaresi et al., 2019). The contracts that are used need to be machine readable. Added complexity of these systems and a different way of thinking about trust impede smooth implementation. Other barriers include the design of intuitive GUI's for facilitation of usage by laymen.

2.2.3 Student Pain Points in current systems

Understanding students need in HE IT system, one needs to look at their current pain points and wishes. A study at the University of Münster, discovers German students' issues with the universities IT system (Thoring, Rudolph, and Vogl, 2014). The most important thing students want was a centralized system instead of multiple small unconnected ones. The ease of use was valued as very important. Students found that commercial applications such as Microsoft Office and Dropbox are much better suited for their needs than home-brewed solutions by the university. A lot of universities have these home-brewed systems, but since they are not receiving as much attention as commercial products, they are behind the current standards by usually a few years, both in UI design and functionality. Overall, the situation can be concluded with a quote from the study: "From the students' point of view, IT should enable them to focus on the content of their studies, provide support for organizational problems, and grant easy access to resources, such as literature and software, while at the same time require little effort."

2.3 Common quality standards in education

Looking at the quality standards in HE ecosystem, first, we check universities accessibility and then we give insights in the accreditation system.

2.3.1 Accessibility of universities

The process of applying for courses in different HE institutions can be quite difficult and lengthy. Focusing on the application process that one can face when want to follow a course in a different institution, we looked at two universities: University of Amsterdam (UvA) and University of Waterloo (UW). Although the universities were selected randomly, they reflect the general application process in Europe. UvA follows the guidelines of 'Global-Exchange' programme. Before the application process one is asked to make a list of the desired courses, then it is checked if the entry and language requirements and the specific criteria per faculty or academic department are met. The guidelines determining relevant academic background of a student are in the 'Courses and Faculty Criteria' document. At UW before one can take a course at another university, must fill in Permission Request Form before enrolment otherwise it will not count towards the degree. There are strict rules for a core course. In conclusion, universities generally are not accessible to outside students easily. It requires paperwork approved by people, making it time-consuming and susceptible to bias.

2.3.2 Accreditation system

Accreditation is described as a procedure to provide legitimacy both inside and outside HE and has become an increasingly popular method for quality assurance. In Europe, accreditation systems are prevalent in almost every nation as a means for assuring the HE standards. Some key points often stated in favour of accreditation is that it is suitable for situations which require a minimum degree of quality, a degree of uniformity between study programmes, and in which increased student mobility is desirable. Some criticism levelled at it is that it narrows the focus on minimal standards rather than the challenge of quality improvement, does not add any value, and pays no mind to the educational context.

A key policy process associated with the spread of accreditation that has significance to the desired outcome of our ecosystem is accreditation's role as a networked governance. This role is seen as a consequence of governance agreements transcending the national level, such as EU wide directives. One such directive (Lex, 2006) allows educational institutions to adopt any accreditation agency within the EU Register. This piece of legislation is pivotal for our ecosystem, as the ability of any institution to adopt the accreditation agency of their choice opens the possibility of an EHEA wide standard (Stensaker, 2011).

3. Ecosystem design

Ecosystem design and ecosystem goal with the main research question in mind: How can an ecosystem be created where students are able to follow higher education at different institutions in Europe by creating a common shared quality standard, from a decentralized perspective? is next to discuss.

Currently, students can take classes from other HEI and have them count towards the completion of their current degree. The approval process is not simple. The check and approval require a lot of administration and communication along the institutions' different channels, sometimes in different languages. Most of the processes are manually done by employees. This costs the institutions time and money that can be better spent on the education and the institution itself.

The goal of this ecosystem is to create an environment where students can sign up to HE classes, courses, programmes at different institutions across Europe by creating common shared quality standards. This is done from a decentralized perspective that increases the learning level and provides students with more freedom and opportunities in their personal learning experiences.

We divided the ecosystem design chapter to several topics to highlight how the ecosystem should look, who are involved, what their roles are and how to make the system future-proof.

3.1 Partners of the ecosystem

There are many different actors involved when implementing international education quality standards across Europe. All have different purposes, different roles, connections, and mechanisms that are important to comply with. The collaborating partners are internal, external, and international.

Partners of UvA are interconnected and share common interest to create knowledge, communicate, and co-create within the organization. They focus on certainty, uncertainty, and risk that represents the status of activities and reflects the probable future.

Internally, there are many actors playing a role surrounding international education and establishing quality standards. They are a part of the policy and governance, the faculty, and the education branch. Specifically, the following departments are directly involved within the proposed ecosystem:

- Academic affairs (Policy and Governance) is responsible for formulating the strategic education and research policies. This includes the international aspect of strategy.
- Board of the University (Policy and Governance) is the central board of the university.
- Deans (Faculty) important link between student and university excluding the content of education.
- Education committees (Education) is a collaboration of students and professors where the quality and organisation of the concerning educational program are discussed.

The institutional plan 2021-2026 represents the goals and values the UvA wants to adhere to. Within this plan, there are ambitions of UvA to cooperate with partners, suppliers, and universities (UvA, 2021). The university aims to broaden the accessibility of the university as a partner, specifically for external partners on local, national, and international level.

Collaboration with external partners positively influences the university as, according to the Plan it stimulates research, gains insights from practice and experts and helps to spread and use the knowledge that is generated from these partners. Specifically, UvA works together with international universities in the League of European Research Universities (LERU) and Erasmus+ programme. Also, the Dutch ministry of education is involved as regulator of the education standards and interact with other countries in the international education system.
Other external (international) partners are involved as well:

- European Higher Education Area (EHEA) is a collaboration of 49 countries with a common set of commitments: adopt key values such as freedom of expression, autonomy of institutions, academic freedom and free movement of students and staff with the goal to make HE systems more compatible and strengthen quality assurance mechanisms.
- European University Alliance (EPICUR) is an initiative to strengthen strategic partnerships encouraging bottom-up networks of universities across EU. It allows students to obtain degrees by combining studies in different EU countries.

UvA claims that they can take advantage of the location of the university and good research and educational practices to enhance the partnerships and collaboration between involved parties. This is possible by investing into external relationships and the role in the European education and research system. This proposal therefore aligns with the wishes of UvA and the partners.

3.2 The role of managers and teams

After ecosystem partners, we determine the internal role of managers and teams and the external role of managers to create common quality standards for education across Europe.

Looking at the 2021-2026 UvA Plan, a leader is someone with an entrepreneurial mindset, an eye for diversity and working together with teams. They are expected to understand the relevance of effective workflow organization and transparent decision-making together with other employees. Employees should develop leadership skills to support management duties. It highlights the difficulty making a management position attractive (ibid.).

Diving deeper into how UvA sees the role of managers, inclusivity and diversity play a more important role in how management is organized. The university from an organizational perspective strives to be agile with teams that ensure creativity, creating standards for business processes and shrinking the distance between the scientists and managers. Another key finding, which is relevant to outline for the proposed ecosystem design is about internationalization and the ability to study abroad. From a managerial perspective, a collaborative approach with the EPICUR and EHEA is extremely important. Also, the focus on diversity and inclusivity as collaborating internationally comes along with cultural differences, races, etc.

Linking these findings back to our related work, we recommend a bottom-up approach for the ecosystem. It strives to create a decentralized educational system that enables following courses at every institution due to common quality standards. From an internal perspective, the role of managers with the current standards of UvA are clear and able to succeed in the proposed ecosystem. From an external perspective, the management role is more important for different aspects.

Creating an overarching strategy and common governance so that participating universities know responsibilities, goals, and roles in governance the ecosystem can succeed. An externally responsible manager is advised to design clear objectives and time periods. Also, teams should be formed with responsibilities for certain objects. Making diverse teams to learn from each other and from different inputs. Teams should feel responsibility, set deadlines, and divide the roles. The manager role must be accessible and open-minded.

3.3 The role of I(T)

To support all the functionality of the ecosystem, an IT system is used to make easy interaction and work for all the stakeholders. The background research for this ecosystem design showed one of the biggest problems mentioned by students: the number of different systems used every day (Thoring, Rudolph, and Vogl, 2014). We envision the creation of a shared platform, that will act as a bridge between all involved parties.

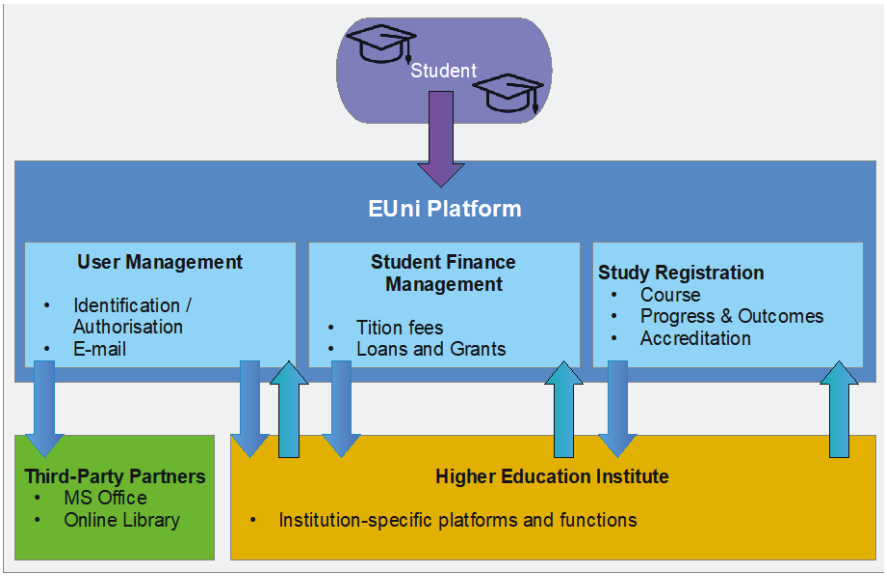


Figure 1: EUni Platform high level design

The platform enables students to do course registration and HE learning by providing interaction points:

1. Student registers with EUni Platform
2. Student applies at primary HEI for programme
   - HEI checks students' prerequisites and admits student
   - HEI provides tuition fees to EUni Platform
   - Student pays fees centrally using EUni Platform
   - Student can now make use of Third-Party Partner applications and resources
3. Student signs up for courses at primary or other HEI using EUni Platform depending on preference
   - HEI allows students to access their course using their EUni Platform user account
   - HEI reports results for courses to EUni Platform
4. Primary HEI issues graduation certificate to Student once credits, programme requirements fulfilled
   - Student can access certificate via EUni Platform

This description shows the platforms functioning from students' perspective to help them with their studies and the enrolment to courses to complete within the new ecosystem.

3.4 Resilience and Adaptivity

Resilient and adaptive ecosystem design is key for implementing international education quality standards across Europe. Possible resistance may arise, and HEI must handle unforeseen circumstances.

3.4.1 Resilience

A resilient ecosystem can bounce back from difficult events. It has capacity to respond to disturbances by resisting damage and recovering quickly. Resilient organisations are better in dealing with complex adaptive systems settings. Especially when implementing international education quality standards across Europe, resilience is crucial. Creative academic programming is becoming more and more important. Research shows that graduates will change their profession multiple times before they retire. A trend in increasing joint degree programs is identified and a demand to further encourage collaboration between faculties and universities (Michael and Balraj, 2003).

It consumes time to change to designed processes within an ecosystem. Innovation happens in three main forms: Reactive, Proactive and by Anticipatory innovators. The last shape is the most suitable for the introduced ecosystem since it causes the emerge of resilient organisations, which ensures innovation within the organization culture (Teixeira and Werther, 2013).

Although resilience is one of the key design principles of the envisioned ecosystem, resistance may happen:

- The prestige of universities: Universities who fear for their spot in the QS World University Rankings®

- Value of a diploma/certificate: not guaranteed European institution prestige can lead to worthless certificates
- Quality guarantee of education: When courses can be attended at multiple faculties/universities it will be harder to guarantee the uniformity of the provided education.

3.4.2 Adaptivity

Organizational adaptability shows how quickly organizations adjust their business processes and improvise themselves to achieve goals. They must prepare for future challenges. Several ones need to be considered in our proposed ecosystem. To make the system successful and adaptive, the following four things must be considered.

Institutional Governance: Most institutions within the educational ecosystem are autonomous and stand-alone. Each institution has its own governance structure with its set of rules and policy processes. One such policy process, for example, is the approval process, to which different institutions have different special rules.

Faculty resistance: To make it accessible for a student to take courses at different universities a major characteristic is faculty cooperation. If faculties cooperate poorly with the initiative despite it being initiated by the university council, it will have a major impact on the success of the programme. From a traditional point of view, faculty members themselves work focused on their own research agenda and interests. This new programme will require faculty members to work together to form a shared curriculum and interact with members from the other institutes. Since this requires new ways of thinking and somewhat changed beliefs, it may be an uncomfortable process.

Institutional ownership: Institutions claim ownership of every degree they expend. A question arises as to who owns a joint degree. For the purpose of access to resources, this will need to be looked at carefully.

Communication ownership: Availability of the necessary infrastructure that allows communication between two faculties is crucial. When faculty members or students experience difficulties in connecting to the other institution, the programme will suffer from unreliable support.

4. Discussion

Naturally, a system as ambitious as this does not come without several limitations. Some fundamental matters of he may have to be uprooted and built from the ground up, or at the very least, restructured. It is important to note that some of these limitations do not fall within the scope of the proposal, but their relevance is such that it would be amiss not to mention them. These limitations are not limitations in that they are unsolvable, or even difficult to solve, however the issue arises in finding a solution that the majority of institutions agree with.

4.1 Financial

Perhaps the first limitation that springs to mind in this context is a financial one. This limitation has many facets, however the two most relevant ones from a student perspective are those of tuition and financial aid. Tuition rates within the EHEA can differ significantly from nation-to-nation European students in Austria receive their education for free, while those in England can expect to pay well over €10,000 per annum. This would need to be addressed, and some sort of standardized tuition fee would be the logical solution, as a student who is registered to study in England and takes half of their credits in Austria should not pay any more than a student registered in Austria taking half of their credits in England in the ecosystem. If tuition fees remain at the discretion of the institutions/national governments, then there would be numerous scenarios of students paying differing amounts to receive the same education. Just as there now exists in many European country's tuition fees set at a national level for public institutions, so would there be a need for tuition fees set at an EHEA level.

The other relevant financial matter from a student perspective is the allocation of financial aid. Financial aid is administered at the national level, with many nations having incentives for students to remain studying within their home nations, by offering less - or even no - financial aid when studying abroad. This is another topic that would need addressing, as the ecosystem allows for the possibility of a student being registered at an institution abroad while taking a majority of courses within the home nation. At first glance, however, this appears to be a more minor issue in comparison to tuition given that students would have the option to register at an institution in their home country.

4.2 Admissions

Admission conditions to various institutions in various countries is an issue that would rapidly need to be addressed and ideally standardized. The Netherlands provides a good example. Secondary school in the Netherlands is separated into three different levels (VMBO, HAVO, and VWO), with only students at the VWO (university preparation) level being allowed to directly transition into a Dutch university. These separations and pathways do not exist in all European countries, providing the possibility that a student who is not eligible to apply for university in Netherlands after completing HAVO (general secondary school) level may be accepted at another university in Europe. Within the ecosystem, this would then allow them to take courses at the very universities in the Netherlands for which they are technically not qualified to attend. Differences in the acceptance of students into programmes would have to be considered in a larger scale, and preferably result in a form of standardized admissions policy.

4.3 Rules and Regulations

To make this ecosystem function in the intended manner, rules and regulations must change. In the Netherlands regulations stipulate that student receiving a diploma from an institution must have completed at least two-thirds of their credits at said institution. While this is becoming generous allowance, similar regulations exist in nations throughout EHEA to differing degrees, and ultimately creates a barrier to the freedom intended by the proposed ecosystem. Ideally, no such restriction would exist, and students could choose their courses freely, however an EHEA-wide rate would also help the system thrive. We expected that institutions and legislators push this percentage to be higher, while students for a lower one. It is hard to estimate what figure would ultimately represent a happy medium, however the lenient nature of the Dutch rule gives hope for an even more generous allocation.

5. Conclusion

Answering the question on How can an ecosystem be created where students are able to follow higher education at different institutions in Europe by creating a common shared quality standard, from a decentralized perspective? we highlighted the importance of providing the optimal form of teaching, analysing the education ecosystem upon partners, roles of managers and teams, IT, resilience and adaptivity.

We defined an optimal HEI ecosystem for the future based on interviews and literature reviews. If a decentralized education system will be implemented a bottom-up approach is recommended for policy making (Nudzor, 2014). We recommended a centrally formulated IT Governance strategy based on four aspects (simplicity, inclusively, maturity and specificity) and managed de-centrally.

EA are not future fit, resilient, or suitable for the future ecosystem. Multiple challenges can arise when transforming EA in the education domain and management support and prior knowledge is needed to support HEI with the right IT tooling to become more resilient (Gong and Janssen, 2019)

Common quality standards in educations can be a solution, making universities more accessible that leads to a simplified (uniform) accreditation system.

Collaboration with external partners positively influence the university, stimulates research, gains insides from practice and experts and helps to spread and use the knowledge that is generated from these partners.

The role of managers is key to make an ecosystem succeed, by creating an overarching strategy and common governance so that every participating university knows the responsibilities, goals, and their role within the governance. The role of a manager must be accessible and openminded.

Examining the role of IT in the new ecosystem, it plays a central part in connecting all partners of the ecosystem. Data transfer via an IT system would greatly streamline the process of enrolment of students cutting down on administrative overhead. Connecting different institutions' IT systems and partners is a challenge and a long process. The advantages it would bring in terms of efficiency and ease of use for all parties involved would make it a worthwhile endeavour.

To make sure an organisation is resilient and able to bounce back from difficult unforeseen circumstances, anticipatory innovators should be introduced. This group will make guarantee innovation within the organization

culture. To create an adaptive system the principles of institutional governance, faculty resistance, institutional ownership and communication ownership should be adhered.

We proposed an ecosystem of institution-free HE within the EHEA, which brings benefits to all involved parties. Students would have the ability to tailor their learning experience and the opportunity to obtain the highest education level possible. HEI would see benefits in both improving the quality of their programmes due to added competition, as well as dropping courses that are better taken elsewhere, allowing for specialization in certain fields. Of course, such an ecosystem brings with it limitations, otherwise it would likely have already been limited. Financial, administrative, and even legal (to some extent) barriers stand in the way of a full implementation of the proposed system. By its very nature the ecosystem could be implemented on a step-by-step basis, giving affordance to the substantial bureaucracy that will inevitably ensue.

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Towards Knowledge Governance in Public Administration

Fronika de Wit[1, 2], Alice Lourenço[1], Hugo Moreira[1] and Filipa Vala[1,3]
[1]Competence Centre for Planning, Policy and Foresight of the Public Administration-PlanAPP, Lisbon, Portugal
[2] Institute of Social Sciences, University of Lisbon, Lisbon, Portugal
[3]Center for Ecology, Evolution and Environmental Changes -CE3C, University of Lisbon, Lisbon, Portugal
Fronika.wit@planapp.gov.pt
Maria.lourenco@planapp.gov.pt
Hugo.moreira@planapp.gov.pt
Filipa.vala@planapp.gov.pt

Abstract: Today´s public administration is increasingly dealing with wicked problems, involving high levels of complexity and uncertainty. Wicked problems, such as combating climate change, ask for multistakeholder approaches and the interweaving of diverse types of knowledge. Currently, however, public administration mainly works with Knowledge Management (KM): effectively using and producing in-house knowledge and developing organizational competences. To improve governmental responses to wicked problems, this paper proposes a shift in the public sector towards Knowledge Governance (KG), thereby expanding the practices of KM. The transdisciplinary field of KG focuses on structures and techniques that influence the processes of sharing and creating knowledge and the implications of types of knowledge on policy. A KG approach has proven to be more effective for addressing wicked problems through multilevel governance and system innovation. The objective of this paper is threefold. First, to summarize the state-of-the-art scholarship on KM and KG in a comparative perspective. Second, to showcase boundary organizations in public administration as an example of KG. And third, to discuss three critical factors for successful KG in public administration: 1. Establishing an institutional culture focused on system thinking and knowledge creation; 2. Reconceptualizing the concept of knowledge and address its inherit power imbalances; and 3. Enhancing active and meaningful multi-actor participation in public decision-making processes. In conclusion, we recommend boundary organizations, working on the knowledge-policy interface, for dealing with wicked problems and enhancing a paradigm shift towards KG.

Keywords: Boundary Organizations; Knowledge Governance; Knowledge Management; Public Administration

1. Introduction

Complex challenges, such as combating climate change, highlight the need to rethink current public administration practices and governance approaches. The uncertainty and complexity of these challenges requires considering dynamic and multifaceted forms of knowledge, including practitioner, experiential, and traditional knowledge (Feagan et al. 2019; Tengö et al. 2014). Recent scholarship highlights the need to create knowledge deemed actionable for policy decision-making through an iterative and dynamic process of co-creation between science and policy-making (Fazey et al. 2020; West, van Kerkhoff, and Wagenaar 2019).

Current practices in public administration, however, treat the concept of knowledge as something to be managed in-house on the organizational level. Almost 50 years ago, Henry (1974) introduced knowledge management (KM) as a new concern for public administration, describing it as “public policy for the production, dissemination, accessibility, and use of information as it applies to public policy formulation”. KM has become not only a huge body of literature, but also a widespread organizational practice to identify, create, store, share and apply knowledge inside an organization (Dalkir 2013; Wiig 2002).

Although KM has proven to be effective on the organizational level, it lacks an institutional perspective of the concept of knowledge and fails to understand policy issues as ways of knowing (van Kerkhoff 2014). Half a century after Henry´s call for KM in public administration, a growing body of evidence highlights the need for a new knowledge architecture in public administration. Research points to the urgency of implementing a knowledge governance (KG) approach to inform timely and wise decisions (Cummings et al. 2019; Oliver et al. 2021). KG focuses on processes of knowledge brokering and the implications of types of knowledge on policymaking. A practical example of KG are boundary organizations that aim to bring politics and science together in a variety of collaborative configurations (Clark et al. 2016; Guston 2001).

To improve policymaking for complex challenges, this paper highlights the need for more attention to KG in the public sector. Its objective is threefold: First, to present the state-of-the-art scholarship on KM and KG in a comparative perspective. Second, to showcase boundary organizations as an example of KG in public administration. And third, to discuss the potentials and pitfalls of a KG approach in public administration. We structure this discussion around three critical factors: 1. Establishing an institutional culture focused on knowledge sharing and system thinking; 2. Reconceptualizing and repoliticizing the concept of knowledge; and 3. Enhancing active multi-actor participation in public decision-making processes. In conclusion, we recommend boundary arrangements, working on the knowledge-policy interface, for dealing with wicked problems and enhancing a paradigm shift towards KG.

2. The management and governance of knowledge

The concept of knowledge is complex, multilayered and multifaceted and lacks a uniform understanding. Heissig (2009) presents a list of 29 "knowledge dichotomies" found in the literature, including, among others: tacit vs explicit knowledge; individual vs collective knowledge; internal vs external knowledge; and knowledge as a process vs knowledge as a product. To highlight the difference between "information" and "knowledge", scholars often use the data – information – knowledge – wisdom (DIKW) hierarchy´ (Ackoff 1989). Where data and information are related to researching and connecting parts, knowledge and wisdom are about the formation of a whole and interacting and reflection on the whole. Also, where information is an end-product that can be stored and analyzed, knowledge is process-based: it is internalized by the knower, and as such is 'shaped' by their existing perceptions and experiences. Knowledge is referred to as the way people interpret, understand and apply meaning to the world and to their experiences (Clarke, B., Stocker, L., Coffey, B., Leith, P., Harvey, N., Baldwin, C., ... & Haward 2013).

Knowledge management (KM) also falls short of a common understanding and definition (Heisig 2009). KM approaches can be divided into two schools of thought: the "codification" or "people-to system" school and the "personalization" or "people-to-people" school (Hansen, Nohria, and Tierney 1999). Where the first emphasizes the importance of knowledge collection and managing digital information, the second approach focuses on connecting knowledge and managing social relations. As knowledge is inseparable from reflection and dialogue between individuals about their experiences, KM implies not only managing digital information, but, most importantly, managing social relations. According to Liebowitz (2019), the heart of KM is sharing knowledge, making connections, and generating new ideas through collaboration and interaction.

KM is mainly concerned with social relations and knowledge sharing inside the organization. However, collaboration across organizational boundaries can promote new ideas through building on different epistemic perspectives and backgrounds (Liebowitz 2019). These different perspectives are also called knowledge systems (Tengö et al. 2014, 2017), such as scientific knowledge, local or indigenous knowledge, and technical knowledge. Knowledge governance (KG) offers a conceptual basis from which to think critically about the interweaving of these knowledge systems of ways of knowing for more inclusive decision-making.

Both KM and KG are based on creating a knowledge-supportive culture that stimulates learning and transferring knowledge. Van Kerkhoff (2014) points to "a fuzzy line" between both fields, particularly evident in the private sector literature. There are, however, fundamental differences between KM and KG (see Table 1). The KG approach focuses on the deployment of governance mechanisms that influence knowledge processes, such as creating, sharing, accessing, and using knowledge (Foss 2007). Governing knowledge processes means choosing governance structures and mechanisms to favorably influence processes of transferring, sharing, integrating, using, and creating knowledge (Foss and Michailova 2009).

Van Kerkhoff (2014) presents KG as related to the ´institutional layer´, a scale above KM, better suited for multi-level, complex challenges. It is broader in scope than KM, which sits within the domain of projects and organisations, and is concerned with the institutional structures, i.e. rules and norms that enable or constrain knowledge management decisions. KG goes beyond discussing knowledge questions and sharing knowledge in workshops, and is about "engaging actors in innovative ways of solving societal issues" (Gerritsen, Stuiver, and Termeer 2013, 605). In contrast with a decisionist and a technocratic model, KG is based on a co-production model: it values both scientific and non-scientific considerations (Hulme 2009). KG is based on networks of actors and processes that enable these actors to draw on various forms of knowledge and connect it across sites

(Wyborn et al. 2016). In summary, KG is a more flexible essentially network-based polycentric architecture for knowledge and evidence gathering and flow than the typical static, unidirectional KM structure.

Table 1: Comparing Knowledge Management (KM) to Knowledge Governance (KG)

KM	KG
Organizational layer	Institutional layer
Knowledge processes	Knowledge systems/ Ways of knowing
In-house	Networked
Linearity	Circularity
Monocentric	Polycentric
Knowledge taken for granted	Critical perspective on knowledge processes
Knowledge as a private asset	Knowledge as a global public good/human right
Convention	Innovation
Centralized governance	Combined decentralized, interactive and self-governance
Present-oriented	Future-oriented
Interdisciplinarity	Transdisciplinarity
Organizational management	Boundary management
Dissemination of knowledge	Collaborate knowledge production
Managerial thinking	System thinking
Informing civil society	Active public participation
Decisionist model	Co-production model

Source: Elaborated by the authors, adapted from Van Kerkhoff, 2014; Oliver et al., 2021; Gerritsen et al., 2013; Foss, 2007; Hulme, 2009).

Gerritsen et al. (2013) point to five main principles of KG, which can be contrasted with the KM approach. First, where KM is implemented through a top-down, centralized approach, KG is based on combined decentralized, interactive and *self-organization* (1). Second, although KM looks at knowledge from an interdisciplinary perspective, KG goes a step further and aims for *transdisciplinary knowledge production and dissemination* (2). It goes beyond the disciplinary fields and aims for the unity of knowledge (Nicolescu 2010). Third, KG highlights *social learning* (3) about policies to be able to change them and enhance policy innovation. Fourth, KG is based on *reflexivity* (4): where KM takes knowledge for granted, KG critically analyses knowledge processes. Fifth and last, KG needs *boundary management* (5) and improve the knowledge-policy interplay. The next section takes a closer look at the concept of boundary management and showcases examples of boundary organizations in public administration.

3. Boundary organization in public administration

Boundary organizations (BOs) are crucial to gaining impact with KG (Gerritsen et al. 2013). The concept was first introduced by Guston (1999) to describe those organization that 'straddle the shifting divide between politics and science'. Expanding on the concept, Clark et al. (2016) go beyond the organizational level and point to the importance of networked governance. They describe this knowledge-policy interplay as "boundary arrangements": a variety of collaborative configurations mediating the boundary between science and public sector organizations and working towards evidence-based policy.

In what knowledge is concerned, the challenges faced by public administrations entities in the policy cycle and advice ecosystem are threefold: 1.) to identify and access knowledge produced elsewhere to design, monitor, evaluate and advise policy; 2) to identify and produce the knowledge required to those goals (the knowledge "content" challenge); and 3.) to digest this knowledge into a shape so it can be of use to policy- and decision makers in their tasks (the knowledge "form" challenge). While apparently simple to enunciate, these phases do not correspond to discrete institutional arrangements. As such, while conceptually useful to define the challenges faced by public administration, a BO is a difficult object to define. Likewise, the term "knowledge broker" is useful to describe the work of professionals dealing with knowledge transfer but may in practice be difficult to define within the realm of the public policy ecosystem.

3.1 The goal of evidence-based policy

Keeping these difficulties in mind, let us now turn to the idea of evidence-based policy. Generally, everybody agrees that evidence-based policy is important. The debate usually centres around what constitutes "evidence" (Sienkiewicz and Mair 2020). Scientific knowledge is part of the "package" of evidence usable in policymaking because science, while not perfect, is perceived as a reliable process to gather information. Policy problems then

have at least two dimensions: an analytical, scientific dimension and a normative one. Designing evidence-based policy is difficult because it must balance societal values, political priorities, competing interests *and* scientific knowledge. Whether the solution to a given problem falls more under the realm of science depends on how technical an issue is, and at what point of policy intervention the evidence is required (Sienkiewicz and Mair 2020).

Based on a survey by the Finish Innovation Fund SITRA that collected responses from professionals at the interface of knowledge and decision-making, Hellstrom and Ikaheimo (2017) recognize two approaches for using knowledge in decision-making. The *linear approach* ensures that information is produced for specific questions. The *dynamic approach* sees knowledge production as an interactive process where experts and decision-makers contribute to formulate questions and make sense of the information from the start. To be productive, these interactions require specific skills and training (see Hellstrom and Ikaheimo 2017; Topp et al. 2018).

Both accepting the information used and perceiving the process of using knowledge as legitimate affect decision-making: shared knowledge, that is, knowledge that results from a joint question formulation, research development and interpretation process, increases the impact of knowledge on decision-making (Hellstrom and Ikaheimo 2017). The SITRA survey results suggest that most participants feel that the responsibility for taking the initiative to interact is shared by all actors at the knowledge/decision-making interface (Hellstrom and Ikaheimo 2017). Science and policy will be brought closer together by engaging them in co-creation at all stages of policymaking (Sienkiewicz and Mair 2020).

3.2 Examples of Boundary Organizations

This is where BOs in public administration come in. Table 2 summarizes four examples of BOs. Three examples of national level entities (the Office of Evaluation Sciences (OES), a US federal organization; the French, *France Stratégie*; and the Prime Minister Office's interministerial group of Finland) and a transnational BO (the Joint Research Centre (JRC), a service of the European Commission).These are examples of what we may describe as strategies/architectures for KG specifically to address wicked problems, and the number of such flexible network structures seems to be increasing in public administration. We contend that they are increasing because they are more efficient at providing the evidence/knowledge required for decision making.

Our last example, the JRC, sees itself and other BOs as institutions whose task is to both bridge the gap between scientific disciplines and policy fields by producing knowledge, and to act as lighthouses, helping policymakers to navigate knowledge and information produced by others (Šucha and Dewar 2020). To this end, it has been experimenting and implementing strategic activities that foster the relationships between scientists and policymakers and the collaboration around research needs for policy. To increase the relevance and uptake of research for policymaking, special entities focused on knowledge for policy in several priority areas (e.g., migration and demography, disaster risk management, among others) were set up. These centres seek to define the problems to be solved in given fields and collect policy-relevant knowledge, by engaging scientists, policy makers and other stakeholders.

Table 2: Examples of Boundary Organizations in Public Administration

	Who	**Where**	**What**	**How**
1	The Office of Evaluation Science (OES)	Entity of the federal US government at the General Services Administration's (GSA) Office	Designs and conducts evaluations of existing programs and evidence-based program changes on a demand basis.	Partners with federal agencies; brings in Academic affiliates and fellows as required
2	*France Statégie*	Autonomous institution at the centre of government	Provides analyses and proposals, expert advice on policy drafting and assessment analyses of public policies, conducts planning and foresight studies.	Directs a network of eight sectoral public entities, with expertise in different areas; Promotes public debate and engagement on collective choices of social, economic, and environmental issues seeking to cover the plurality of points of view.
3	Joint Government Analysis, Assessment and	Inter-ministerial group at the Prime Minister of Finland's Office	Provides analyses, assessment and research activities to support decision making and	Publishes an annual governmental plan for analysis, assessment and research in support of decision-making that defines research priorities addressing

	Who	Where	What	How
	Research Activities		knowledge-based working practices and management	the knowledge needs and establishes funding lines for projects that address them.
4	Joint Research Centre (JRC)	European Commission's science and knowledge service	A cross-European Commission that supports evidence-based policymaking, through the Knowledge4Policy (K4P) platform	Through multidisciplinary teams, including scientists and knowledge brokers, which work with policymakers at: 1.*Knowledge Centres* that develop research to help inform policy; and 2. *Competence Centres* that develop tools to help analyse scientific knowledge and data. Created Communities of Practice starting with stakeholders' mapping and keen to promote citizen engagement.

Source: (French Republic 2022; Government of Finland 2022; JRC 2022; United States government 2022).

4. Critical factors for knowledge governance in public administration

Boundary organizations are a first step towards a shift from KM to KG in public administration. However, for this shift to be successful, we highlight three critical factors: 1.) the creation of an institutional culture of system thinking; 2.) the reconceptualization of the concept of knowledge; and 3) the enhancement of active multistakeholder participation. Finally, we provide a future perspective and reflect on the process of creating a BO by looking into the recently created Portuguese Competence Centre for Planning, Policy and Foresight in Public Administration – PlanAPP.

4.1 Institutional culture of system thinking

A first critical factor for successful KG in public administration is the institutional transformation to a culture of system thinking in public administration. System thinking is a cognitive style (a mentality or way of thinking) that recognizes the emerging complexity of sociotechnical systems (Meadows 2009). Heissig (2009) points to the institutional culture as the most critical factor for successful KM and highlights the importance of creating a knowledge-oriented culture. This knowledge-sharing culture is a critical factor for both KM and KG. However, when talking about KG, this knowledge-oriented culture needs to be placed inside a system: a transdisciplinary, multi-level and multi-actor context. Successful boundary organizations and KG arrangements are those that have adjusted to their context of policy networks and multidimensional context (Hoppe and Wesselink 2014). Scholars also highlight the importance of creating a "system mindset" and placing public policies into the bigger picture of system innovation (Gerritsen, Stuiver, and Termeer 2013; Vergragt 2013).

However, confronting this system mindset with the dominant paradigms and mental structures of public administration highlights the need for a paradigm shift to overcome three barriers: 1) from "command and control" governance towards a high degree of unloosing and flexibility; 2. from a strong focus on incontrovertible planning for concrete results towards a high degree of emergency and serendipity; and 3. from strictly imposed planning towards creating a space for learning and reflection (Nevens et al. 2013). Also, especially in relating to complex challenges such as climate change, public administration often uses a sectoral rather than a more integrative approach. Research shows, however, that citizens that see climate change through a system thinking lens and understand it as a complex system, are more likely to recognize its risks and the co-benefits of climate action (Lezak and Thibodeau 2016).

4.2 Reconceptualizing knowledge

A second factor for enhancing successful KG is the reconceptualization of knowledge and knowledge-based interactions. Research points to the reconceptualization of knowledge as a global public good instead of a private asset (van Kerkhoff 2014). Looking at knowledge as "commons" means developing arrangements for overcoming the various dilemmas associated with sharing and producing information, innovation and creative works (Hess and Ostrom 2006). It also implies the re-politicization of wicked problems, such as climate change, to include more democratic debate and argument, based on a wider discussion of values, norms and experiences (Rice, Burke, and Heynen 2015). Without explicit boundary organization and KG, complex issues may be de-politized,

running the risk of creating crises of legitimacy (Clarke, B., Stocker, L., Coffey, B., Leith, P., Harvey, N., Baldwin, C., ... & Haward 2013).

Therefore, research needs to examine the black box of the power/knowledge nexus and hierarchy of knowledge systems and knowledge-based interactions in public administration (Avelino and Wittmayer 2016; Foss and Michailova 2009). It needs to address critical questions of power and contested claims to knowledge and expertise within its services. Scholars point to the important role of the "knowledge broker" for successful KG (Mourato, Bussler, and de Wit 2020). Knowledge brokers are responsible for facilitating the sharing and transfer of knowledge across knowledge systems and thereby steward long-term institutional networks. For public administration that means enabling policy-makers to acquire and value expert knowledge that otherwise would not have been incorporated into the policy-making process (Michaels 2009).

4.3 Participatory governance

A third and last critical factor for successful KG is the mainstreaming of participatory, multi-actor approaches in public administration. Increasing stakeholder involvement in governance implies that new modes of jointly creating and exchanging knowledge may need to be taken into account (van der Molen, van der Windt, and Swart 2016). Arnstein (1969) describes a "ladder of participation" with eight rungs, corresponding to the extent of citizen power in decision-making processes. Her ladder ranges from solely informing civil society about plans and projects, to providing them decision-making power and control over the final decision. Successful KG needs to step up its ambitions in relation to participatory approaches and provide opportunities for active and meaningful participation, thereby introducing public values and enhancing higher levels of trust in governmental decision-making (Beierle and Konisky 2000).

Although participatory approaches have often been presented as the silver-bullet for complex governance, a closer look to the concept of participation highlights naïve assumptions about its complexity and implications. Cooke and Kothari (2001) criticize the participatory discourse and its legitimization of hegemonic perspectives and knowledge systems instead of challenging them. They highlight the danger of obscuring "politics of participation" and the risk of it becoming an instrument of control. Participation and participatory decision-making processes are often promoted and even imposed by funding organizations and could lead to extended state control over people and their knowledge (Bixler 2014). Therefore, Cooke et al. (2021) highlight the importance of reflecting on the knowledge co-production process and assess whether its partnerships are truly respectful and inclusive.

4.4 Looking forward: the strategic setting of PlanAPP and REPLAN

Taking stock of these critical factors, we showcase the recently created Portuguese Competence Centre for Planning, Policy and Foresight in Public Administration (PlanAPP). PlanAPP provides a unique opportunity to strategically reflect on and combine lessons learned from both the knowledge and policy front in its institutional knowledge architecture. It aims to contribute to define public policy goals, indicators, and targets, monitor public policy program implementation, and coordinate assessment and monitoring studies of economic, social and environmental policy impacts. PlanAPP also presides REPLAN, the Portuguese Network of Planning and Foresight Services Public Administration.

PlanAPP´s strategic setting is that of a BO, with REPLAN as a main network for knowledge brokering and co-creation. Indeed, the setting of REPLAN considers the possibility of creating inter-ministerial groups, which may be open to stakeholders and experts outside the Public Administration, fostering subsequent knowledge (by practice) pollination into the remaining public administration, and contributing to institutionalize the relationship between knowledge producers (in academia and elsewhere) and policy- and decision-makers – a relationship that in Portugal remains poorly developed.

5. Conclusion

This paper sheds light on a paradigm shift towards KG in public administration. KG goes beyond KM and works on the institutional level, through a network governance approach. We compare KM to KG and highlight the latter´s potential for addressing complex challenges, as it provides an innovative, transdisciplinary and systemic approach toward knowledge systems. In addition, it supports a more politically- and socially sensitive intervention, avoiding the pitfalls of managerialist approaches (West et al., 2019). KG improves evidence-based policymaking through boundary organizations that work on the knowledge-policy interplay, of which we showcase four empirical examples. These examples highlight the need to focus on institutional design and for

new principles for institutional practices to close the gap between knowledge and policy, (Sienkiewicz and Mair, 2020). Current practices of KM in public administration will not be able to close this gap. To improve our understanding of BOs and their role in enhancing successful KG, we recommend further research and strategic reflection on the institutional setting of newly created BOs, such as the Portuguese PlanAPP. Following Hellstrom and Ikaheimo (2017), we believe that the development of the interaction between knowledge and decision-making is a central strategic competence and governance challenge. Instead of managing knowledge processes through KM, meeting this challenge requires greater societal dialogue and the creation of a shared vision for the future through KG.

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Open Design: Exploring the Use of Open Knowledge in Service Design

Anıl Dinç Demirbilek and Onur Mengi
İzmir University of Economics, İzmir, Turkey
anil.demirbilek@izmirekonomi.edu.tr
onur.mengi@ieu.edu.tr

Abstract: The aim of this paper is to investigate the usage of open knowledge in service design platforms within the theoretical framework of open design. The paper also explores the innovative outcomes of the integration of knowledge management into service design through available digital environments and tools. The methodology is based on a framework analysis of current research on open design and open knowledge, and a critical review of case studies in the service design industry. The structure of the methodology consists of two phases. For the first, framework analysis is employed to organize and examine open design, through the process of summary, to reach a flexible matrix output. The second phase is to analyse different service design platforms as a case study, considering the theoretical discussions of open design that would allow the positioning open knowledge as an instrument to create innovative solutions within service models. The findings will discuss the importance of open design in the context of knowledge management. A critical review of theoretical discussions will enable the exploration of open knowledge in service design through the utilization of digital technologies, and how it responds to emerging problems, and creates solutions and opportunities using technological systems and infrastructure. The relevance of our findings and implications for knowledge management underline the importance of open knowledge integration within service structures. The case study provides a contemporary approach to open design as a methodology, which leads to improved understanding of service design capabilities for the creation of participant involvement in knowledge generation and management. The paper generates value for knowledge communities and designers in different sectors, while illustrating the significance effect of open design methodology on shaping service flows and structures built up on open knowledge.

Keywords*:* open design, open knowledge, service design, innovation management, knowledge management

1. Introduction

"Design is about formulating service concepts and generating ideas'' (Yu and Sangiorgi, 2018, p.41). As a design practice and research area, service design has gained a vital role in terms of generating new experiences and values for users. Its reach has significantly extended over the past two decades and as a design approach, it has become the main driver on enabling service innovation (Meroni and Sangiorgi, 2011). As a brief explanation, service innovation created by service design is a new process, or a new service offering for users, curated specifically by organizations to create value within certain networks (Snyder et al, 2016). Service design also emerged as a new sub-field of design, where designers address the service context in order to develop their roles among participants and actors, providing new solutions to given problems (Kimbell, 2011). On a contemporary scale, creation of value and knowledge became the focus points of service design throughout its development. In this sense, the concept of *service* has shifted to a more process-based market offering which provides value co-creation among multiple participants, and is guided by institutional or organizational structures, rather than referring only to tangible outputs complemented by tangible touchpoints (Vargo and Lusch, 2016).

Regarding knowledge management within service design, open distribution of knowledge and access to information with the contributions of varied participants and users is crucial for the success for firms and companies in terms of their service deliveries. For instance, absorbing and utilizing customer knowledge would not only become an important aspect while designing user-oriented service flow to create innovation (Ordanini and Parasuraman, 2011), but would also stand as an important component for open design to influence the emergence of open knowledge within service deliveries. In this case, when designers and actors among an organizational structure collaborate with their customers and users through their designed service deliveries, distributed knowledge and data eventually become an openly accessible component in long term development plans.

The aim of this paper is to examine the above-mentioned points within the framework of open design and its core features. To explore the usage and integration of open knowledge within service design and delivery mechanics, paper aims to build a connection within knowledge management capabilities and open design approach while considering the openness ideology within its theoretical positioning.

2. Knowledge Management Through Open Design

Open design eliminates boundaries in terms of knowledge sharing and dissemination, range from the level of decision-making on management level operations to the level of manufacturing methods on production capabilities. Both on manufacturing procedures and for creative processes, open design can create transparency in methods of distributing knowledge and in design-based idea generation. Boisseau, Omhover, and Bouchard (2018, p.17) acknowledges the term as "the state of a design project where both the process and the sources of its output are accessible and (re)usable, by anyone and for any purpose". Since ''knowledge'' is considered as an important resource for firms and companies, which can create value and keep sustainable competitive advantage (Wu and Chen, 2014, cited in Wu and Hu, 2018, p.1736), it has become not only the main driver for innovation and development across a whole organizational structure, but also a focus point of open design to propose new ways of producing products and services. In this regard, open design operates with and through knowledge management in terms of providing innovative outcomes, and their connection is evident in innovation strategies. Within a management structure, open design has the potential to provide an influential effect on distributing a more democratized and more equitable knowledge-based information to varied actors in different service or system models through utilizing open knowledge. Since the term operates on a large spectrum and effects the overall knowledge generation and distribution through design attitude, these fundamental abilities enable researchers to consider it within the framework of knowledge management. In order to explain the true and integral connection between open design and knowledge management, the following terminologies were specifically selected to show the influential factor of design thinking on knowledge generation and ideation within the framework of open design ideology. Methodologies of open design: *co-creation, co-design, participatory design and peer-to-peer* keywords perform as foundations for knowledge management through open design processes. Each method is utilized as an approach to make design-based knowledge accessible, visible and most importantly, openly configurable to users and related actors in respect to open knowledge usage and integration. Each method, with their own specific operation areas on design-based systems, enable knowledge transfer and sharing on multiple layers on a wide-ranging spectrum, ranging from the level of individual level ideation to organizational level executions for desired outcomes. Research considers given four main methodologies under three specific categories, which signify their usage levels: *systems, processes* and *tools*. Given levels separate each method to provide a more controlled and focused approach when it comes to explaining open design's integration to service and system models.

The following section is narrated through four specific foundations, derived from their categorization. It explores how each foundation is related to open design in terms of their structure as well as their potential contributions on knowledge management.

2.1 Systems: Peer-to-Peer

Peer-to-peer (P2P) proposes a more democratized management approach within organizational structures to understanding the overall picture in terms of knowledge and information sharing. It generally refers to the decentralization of communication and knowledge distribution without considering any hierarchical collaboration within organizations, thus enabling a more lateral approach in terms of executing design and project development processes (Menichinelli, 2016).

Regarding the previous explanation, Menichinelli (2016) considered P2P from a socio-technological perspective and proposed a framework integrating P2P and open dynamics. Derived from this integration, P2P was divided into four sub-systems to explain its true contribution to knowledge and innovation management through open approaches; *diffused, distributed*, *decentralized* and *centralized* systems. Following explains each system's functions and focus points according to the pre-defined framework.

- *Diffused Systems:* Refers to the system models, where there is no certain pattern of flow of information, and agents are not specifically organized in terms of homogenously distribution of operations.
- *Distributed Systems:* Refers to computer and digital networks, where data and information are stored and shared among each coordinated device.
- *Decentralized Systems:* Refers to the distribution of functions, information and data without reliance on any central authority. Decentralized systems enable the equitable distribution of activities and assets between agents and selected peers.
- *Centralized Systems:* Refers to systems where main operation and functions are stored within a selected focus point to provide control and central monitoring

Each sub-system act as skeleton structure to enable P2P within socio-technological networks. Furthermore, their relationship with the ideology of openness plays a vital role regarding the information and knowledge management for organizational level procedures through software networks and infrastructures.

2.2 Processes: *Co-Design*

Chesbrough, Vanhaverbeke and West (2006) underline the importance of co-design approach's potential to act on multiple layers, such as organizational level structures, and refer to the management of open innovation through the combination of ideas and knowledge of varied users from different organizations and divisions. Similarly, Kleinsmann (2006, p.30) examines the term on design scale and emphasizes its importance in knowledge creation, stating that, '' Co-design is the process in which actors from different disciplines share their knowledge about both the design process and the design content. They do that in order to create shared understanding on both aspects, to be able to integrate and explore their knowledge and to achieve the larger common objective: the new product to be designed''. The term ''co-design'' is crucial when it comes to knowledge sharing, creation, and distribution between multiple and different actors in service models, system structures and design development processes. In this regard, Sanders and Stappers (2008) envisions co-design in a broader sense as a creative act where non-designer and designer participants collaborate to develop innovative solutions in the overall design processes.

2.3 Tools: Co-Creation & Participatory Design

Co-creation provides a fundamental approach by enabling multiple actors to come together and create ideas or solutions for specific issues on both institutional and organizational levels. By nature, co-creation embraces every other mentioned key word of knowledge generation within open design ideology, since its core beneficial aspects can be applied on any other term or operational field. From an organizational perspective, co-creation is a crucial concept that provides engagement between employees, improved supply chain integration, re-defines stakeholder commitment, and enhances workflow and knowledge sharing with external stakeholders and competitors in the market to create innovative outputs (Hatch and Schultz, 2010; Jüttner, Christopher and Godsell, 2010; Madden, Fehle and Fournier, 2006; Kohlbacher, 2008).

Ranjan and Read (2016) considers the concept in terms of its contribution to value creation and suggests two main dimensions followed by their complimentary sub-layers. The initial dimension is co-production, which refers to the involvement of customers in production phases and realizing their engagement with companies (Frow et al, 2015). There are three main sub-dimensions for co-production, each compliments the others, and facilitate co-production process in terms of openness, equity, and also considering user interaction with services and products; *Value-in-use*, on the other hand, a co-creation dimension which refers to collaborative value creation practices, derives its core expansion from a user's evaluation or perception towards product and service functions and affordances when compared to their own individual motivation and goals (Edvardsson, Enquist and Johnston, 2010). Likewise, value-in-use also carries three sub-dimensions that address the value and knowledge creation, focusing on user needs and capabilities. Research has so far focused on selected three sub-dimensions as follows: *equity, experience* and *personalization*.

- *Equity:* Refers to user empowerment through sharing companies' management capabilities and control to enable co-production and creation in terms of equally distributed knowledge.
- *Experience:* Refers to a firm's ability to create cognitive and emotional perception within users through utilizing their services and products to make them able to generate value.
- *Personalization:* Refers to the potential change on creation processes through alterations and customizations provided by the users. These changes can be realized by changes in how users perceive any created services or products in terms of their own unique backgrounds.

The second methodology from tools layer, participatory design, emphasizes the role of collaboration both in the process of designing and of ideation. It enables users and stakeholders to generate solutions to resolve certain problems while participating in the whole structure of design projects. It adds a perspective on mutual development through participation between multiple participants (Simonsen and Robertson, 2013). Democracy and participation appear as two main principles of participatory design (Bratteteig et al, 2013), these concepts provide opportunities for different users to work collaboratively without inequalities in terms of development and knowledge sharing with equalised power relations (Kensing and Greenbaum, 2013). Like the co-design approach, participatory design refers to a collection of design practices which involves target users of design outputs as collaborators during the design processes (Velden and Mörtberg, 2014). Furthermore, participatory design deals not only with the designing process, but also with the aftermath and results of each project. Iversen

and Dindler (2014, p. 154) emphasizes participatory design's inclusiveness and state that, ''as researchers or designers engage with more ambitious goals, such as ensuring that participants and organisations enjoy lasting gains from their participation, it becomes important to consider not only what happens during the project, but also what happens after the project has ended.'' Their explanation shows the importance of realizing that there are multiple actors to consider during the process, and that, through design, knowledge and idea generation expand their reach through each participant's influence on both during and after the process ended.

Methodologies of open design and their categorization according to their usage levels provide sufficient information about how they are related to knowledge management in terms of distribution and democratization of access to data. System level, for instance, through the peer-to-peer approach, deals with infrastructural capabilities, and acts as a main layer of executing data-based systems for managing knowledge-based solutions. At the process level, co-design suggests the involvement of non-designers and other actors in the overall designing processes within the perspective of open design's ability to transform diverse knowledge into an integrated component within design teams and organizations. The final level, tools, and its sub-topics, co-creation and participatory design, focuses on mass participating actors in any given project within organizational and institutional structures. Following table 1, it configures itself as a toolbox of open design's selected methodologies and collects selected keywords to present a brief summary of previous explanations.

Table 1: Open Design methodologies and drivers

Levels	Methodologies	Existing Drivers of Open Design
Systems Layer	Peer-to-Peer	Diffused Systems Distributed Systems Decentralized Systems Centralized Systems
Processes Layer	Co-design	Dialogue Interaction Relationships Knowledge Exchange
Tools Layer	Participatory Design	Equity, Experience, Personalization Knowledge Sharing
	Co-creation	Democracy, Participation

3. Investigation of Open Knowledge in Service Design Industries

Regarding the collaborative nature of open knowledge through co-creative acts, Xin et al (2021) focus on the user participation on knowledge management capabilities in the delivery of innovative services. According to this perspective, in the digital era, by using provided products or services, users leave traces revealing their characteristics, capabilities and demands, but currently, users can additionally give crucial feedback and share their perspectives of service structures. Constant user feedback and data input is a crucial process for open knowledge to integrate itself to any given service model as a main driver for innovation and improvement. Integration between external and internal factors also facilitate information-sharing within service structures and affects the total innovation process. Peñalvo, Figuerola and Merlo, (2010) understand this integration and highlight innovation through collaboration as an open system, where the meeting of internal capabilities and possible external resources (users, participants, providers and networks etc.) enable the creation of value.

To explain the status of open knowledge and analyse its role as an instrument within service design industries to create innovative outputs, this research focuses on three different service and platform examples as cases with the aim of expanding its theoretical framework through contemporary systems. Each case was selected specifically according to its potential to utilize open design's methodologies, its possible contribution to enable the integration of open knowledge through open design framework, and its potential for collaboration with external sources (users, participants, experts etc.) to utilize knowledge management capabilities.

Following attributes were also considered as crucial points while searching for each case and selecting them for further analysis. Each case is:

- A non-profit organization (NGO).
- Utilizes openness ideology.
- Collaborates with users and they are active co-creators.
- Established as a community-based operation system.
- Gathers related data through their digitally established platforms.
- Located within the European region.

The following section describes each case and establishes a perspective based on previous discussions with the contribution of open design's methodologies and drivers.

3.1 Case No.1: FixMyStreet

FixMyStreet (FMS) is an independent web platform established in 2007 by mySociety, a non-profit group, created specifically to encourage the usage of online tools and systems to enable civic empowerment. Their stated main goal is to enable a democratized digital environment where each member of society can become active collaborators in change and development through participation and data exchange. FMS focuses specifically on reporting problems which citizens may encounter during their daily routines within specific public areas or any locations. The platform encourages certain service design attributes contributed by geographical capabilities, such as crowd mapping and sourcing to generate substantial data from each participant. Every reported problem is completely open to access by citizens, and alteration for further development to encourage them become active collaborators. Thus, total service acts as strong decentralized system from peer-to-peer methodology.

Basic service and usage flow of the platform contains three main and simple steps:

- **Location:** Users define their locations and where they encountered the issue.
- **Description:** Users describe the problem.
- **Conformation:** Users follow the conformation of the reported problem via e-mail or selected channel.

Utilizing openness ideology, this case clearly exemplifies alteration of data into useful and accessible tools, which results into an open knowledge-based system is which each citizen is an active collaborator.

3.2 Case No.2: D-Cent Project

Decentralised Citizens Engagement Technologies (D-CENT) was a project aimed to bring together different citizen-led organizations to empower the usage of the next generation of open source, distributed and privacy-aware tools for democratic purposes. The project ran between October 2013 and May 2016 and executed its main goals and targets through proposals of four different digital networks located within specific European geographical areas:

- **Barcelona: ''Decidim Barcelona''** is a digital platform for enabling participation to build democratic, open and a transparent city.
- **Reykjavik: ''Better Reykjavik''** is a participatory platform for citizens to propose ideas and guidance in terms of budgeting of city-wide operations.
- **Helsinki: ''Decisions Helsinki''** is an open API (application programming interface) tool for citizens to follow municipal policy decisions through notifications and data sharing.
- **Madrid: ''Decide Madrid''** is a democracy platform which allows participants to propose, debate and implement policies for the city.

Related to given proposals, D-Cent utilizes following drivers to provide open standards on development and improvement: *ownership of data, opensource / open standards, open authentication, blockchain trust.*

3.3 Case No.3: DECODE Project

Funded by the European Union's Horizon 2020 Programme, DECODE is a key project proposed by Dyne Foundation, a non-profit organization established in 2005 in Amsterdam, Netherlands. It aims to provide online tools for citizen empowerment. DECODE Project acts as a response to people's concerns about the privacy of their data, and helps them utilize their information, regardless of whether they want it to become public or not, with the help of digital tools to change overall data input into useful components for development. Project focuses on IoT (internet of things) capabilities to promote digital citizenship through co-creation methodologies

on a wide range of operation scales. In order fulfil its goal, the project proposes collaboration with specific actors, and considers open knowledge and its components as its main utilities:

- **Citizens and local communities**: Integration of feedback from end-users and citizens.
- **Open-source developers**: Offering knowledge exchange, inspiration and networking.
- **Startups/SMEs (Small and medium sized enterprises):** Introduction of decentralized networks and data architecture to provide data-driven applications within ecosystem building with the collaboration of industry.
- **Academic and research communities:** Distribution of data and knowledge through different levels of expertise and academic backgrounds.
- **Cities and policymakers:** Implementation of data sovereignty and decentralized technologies through city governments and policy makers.

Each case analysis identifies drivers and sub-operation areas related to their utilization of open knowledge and its core capabilities to enable service integration within defined system structures. Regarding previous discussions about openness ideology, the investigation shows an evident relationship between open knowledge and open design methodologies at three main levels (systems, processes, tools). To provide a brief and a concise summary of the given analysis of each case, table 2 presents each observed drivers of open knowledge within provided service industries and project examples and summarizes each main point.

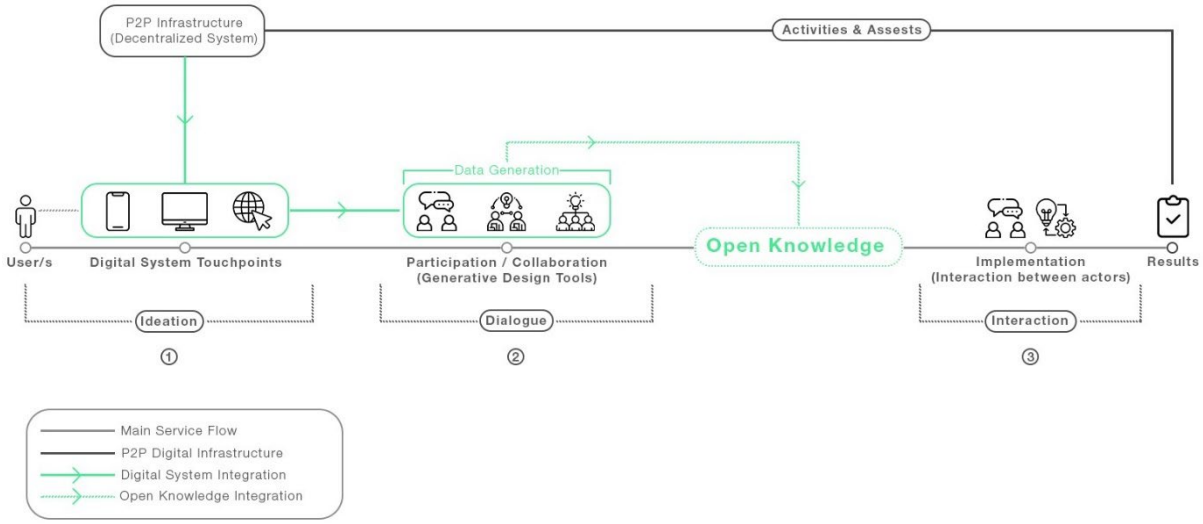
Table 2: Significant drivers for open knowledge within service design cases

Cases	Levels	Significant Drivers for Open Knowledge
FixMyStreet	Systems	*Decentralized System*
	Processes	*Knowledge Exchange*
	Tools	*Participation*
D-CENT Project	Systems	*Decentralized System*
	Processes	*Dialogue*
	Tools	*Democracy, Knowledge Sharing*
DECODE Project	Systems	*Decentralized System*
	Processes	*Dialogue, Knowledge Exchange, Interaction*
	Tools	*Democracy, Equity, Participation*

4. Conclusion

In scope of the research, the overall investigation and the analysis of prior literature shows the evident relationship between knowledge management and open design in utilizing openness ideology, while shaping service and system structures. Within the framework of open design, open knowledge emerged as the main driver for innovative, facilitative and democratic means of distributing information and data. Across the two phases of the research, the following were identified as methodologies of open design: *co-creation, co-design, participatory design and peer-to-peer* within *systems*, *processes* and *tools* layers. These possess the ability to convert acquired data into a valuable knowledge capital, which can become a transparent component allowing the emergence of open knowledge-based design solutions. Following the second phase, overall theoretical approach was complemented by specified cases to illustrate the current state of open knowledge within contemporary service design industries. Development of selected system and service structures is supported by participants and collaboration with users, building on decentralized digital layers which considers P2P as their main infrastructural operation area. Even though each case proposes a linear flow as a simple approach to shape a basic system integration, openness ideology and collaboration allow services to become self-regulating and sustaining, thus providing a significant opportunity for open knowledge to emerge and become integrated into the total flow. Table 3 summarizes this analysis and helps visualize the desired service and system flow.

Table 3: Open knowledge integrated service/system flow



Regarding the table above, as a whole delivery process, consideration of decentralized system layer as the main infrastructural ecosystem, total service and system flow becomes available for open knowledge to emerge and integrate itself through the usage of digital mediums and touchpoints, which are specific user access points for initiating the service to generate data. Furthermore, with the integration of open knowledge, new model becomes multi-dimensional through multiple users and collaborators. To propose a concise and a brief look, general flow of the given service model is divided into three specific phases: *ideation*, *dialogue* and *participation*. With the collaborative processes, users participate and produce relevant information and share their knowledge among themselves through ideation. Next phase is to alter generated data into a transparent tool for further implementation through dialogues and communication between participants. With the help of open knowledge, the delivery phase becomes realized through interactive processes, thus results with innovative outcomes for every actor. Regarding knowledge management capabilities, all three steps compliments the integration process of open knowledge and its distribution to the total service structure, in order to provide an efficient service delivery process as a result.

The findings of this research suggest that the ongoing utilization and integration of open knowledge to knowledge management capabilities is an important aspect to provide the sustainability of service structures and platforms. Shaping up new and innovative service flows where value creation through the utilization of data is a co-operative procedure with the help of participants, would become an important factor in terms of knowledge management capabilities. Regarding practical implications, research contributes to the total framework by explaining the capability of open knowledge on providing social value between actors through dialogue, networking capabilities and sustainable communication, competitive advantage for companies not only from the perspective of producing outputs but also for the sake of collaboration and co-creation to develop and innovate by new service opportunities. Alternative approaches of identifying and observing the integration of open knowledge on service delivery procedures would be necessary for subsequent research to enlarge the framework and the total scope. Theoretical implications of the given research might enable to propose a certain question like, how would open knowledge emerge, if the service capabilities of different system layers such as diffused, distributed or centralized models become the main infrastructural backbones? Moreover, future research can also focus on implementing the proposed open knowledge integrated service model in different industries and service areas like community driven mobility within public transportation systems, within health sector to provide multi-dimensional medical interventions or in education sector where open knowledge sharing is the top priority goal. This possible implementation, complimented by further research can deconstruct and challenge the overall service delivery processes. Next step would be trying to understand the business capabilities through service deliveries and structures in practice, so it can be important to search about the necessary dynamics between participants and actors while utilizing generative design tools during the data and knowledge generation processes within a total service delivery scenario to conduct further research and contribution.

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Do Entrepreneurial Ecosystems Matter in Knowledge Sharing Through Startups?

Roberta Dutra de Andrade[1], Paulo Gonçalves Pinheiro[1] and Luísa Cagica Carvalho[2]
[1]NECE – Research Center in Business Sciences, University of Beira Interior, Covilhã, Portugal
[2]CEFAGE - Research Center for Advanced Studies in Management and Economics, Polytechnic Institute of, Setúbal, Setúbal, Portugal
roberta.andrade@ubi.pt
pgp@ubi.pt
luisa.c.carvalho@esce.ips.pt

Abstract: The entrepreneurial ecosystem metaphor has been overused with scarce and often inconsistent definitions in academia. Its impact on management has been studied for decades with growing interest from industry and policymakers. For this reason, research on entrepreneurial ecosystems was mapped to understand better how this domain has evolved as a function of venture geography, innovation adoption and knowledge sharing. A systematic literature review was conducted using Web of Science to collect metadata. First, using Biblioshiny, we conducted a bibliometric analysis and content analysis of the conceptual and social structures of the metadata to reveal the evolution of research from 1984 to 2022, networks, and collaborations. We then provide critical insights on trends, journals, articles, authors, institutions, and countries. The results have been classified into major thematic groups - (i) entrepreneurial ecosystems and innovation efficiency, (ii) Innovation systems, digital affordances, and networks, (iii) Knowledge-based innovation systems, metrics for entrepreneurship, and collaboration in helix, and (iv) digital entrepreneurial ecosystems - emphasising their contributions and presenting a research agenda. Finally, we present implications for future research.

Keywords: Entrepreneurial Ecosystem; Knowledge Sharing; Bibliometric Analysis; Systematic Literature Review.

1. Introduction

The ecosystems epistemology comes from the word *Oikos* and dates back to 700 bc, and since then, there has been an evolution of vocabularies and taxonomies. The territorial approach to entrepreneurial ecosystems relates to other precursor concepts such as industrial districts (Marshall, 1890; Becattini, 1989; Bellandi, 1996), regional and national innovation systems (Asheim and Coenen, 2005)Freeman, 1987; Lundvall, 1992; Nelson, 1992; Cooke, 1992, 2001; Edquist, 1997), learning regions (Morgan, 1997; Cappellin & Wink, 2009; Ascheim & Gertler, 2005), clusters (Porter, 1998, 2000; Asheim & Coenen, 2005) and innovative environments (Aydalot, 1986; Ratti, 1989; Camagni, 1991; Camagni & Maillat, 2006).

Interest in entrepreneurial ecosystems (EEs) has been growing over the last 15 years and, as of 2017, has led to a considerable increase in publications in academic journals (Theodoraki, Dana and Caputo, 2022). The concept of ecosystems has become popular in strategy corresponding to "the alignment structure of the multilateral set of partners that need to interact for a focal value proposition to materialise" (Adner, 2017, p.40). EE has become a central topic in entrepreneurship research (Torres and Godinho, no date). However, definitions remain scarce and often inconsistent, with atheoretical, static and broad conceptualisations (Audretsch and Link, 2019). Ecosystems differ in governance form and emerge from multi-polar coordination based on many types of complementarities (Jacobides, Cennamo and Gawer, 2018). It also includes external resources and orchestrated stakeholder communities that focus on identifying, reaching and scaling opportunities (Autio *et al.*, 2014).

Most EE definitions ignore the entrepreneur's role in creating new values (Acs *et al.*, 2017). Previous research presents multifaced approaches concerning entrepreneurial ecosystems. Even taking venture geography as a basis, the existing vague definitions do not respect the boundaries of the respective clusters (Audretsch and Link, 2019). This wide variety of topics raises the need to assess the state of the art of the managerial literature on entrepreneurial ecosystems so that there is an adequate performance evaluation and measurement of their results, which is currently made impossible by the imprecision of their definitions (Acs *et al.*, 2017; Cavallo, Ghezzi and Balocco, 2019; Audretsch, Lehmann and Seitz, 2021; Volkmann *et al.*, 2021).

Recently, comprehension of entrepreneurial ecosystems permeated different approaches considering features, dimensions, key elements, and business conditions (Audretsch, Lehmann and Seitz, 2021). Previous research presents interwoven and multi-layered paths. It includes a focus on (i) innovation efficiency analysis (Fischer *et*

al., no date; Guan and Liu, 2005; Guan and Chen, 2009, 2012; Chen and Guan, 2016; Fischer, Queiroz and Vonortas, 2018; Sunny and Shu, 2019; Alves, Fischer and Vonortas, 2021; Zhao *et al.*, 2021; Dionisio, Inacio Junior and Fischer, 2021; Pushkarskaya *et al.*, 2021); (ii) digital affordances and networks (Autio *et al.*, 2014; Autio, Nambisan, Llewellyn D W Thomas, *et al.*, 2018; Autio, Nambisan, Llewellyn D.W. Thomas, *et al.*, 2018; Lamine *et al.*, 2018; Qin, Wright and Gao, 2019); (iii) knowledge-based innovation systems, and collaborations through multiple helices (Carayannis et al., 2018; Carayannis & Campbell, 2021; Heikka & Carayannis, 2019; Inacio Junior et al., 2021; Mikel Zabala-Iturriagagoitia et al., 2021; Fritsch et al., 2020; Ivanova et al., 2019; Leydesdorff & Porto-Gomez, 2019; Perret, 2019); e (iv) digital entrepreneurial ecosystems, and technological transitions for sustainability (Grillitsch *et al.*, 2019; Yap and Truffer, 2019; Kashani and Roshani, 2019; Andersen and Markard, 2020; Hipp and Binz, 2020; Kieft, Harmsen and Hekkert, 2020; Koehler, Raven and Walrave, 2020; Musiolik *et al.*, 2020; van Welie, Boon and Truffer, 2020; Heiberg, Truffer and Binz, 2022; van der Loos *et al.*, 2022).

Several systematic and bibliometric literature reviews present research agendas for EEs (Theodoraki and Catanzaro, 2022). However, a holistic framework that addresses diverse methods, theories and approaches, integrating the factors of venture geography, innovation adoption and knowledge sharing, is still needed. This research aims to unravel the domain addressing entrepreneurial ecosystems by providing a framework through a systematic literature review with bibliometric analysis considering high-quality contributions in the management literature. We conducted a systematic literature review in the Web of Science database, followed by performance analysis and comprehensive bibliometric scientific mapping. The most relevant articles, journals, institutions, countries and authors were categorised. Publications and citations were networked considering co-authorship, co-occurrence, and bibliographic coupling.

Content analysis of the metadata revealed collaborative networks and the evolution of research over the last thirty-eight years, resulting in descriptive statistics, social and conceptual frameworks. The state-of-the-art mapping resulted in four distinct thematic clusters with temporal overlaps. A holistic framework is then developed by integrating venture geography, innovation adoption and knowledge sharing into the EE literature. Finally, we offer a qualitative cluster thematic analysis and several emerging directions for future research are highlighted with suggestions for future theory and practice development.

2. Systematic review protocol

A systematic literature review protocol (Liberati *et al.*, 2009) was used to ensure primary research's greatest strength, synthesis, significance, pertinence, and reliability in a specific field (Snyder, 2019). The review focused on studies about entrepreneurial, digital, and innovation ecosystems. Data analysis was carriperformanceing meta-analysis using the Bibliometrix – Biblioshiny (Aria and Cuccurullo, 2017) on R-Studio software. To guarantee the transparency and replicability of this review, the researchers used the procedure was proposed by (2003).

The articles collection was done in the Web of Science (Pranckutė, 2021), indexing database on March 10th, 2022, with the search research equation for the entire period. The search resulted in 8,606 documents. Applying some selection criteria reduces to 2,312 papers used for bibliometrics and scientometrics analysis. The protocol and the article selection process with all descriptions by stages can be seen in detail in Table 1.

Table 1: Systematic literature review protocol

STEP	INPUT	DESCRIPTION
Search Method & Scope	Database	Web of Science - WoS
	Type of articles	Published in Journals - full Search (Liberati *et al.*, 2009)
	Scope	Topic (title, abstract & keywords) (Snyder, 2019)
	Research equation	((("entrepreneur*") AND (knowledge*) AND (("digital entrepreneurial ecosystem*") OR ("digital business ecosystem*") OR ("digital platform ecosystem*") OR ("entrepreneurial ecosystem*") OR ("innovation ecosystem*") OR ("innovaton system*")))
	Research date	March/10/ 2022
Research selection process	Research selection process: **full WoS search**	8,606 all findings: WoS Only (Pranckutė, 2021) https://www.webofscience.com/wos/woscc/summary/83b44d1b-9c8a-4478-8339-c36062062c99-287690a3/relevance/1 no additional records through other sources; no duplicated articles 5,918 articles: full articles Only (Tranfield, Denyer and Smart, 2003)

Records used for **descriptive analysis** in **Bibliometrix**	3,107 articles: manager, business, and economics categories (Bengtsson and Raza-Ullah, 2016)
	2,959 articles: English only (Ankrah and Al-Tabbaa, 2015)
	2,312 articles: SSCI - Social Sciences Citation Index (Jones, Coviello and Tang, 2011)

Origin: prepared by the author

3. Bibliometric analysis

The bibliometric method was used to identify patterns in the literature through science mapping and performance analysis with a quantitative perspective (Aria et al., 2020). The open-source R-package Bibliometrix – Biblioshiny (Aria & Cuccurullo, 2017) provided plural tools for bibliometrics and scientometrics. Network extraction offered a descriptive analysis focused on prominent authors, sources, documents, and social and conceptual structures with their upcoming outputs.

3.1 Dataset Results

The Bibliometrix's descriptive analysis of collection metadata describes a summary of collected results. Unless we did not use any time filter, publications refer to 1984 until March/10/2022. 4,260 authors published 2,313 articles - 396 single-authored - in 238 journals with 89,754 citations. These papers represent an average of 4.48 publications per year with a 2.06 collaboration index and 5,267 author's keywords.

Regarding the annual scientific production (1984-2022). We decided to maintain data, despite the false impression of decreasing publications in 2022 due to research conducted in March. The results reveal the field remained hibernating from 1984-to 2000, and researchers have become more involved since 2011 and 2021 reached higher peak frequencies of publications in an upward curve.

3.2 Leading sources

A fundamental part of a bibliometric analysis is identifying the most active sources (Aria et al., 2020), and figures 1 and 2 categorise them. Figure 1 refers to the reference lists of the results, and Figure 2, refers to the citation of journals publishing the results. The most cited and cited source is the Journal Research Policy, with 12,245 articles and has a vast distance from the second place, Journal Technology Forecasting and social change. With an impact factor of 8,110 and a total citation of 32,584 in an upward curve, articles citation median of 5, the journal is 26/226 in the management category belonging to the first quartile of the Ranking Clarivate Journal Citation Reports®.

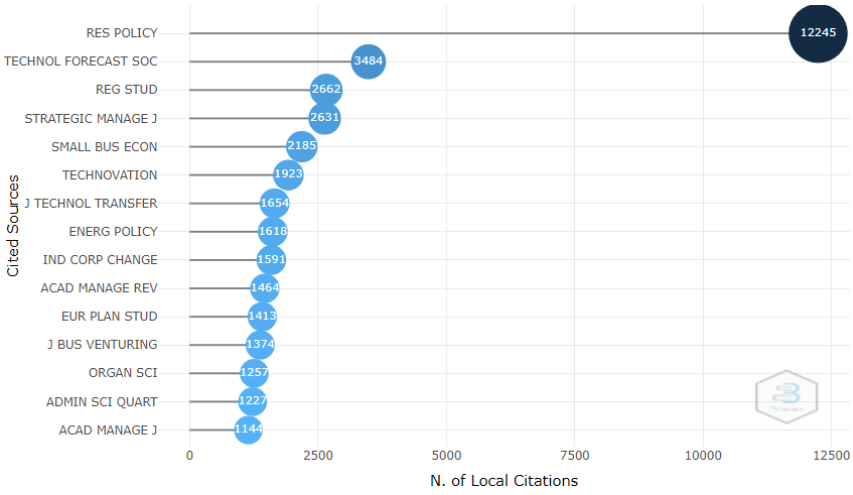


Figure 1: Most Relevant Cited Sources

Origin: Bibliometrix – Biblioshiny, opensource R-Studio

Figure 2 brings the same two Journals of figure 1 at the top of the citing sources ranking with inversion of the order. The Journal Technology Forecasting and Social Change occupies the first place with 267 and is very close to the Journal Research policy with 246 citations. The other sources are even earlier, with 97 or fewer citations. The results point to a wide range of journals divided into three distinct blocks of citation quantities. The first two

Journals exceed 200 citations; the middle block shows between 70 and 100 citations, and the last block is from 30 to 50.

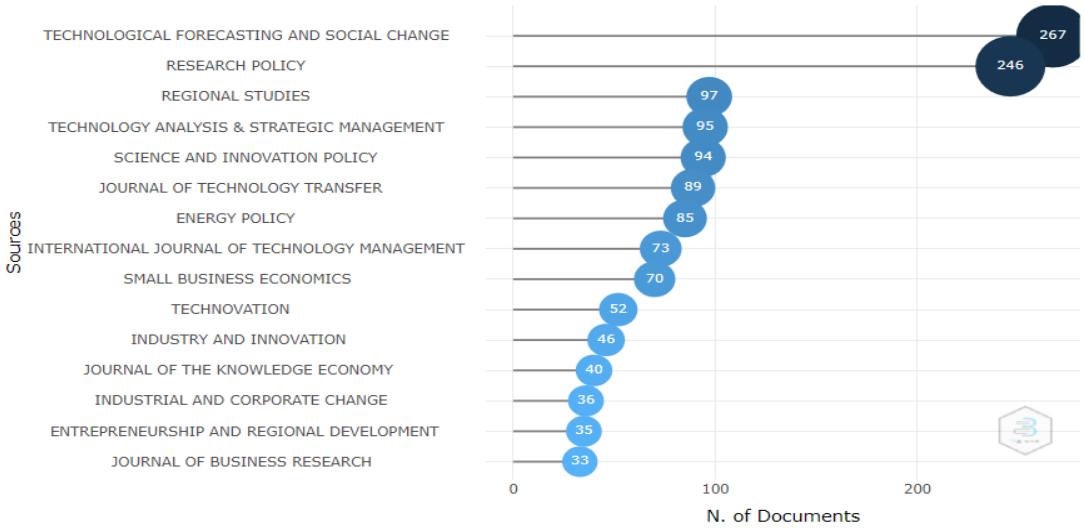


Figure 2: Most Relevant Citing Sources

Origin: Bibliometrix – Biblioshiny, opensource R-Studio

3.3 Most influential authors

In terms of publications, the twenty most relevant authors published 4,260 papers. The most pertinent authors are Truffer, B (22 publications and 577 citations); Hekkert, MP (17publications and 516 citations); and Markard, J (16 publications and 421 citations). Two other authors who had many citations even with few publications were Jacobsson (534 citations in only nine publications) and Carlsson (438 citations with four publications). The group has an average citation rate of approximately 75 citations per article. Interestingly, the authors of positions 14 (Lindmark, S) and 20 (Uranga, MG) present the highest citation rates per article, respectively, 253 and 218. Also, interestingly, the author of position 8 (Adner, R) presents the lowest and most discrepant rate with only 12 citations per article. A further curiosity is that the two authors with the highest citation per article rates 'produced only one work and stopped publishing. The analysis uses a frequency measure with fractional frequency, which means that it quantifies the individual contribution of each co-author. These results indicate that many researchers seem interested in the topic, but few continue to investigate it.

Considering the output of the Top Authors over time, the most constant author was Truffer, B, who has published since 2008 and already has publications in 2022 starting. His highest publication years were 2013, 2017, and 2018. The most relevant authors in 2021 were Carayannis, EG; Lee, K; Audretsch, DB, and Guerrero, M. Of the authors shown in figure 4, those who have already published in 2022 beginning were Truffer, B; Lee, k; Audretsch, DB; Binz, C, and Alkemade, F.

3.4 Most productive institutions and countries

Utrecht University (Netherlands) is the most productive institute, with 96 articles. It is followed by Lund University (Sweden) with 78 articles and the University of Manchester (England) with 57 articles. The top 3 most productive universities and most of the universities listed are all European. The only American university, George Washington, appears in 6th place with 35 articles. The list also features three universities from emerging countries: Tsinghua of China in 4th place with 38 publications, followed by the Brazilian University Unicamp in 8th place with 29 publications, and Seoul Natl University of Korea in 10th place with 28 journals.

Scientific production by country (the corresponding authors) indicates the top 10. Among them, the countries with the highest production are (i) the United States (USA); (ii) the United Kingdom; and (iii) China; (iv). 5 European Union countries appear on the list, and Australia in 10th place. No Latin country appears anywhere.

On the one hand, the United Kingdom and the United States remain among the most cited countries because they have a high average number of citations. The list repeats itself among the ten most productive. Therefore, a high production may not be reflected in citations.

3.5 Most-cited publications

Table 2 shows the top ten articles ranked by overall and annual citations, considering the most cited publications. All have above 700 total citations and an average of citations per year above 60. The two most recent articles ranked 1st (Markard et al., 2012) and 10th (Smith & Raven, 2012) belong to the same year. Unlike all the other articles that address different perspectives of innovation systems, these deal with sustainable transitions. The oldest article in the top ranking dates back to 1997 (Cooke et al.) and provides an overview of regional innovation systems. The papers in this list were included in the thematic discussion; we address the contributions of the most influential papers, the primary authors, the most cited, and the most recent ones.

Table 2: Most Cited Papers

Reference	TC	ACy
Markard et al., 2012	1324	120,36
Malerba, 2002	1131	53,86
Cooke, 1997	1125	43,27
Hekkert et al., 2017	1121	70,06
Adner & Kapoor, 2010	994	76,46
Furman et al., 2002	978	46,57
Bergek et al., 2008	918	61,20
Acs et al., 2002	837	39,86
Jensen et al., 2007	826	51,63
Smith & Raven, 2012	774	70,36

TC = total citations; **ACy** = Average Citations per year
Origin: adapted by authors from Bibliometrix – Biblioshiny

3.6 Trend topics

Figure 3 presents the trending topics. We set the following parameters, authors' keywords, timespan 2017-2022 to capture the most recent topics remaining a no polluted picture. We kept the system default to a word minimum frequency of 10 and at least 5 per year. The beginning and end of each line delimit the first and last publication's year. The circles' positions represent the average publication year and its size, the co-occurrence of each keyword.

Furthermore, entrepreneurial ecosystems remain an actual and relevant toping; its circle is more significant than innovation ecosystems and a more frequent keyword. It's worth mentioning new approaches to the same constructs. Sustainable Entrepreneurship and development are the brand new perspective on ecosystems, both entrepreneurial and innovation. Moreover, innovation is being studied from an increasingly technological perspective. Knowledge management keeps being a transversal theme of interest.

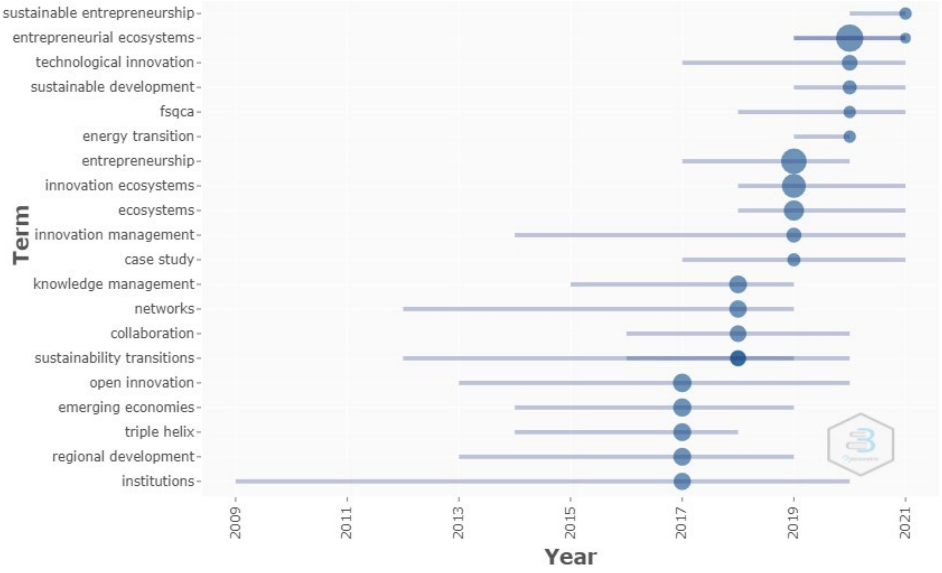


Figure 3: Trending Topics

Origin: Bibliometrix – Biblioshiny, opensource R-Studio

3.7 Social Structure

The software provides three units of collaboration analysis: institutions, authors, and countries. Considering the low average of 1.84 authors per publication and the absence of relevant results on collaborations between authors and institutions, it only presents collaborations between countries. Figure 4 shows a map of this collaboration and its network. The parameters considered were ten minimum edges and five edges size per default.

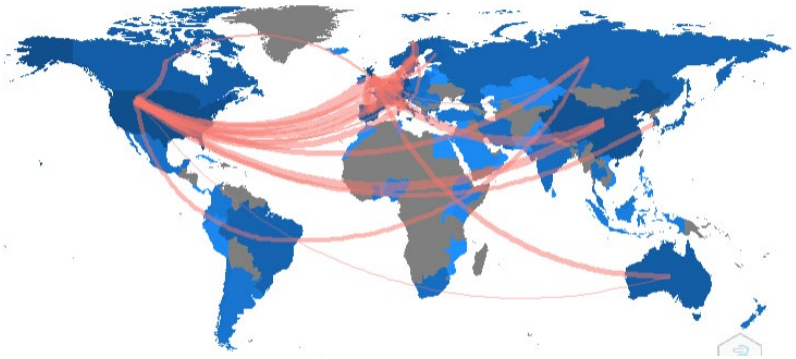


Figure 4: Countries Collaboration Map

Origin: Bibliometrix – Biblioshiny, opensource R-Studio

The USA is the primary collaboration country with the most diverse activities, mainly the United Kingdom, Europe, and China. However, it's worthing noting collaborations with Australia and Russia. No relevant collaborations with and from Africa and Latin America were detected per filters applied. Table 3 presents the correspondent author's top ten most relevant countries. Except for Sweden, which shows a similar index of collaborations, other countries have internal collaboration higher than international. The country collaboration rates turned into 0,3 and 0,5.

Table 3: Intra And Inter-Country Collaboration Among Countries

Ranking	Country	Articles	SCP	MCP	CCR
1	UNITED KINGDOM	279	159	120	0,4
2	USA	271	182	89	0,3
3	CHINA	202	129	73	0,4
4	GERMANY	179	121	58	0,3
5	NETHERLANDS	145	85	60	0,4
6	ITALY	121	78	43	0,4
7	SPAIN	97	69	28	0,3
8	SWEDEN	87	44	43	0,5
9	FRANCE	75	41	34	0,5
10	AUSTRALIA	74	46	28	0,4

SCP = single country; **MCP** = multiple countries; **CCR** = country collaboration rate

Origin: adapted by authors from Bibliometrix – Biblioshiny

The collaboration network shows the three clusters among the international collaborations. The only cluster with clear leadership is the red one which the United Kingdom and the USA lead. Other clusters don't manifest a significant leader. It used the default parameters (Aria and Cuccurullo, 2017), e.g., automatic layout, Louvain clustering algorithm, and normalisation by association, removing isolated nodes. As a result, the blue cluster has more density than followed red one, while the green cluster has less centrality and density once they have fewer collaborations. Therefore, the United Kingdom and the United States' central position corresponds to their relevant position as the most significant number of publications with international affiliations. On the other hand, it's impossible to notify an immense power of centrality or density of emergent economies. In the figure, They appear as supporting roles without collaborations between China and Latin America.

3.8 Conceptual Structure

The conceptual framework presented in Figure 5 distinguishes the most important and recent themes by applying the criteria of centrality (relevance of the theme to the field) and density (a measure of its development) (Aria et al., 2020). Default settings were applied on the authors' keywords, minimum clustering frequency - five (per thousand docs), several words - 250, and three labels for each cluster following Cahlik's

(2000) and Aria et al.'s (2020) criteria. The figure behaves like a life cycle of the presented topic to the research field and gives a static picture of the authors' keywords clustered together.

The lower left quadrant shows "nascent, emerging or declining themes, with low centrality and low density, meaning that they are underdeveloped and marginal." Such themes, represented here by the idea of university-industry collaboration and triple helix relationships and university entrepreneurship, may develop in the future by emerging into the next quadrant. The top left quadrant displays the "highly developed and isolated themes, with well-developed internal linkages (high density) but no important external linkages (low centrality), meaning that they are of limited importance to the field"(Aria et al., 2020: 823). Here universities appear to be being studied in isolation, and technological innovation systems are being analysed in conjunction with the idea of sustainable technical transitions. Much of the transitions studies in this quadrant relate to the energy industry and the development of new sustainable energy. They are of marginal importance to the field.

The upper right quadrant has "the driving themes, characterised by high centrality and high density, meaning that they are developed and important to the research field" (Aria et al., 2020: 822). Here, entrepreneurial and innovative ecosystems are associated with open innovation, regional development, and knowledge management. In contrast, the lower right quadrant has "basic and crosscutting themes, worked across a variety of knowledge areas and characterised by high centrality and low density, meaning that these themes are important for a domain and concern general themes that cut across the different research areas of the field" (Aria et al., 2020: 822). Here there are two major clusters with a tendency to intersect. The rose cluster presents the innovation systems associated with its policies, and a relevant number of studies deal with the topic in emerging economies and the European Union. They also use institutions to measure absorptive capacities in national contexts. The blue cluster presents innovation policies in regional contexts, and most research has been conducted in regions of Greater China. Here the focus was on technology transfer, research, and development of new technologies, with the number of patents as the primary measure.

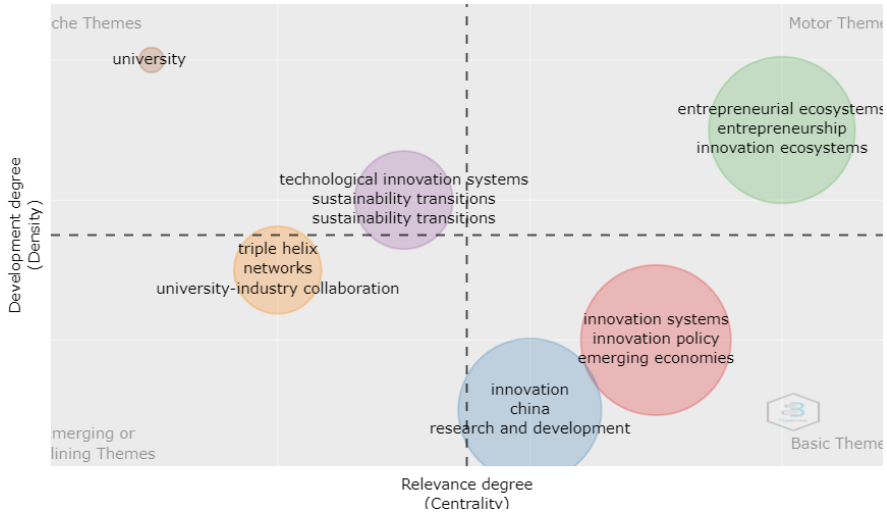


Figure 5: Thematic Map

Origin: Bibliometrix – Biblioshiny, opensource R-Studio

3.9 Overall thematic evolution

The thematic evolution presented in Figure 6 shows that the researched period from 1984 to 2022 was divided by the software into two timespans: i) 1984-2016 (Figure 11), ii) 2017-2022 (Figure 12). This division corroborates the annual scientific production, where we see an increasing increase in publications with a yearly average of more than 150 articles per year. It also shows how the theme was concentrated, evolved, and the turning point in 2016-2017. The terms innovation systems, open innovation, and technological innovation systems were maintained and presented variations with regional approaches. The term technology transfer emerged in the second timespan and merged concepts of innovation associated with biotechnology. The keyword entrepreneurial ecosystems incorporated several keywords associated mainly with innovation and triple helix, which evolved to quadruple and quintuple approaches in the following years.

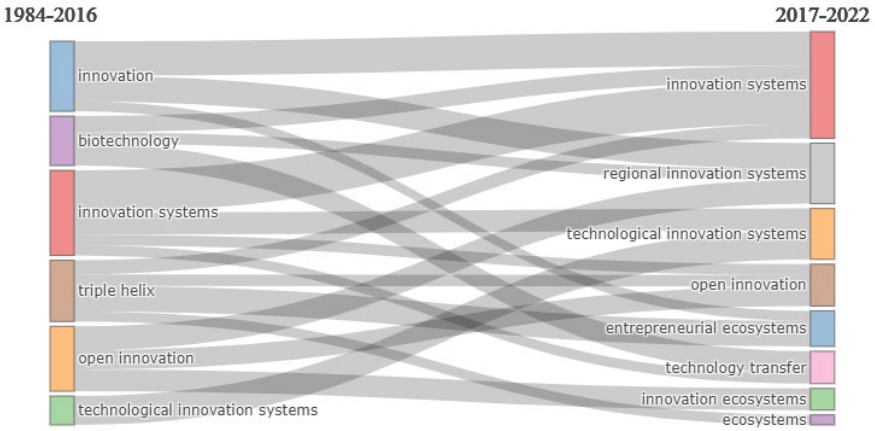
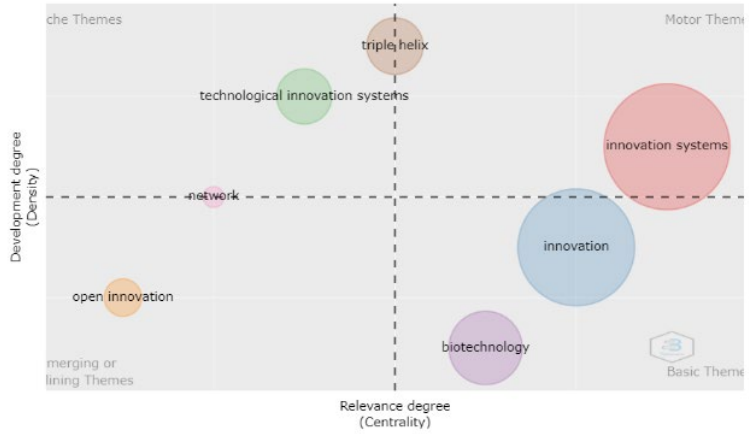


Figure 6: Thematic Evolution Per Author's Keywords

Origin: Bibliometrix – Biblioshiny, opensource R-Studio

3.10 First period (1984-2016)

During the first reference period (1984-2016), innovation systems were driving and crosscutting themes along with the triple helix, while innovation and biotechnology were basic crosscutting themes (Figure 7a). Research on technological innovation systems is a developed and isolated theme. In contrast, open innovation and networks are in the emerging or declining quadrant. It is possible to assume the decline of the network because it is not present in the following reference period and the emergence of open innovation by its permanence and growth in the subsequent period (Figure 7b). It is important to emphasise that the cross-sectional research for this period mainly involved emerging economies, especially China.



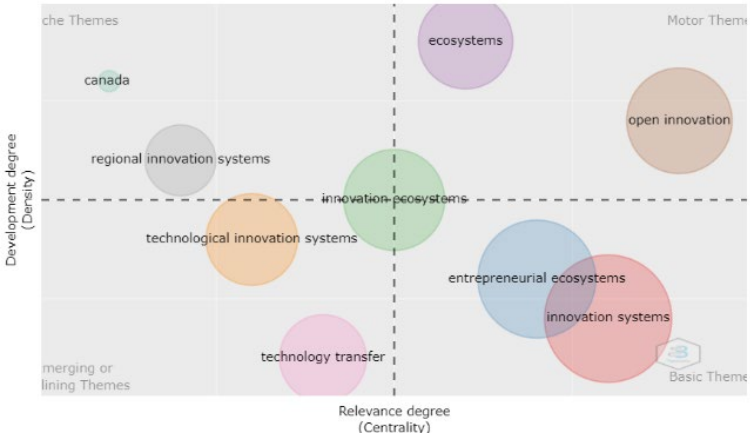


Figure 7a. Thematic Map Of Author's Keywords During 1984-2016

Figure 7b. Thematic Map Of Author's Keywords During 2017-2022

Origin: Bibliometrix – Biblioshiny, opensource R-Studio

It is worth highlighting the keywords associations here since they cluster differently in the next period. The orange cluster associates open innovation with research and development. The yellow cluster aggregates biofuels and sustainability transitions to Technological innovation systems. The brown cluster that deals with the triple helix brings the institutions, regional development, and regional systems and policies. The pink cluster brings the innovation systems associated with the concepts of Knowledge management, social capital, absorptive capacity, and governance. The blue cluster integrates crosscutting concepts of innovation, entrepreneurship, and technology with a significant field of study in China. Finally, the purple cluster relates technology transfer, patents, Universities, and Knowledge spillovers to the biotechnology area.

3.11 Second period (2017-2022)

Figure 8 presents the second timespan (2017-2022). The second timespan gives growth in the number of clusters and brings new keywords and new associations for keywords from the past period. A new technology transfer cluster appears in the emerging or declining themes quadrant. This keyword disaggregated from the biotechnology cluster of the previous period, which lost relevance and dropped and now seems to be associated with higher education, academic entrepreneurship, and knowledge spillover. Still, in the same quadrant, the cluster technological innovation system declined in the previous period despite gaining volume associated with renewable energy and economic development with studies conducted in Africa.

In the quadrant of isolated themes, two new clusters appear. The smaller cluster presents studies conducted in Canada, and a larger one brings together regional and global innovation systems, social networks, and COVID-19. Biotechnology is no longer the central theme and is aggregated to the dark blue cluster. The new cluster innovation ecosystems that aggregate the keywords entrepreneurial universities, sustainable development, and university-industry collaboration appear at the intersection of the quadrants. In the quadrant of the driving themes, the ecosystems cluster is associated with social entrepreneurship, demonstrating the theme's potential for growth. The open innovation cluster, which emerged in the previous period, appears extraordinarily relevant and integrated with the triple helix and knowledge management concepts.

Finally, two clusters communicate and intercede in the quadrant of transversal themes. The entrepreneurial ecosystem cluster aggregates the concept of sustainable entrepreneurship. Several studies were with European startups (including the UK). The innovation systems cluster is associated with studies conducted in emerging economies, mainly China, and used as performance measures patents, research and development, policies whose analysis units are institutions. Although the USA represents a high percentage of publications and collaborations, the country did not present itself as a relevant keyword; it appeared only throughout the articles.

In contrast to the visualisation of the whole period, the themes in the right quadrants have several overlaps and more proximity in both periods. Thus, the most cited articles are in the right quadrants. Hence, the most influential papers are the transversal and motor ones.

3.12 Co-occurrence network

The co-occurrence network presents the research in front of the topics addressed. Again, the standard parameters were used and taken as a basis for the Keywords of the authors (Aria & Cuccurullo, 2017) with normalisation by association, node size proportional to its occurrence, and the line size is proportional to the co-occurrence of the items. The colours red, blue and green identify three clusters. Combining thematic and network analysis, it stands out that crosscutting and driving themes are at the centre of the clusters, e.g. innovation, innovation systems, and entrepreneurial ecosystems. All clusters possess centrality. However, the red and blue clusters have more significant co-occurrence, and their links have greater strength. The red cluster is the largest of all. The theme with the most remarkable centrality is innovation systems and relates to interventions and structures for innovation at the macro level. The blue cluster, whose central theme is innovation, deals with its content and application. Finally, the green cluster brings the entrepreneurial ecosystems as a significant and emerging theme and deals with the relationship of entrepreneurship with innovation and its structures.

4. Conclusions

This research is pioneering in providing a comprehensive bibliometric analysis without temporal clipping of entrepreneurial ecosystems with venture geography and conditions, technological innovation adoption and

knowledge sharing in management research. By identifying and categorising authors, articles, journals, countries, institutions, and their collaboration networks, state of the art are better portrayed, providing key themes and trends. Therefore, the findings presented are valuable for researchers to advance in investigating entrepreneurial ecosystems and their knowledge sharing dynamics influenced by the adoption of innovations.

In addition to its contributions, the limitations of a bibliometric analysis must be considered. We suggest using other databases (e.g. Scopus), other bibliometric analysis software (e.g. VOSviewer), adding different topics to the research equation, and an in-depth discussion of the issues identified. While the analysis also excluded grey literature, it did not capture all available research on the intersection between the concepts addressed. Furthermore, the results do not assess the purpose of citation, which means that it is unknown whether quotations were used to agree or disagree with the authors.

The state-of-the-art mapping resulted in four distinct thematic clusters, which had been qualitatively analysed, highlighting several emerging directions for future research. A holistic framework is then developed by integrating venture geography, innovation adoption and knowledge sharing into the EE literature. Finally, this research had identified relevant issues and gaps to be addressed. It is possible to conduct further bibliometric analyses using co-citation and historiographic networks.

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Sources of Knowledge About Cryptocurrencies: Polish Students Perspective

Monika Eisenbardt[1] and Tomasz Eisenbardt[2]
[1]University of Economics in Katowice, Poland
[2]University of Warsaw, Warsaw, Poland
monika.eisenbardt@ue.katowice.pl
teisenbardt@wz.uw.edu.pl

Abstract: People obtain knowledge from different sources, depending on the issues that they wish to analyze or resolve. In this paper, the authors examine the sources of knowledge on cryptocurrencies that can be useful for young people. The authors used a survey questionnaire to collect empirical data. The sample consisted of students from Polish universities representing the population that is particularly interested in new technologies and solutions emerging on the market, as exemplified by cryptocurrencies. The purpose of this paper is to find an answer to the main research question: What sources of knowledge about cryptocurrencies have students used? Two criteria were taken into account, namely the respondents' gender and the location of the universities where they studied. The general results showed that students choose modern, preferably well-known sources of knowledge about cryptocurrencies such as popular information websites and social media as well as information provided by their family and friends. The gender analysis showed that the main differences concern the sources of knowledge on cryptocurrencies: popular information websites were chosen more often by men, whereas television and radio were used more frequently by females. Regarding the location of the university, our findings showed that the approach of students to sources of knowledge tends to be similar, regardless of whether they study in Warsaw or Katowice. A difference was found for only one variable, i.e., family and friends. Thus, family and friends were a source of knowledge that students from Warsaw used more frequently than those from Katowice. It may indicate that metropolitan students are more sociable or family-minded.

Keywords: knowledge, sources of knowledge, cryptocurrencies, Bitcoin, Poland perspective

1. Introduction

The value of knowledge for modern people increases over the time. Currently there is an agreement in the literature that knowledge is a strategic resource supporting people in achieving and developing their own goals (Aghamirian, Dorri, & Aghamirian, 2015; Tsai, Tsai, Li, & Lin, 2012; Tseng, 2016; Song & Kang, 2016). There are two main sources of knowledge that people can employ. The first one is the sources of knowledge that exist inside enterprises and which enterprises often share with people to achieve their preconceived goals. The second one is the sources of knowledge that exist outside enterprises and which can support people in decision making. The subject of these sources can be consumers and other internet users. These sources of knowledge can be beneficial for both enterprises and people. From those perspectives people can create sources of knowledge on their own and others can use them for their own purposes. Today, ICT play a key role as the sources of knowledge.

Considering the constant change of people's needs and expectations, their willingness to share knowledge (Ziemba & Eisenbardt, 2014) and the continuous development of ICT, which are leading sources of knowledge for many users, people face the challenge of choosing the right sources of knowledge that will enable them to gain knowledge on a specific topic and solution to a specific problem. So they have to decide what sources they want to use, especially if the solutions they are looking for are to specific and innovative problems. In this study, knowledge about cryptocurrencies is considered as a specific problem that people seek knowledge about.

There is a numerous of papers on sources of knowledge that can be found easily (Dost et al., 2020; Hansson, 2020; Kotwica, 2020; Liu & Liu, 2008; Raisi et al., 2020; Tang et al., 2019; Wermke, 2012). Nonetheless, we noticed that there is a lack of papers on sources of knowledge that people use for specific and novel problems. Therefore, we would like to fill this gap with our investigation and results. This paper aims to answer the main research question: What sources of knowledge about cryptocurrencies have students employed? Accordingly, the objectives of the paper are twofold. First, a general analysis of the sources of knowledge about cryptocurrencies that people use was performed. Second, a thorough analyses were performed focusing on such peoples' characteristics as gender and university environment. Studying the statistically significant differences between the sources of knowledge that people use was the main goal of this part of the paper. In practical terms,

the findings showed which sources of knowledge are leading ones for people when they are focusing on specific and quite new issues such as cryptocurrencies.

The sample choice for our research was on purpose. We decided to address our survey to young people only, i.e., university students as they are the group of people who are particularly interested in new technologies and solutions emerging on the market, which are exemplified by cryptocurrencies (Gogus & Saygın, 2019; Szymkowiak et al., 2021). Moreover, our teaching practices have shown that more and more students have experience with cryptocurrencies. They are trying to deepen their knowledge about this issue using different sources of knowledge, both technological and standard ones, focusing on searching and digging for cryptocurrencies for two main purposes, i.e., (1) as a kind of entertainment and way of spending their spare time and (2) as the possibility to make some profit.

The paper is organized as follows: the research questions and hypothesis are followed by the research methodology; then results, analysis, and discussion are provided; and the paper concludes with a summary, limitations, and avenues for future research.

2. Literature background

2.1 Review of literature on cryptocurrencies

Cryptocurrencies are a relatively new term and Bitcoin (BTC) may be considered as the first cryptocurrency. Bitcoin was introduced on October 31, 2008 to a cryptography mailing list. On January 12, 2009 the first BTC transaction took place. On May 24, 2009 a paper of Satoshi Nakamoto was released (Nakamoto, 2009). There are various assumptions who Satoshi Nakamoto really is (Vigna, 2021; Who is, 2021; Sharma, 2021). Thereby, the authorship is puzzling and seems to have become a sensation recently again. Some researchers and journalists proposed that the name 'Satoshi Nakamoto' was derived from a combination of names of tech companies consisting of Samsung, Toshiba, Nakayama, and Motorola. Even NSA agency and USA government are mentioned in the context of BTC's creators. Regardless of who Satoshi Nakamoto actually is, his paper (Nakamoto, 2009) is regarded as the beginning of Bitcoin and cryptocurrencies in general.

Several years after the appearance of the first cryptocurrency, it was enough for an incredible development in this matter. According to data of CoinMarketCap on March 27, 2022 there are 9.735 different cryptocurrencies. Their market cap is $ 2 013 706 496 153 and the dominant cryptocurrencies are BTC: 42.0% of the market and Ethereum (ETH): 18.8% of the market (CoinMarketCap, 2022).

It is difficult to underestimate the phenomenon of cryptocurrencies, if only because of the new technology on which they are based (blockchain) (Tapscott & Tapscott, 2016), the amount of market capitalization, the value of which was quoted above, or the general level of interest in them by the big market players (Phillips & Graves, 2021; Sharma, 2022). Some authors consider it as a permanent alternative to the current money. The literature indicates lists of advantages and disadvantages, and even some dangers that cryptocurrencies bring.

Governments of different countries treat cryptocurrencies very unevenly. In fact, cryptocurrencies are a kind of tokens, analogous to those used, for example, in casinos. However, these tokens are only digital or virtual. The question arises, is it therefore possible to treat cryptocurrencies as a currency unit, means of payment or electronic money? Many countries do not consider cryptocurrencies this way. Some even indicate that their trading is illegal (Venezuela). Some countries do not have a precise position on this issue (such as Brazil). On the other hand, some countries consider a selection of them as means of payment (El Salvador) (Maziarz, 2021) or a completely legal equivalent of traditional money (Germany, Switzerland). An interesting case is Poland that considers cryptocurrency trading as legal and even taxed it, however does not treat cryptocurrencies as a full-fledged currency (Rooney, 2018; Podatek, 2021).

From the investors' point of view, cryptocurrencies can be treated purely speculatively, but there is also a noticeable trend to treat them as even "gold of the 21st century" (Kopańko & Kozłowski, 2015; Pandemia…, 2022) That is because, like gold, cryptocurrencies seem to be a good security in times of crises. Currently, it is said that cryptocurrencies can resist inflation. The example of Venezuela, where cryptocurrency trading is prohibited indeed, confirms this. The cryptocurrencies could also be used to support, and on the other hand, to bypass the legal flow of funds or to circumvent imposed economic sanctions (Suraj, 2022). Yet another issue is the dangerous – energy consumption of cryptocurrencies (Greenberg & Bugden, 2019; Corbet, Lucey,

& Yarovaya, 2021). Therefore, there are more and more opinions that mining cryptocurrencies is sometimes contrary to ecology.

2.2 Sources of knowledge that people use and prefer for specific purposes

In epistemological terms, there are four standard basic sources, from which one can acquire knowledge or justified belief, i.e., perception, memory, consciousness, and reason (Audi, 2009). However, in the context of the development of ICT and in connection with business needs, the sources of knowledge have acquired new connotations.

People obtain knowledge from different sources depending on purposes for which they are searching for knowledge and their personal needs (Dąbrowski, 2018). These sources can vary depending on the problems which people want to go through or solve using this knowledge. From that perspective people's problems can be typical, widely discussed on the internet and in person. On the other hand, the problems can be specific and niche. They can often involve newest issues and people need to use specific sources of knowledge to tackle these problems and issues.

The literature review showed that people often use such sources of knowledge as print media, TV and radio, universities and schools, popular information websites, e-mails, instant messengers, and family and friends mainly for typical and routine purpose, i.e., to search for information on subjects that matter at the moment such as school-, health-, security-, work-related (Jiyoon & Junseok, 2020; Lissitsa & Laor, 2021; Qin et al., 2021). Other times they use more specific sources of knowledge as company promotional campaign, social media, mobile applications. That is especially true when the phenomenon that they would like to uncover is quite new and not typical (Arrigo, Liberati, & Mariani, 2021; Razaa, Usmanb, & Ali, 2022). From that perspective, cryptocurrencies could be an example of such phenomena as they are quite new. Obviously, the popularity of cryptocurrency-related issues has been increasing over the last years, but they are still considered as a new ones.

The point is that there is a massive literature on knowledge and knowledge sources analysed from many perspectives. Researchers focus on consumers as the source of knowledge, particularly for business purposes (von Hippel, 2017; de Jong, Gillert, & Stock, 2018; Ziemba & Eisenbardt, 2016). One can find the evidence for typical and well-known sources of knowledge that people use. From those perspectives people chose the sources of knowledge that they know well, are easy accessible for them, and convenient.

What is more, the place of living and education is crucial as well. Universities are ranked internationally. These rankings often show that metropolitan universities, like the University of Warsaw is, are evaluated better and, in turn, ranked higher in comparison with the universities from other parts of particular countries (Scimago, 2022; TopUniversities 2022). The SCImago's (2022) universities ranking included two universities taken into consideration in this paper. The University of Warsaw is ranked at the 343 position whilst the University of Economics in Katowice is ranked at position no. 622.

3. Research methodology

3.1 Research goal and questions

The main goal of this paper is to find an answer to the main research question: : What sources of knowledge about cryptocurrencies have students employed?

To achieve this goal, the study focused on addressing the following research questions:
RQ1: What are the differences and similarities between males and females in the sources of knowledge about cryptocurrencies?
RQ2: What are the differences and similarities between students from the environment of two universities as to the sources of knowledge about cryptocurrencies?

To generate findings on questions RQ1 and RQ2, two hypotheses were developed:
H1: There are statistically significant differences in sources of knowledge about cryptocurrencies used by males and females.

H2: There are statistically significant differences in sources of knowledge about cryptocurrencies for students from the environment of two universities.

3.2 Research procedure

To address the main research problem, answer the specific research questions, and test the formulated hypotheses, a quantitative research approach was adopted and a questionnaire survey was conducted. The research process consists of the following stages:

1. A pilot survey questionnaire was designed. The purpose of the questionnaire was to collect students' opinions about cryptocurrencies. It contained a question: What was your source of knowledge about cryptocurrencies? We used Yes/No scale for this question. Students could choose from a given list of sources. In October 2021, the pilot survey was conducted leading to substantive and methodological scrutiny of the questionnaire.
2. The survey questionnaire was distributed online. We used LimeSurvey software. Data collection took place between November 2021 and February 2022. The sample choice was on purpose as the university students were in our scope. We addressed the survey to two distinct university environments, placed in different regions of Poland. The first, the University of Warsaw, is the biggest and the best ranked university in Poland. it is located in central Poland. The second one, the University of Economics in Katowice, is located in southern and the most industrial region in Poland – Silesia, and its rank is lower (SCImago, 2022). The point was to know students' opinions on specific sources of knowledge about cryptocurrencies, from two university environments. After screening the responses and excluding outliers, there was a final research sample of 778 usable, correct and complete questionnaires. The sample is presented in Table 1.

Table 1: Demographics of the research sample

	Demographic profile	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.

1. The data were stored in Microsoft Excel. Using Excel and Statistica ver. 13.3 package, the collected data were analyzed. To generate findings on the research questions the frequency procedures were employed as there were convenient samples in the study. The Chi^2 test was used to determine whether the hypotheses posted were supported by empirical data. This test is appropriate for analyzing differences between independent samples such as males and females as well as students from two distinct universities. Moreover, these tests do not make any assumptions related to the distribution (the distribution was checked using Shapiro-Wilk test for p=0.05).

4. Results

4.1 Sources of knowledge - general analysis

In order to answer the main research question, the analysis of sources of knowledge about cryptocurrencies was carried out using frequency procedures. The results, which are presented in Figure 1, showed that popular information websites, social media, and family and friends are the sources of knowledge about cryptocurrencies for students. TV & radio and universities & schools are also sources of knowledge for some of them. Other sources are not popular and are not used so often.

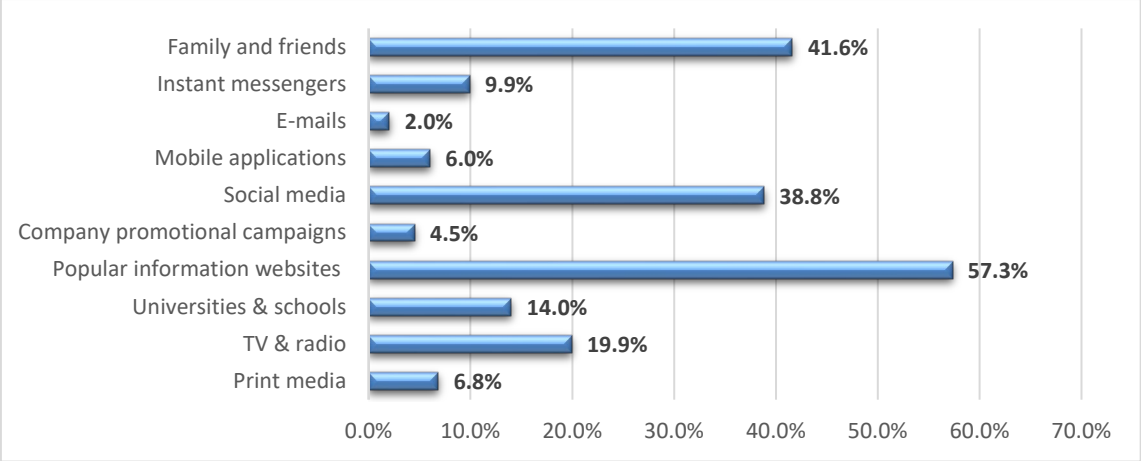


Figure 1: Sources of knowledge about cryptocurrencies for students - general outlook

Source: own elaboration.

The results presented in Figure 1 are general and embrace all survey participants. However, they have encouraged us to perform a detailed analysis of knowledge sources that are used by students classified by their chosen characteristics, i.e., gender and the university's location. This approach could bring the big picture of the problem analyzed.

4.2 Sources of knowledge about cryptocurrencies for males and females

To test hypothesis **H1** and answer **RQ1**, Chi^2 test was conducted for gender group comparison. The results are presented in Table 2.

Table 2: Chi^2 test results for gender group comparison

	Print media	TV & radio	Universities & schools	Popular information websites	Company promotional	Social media	Mobile applications	E-mails	Instant messengers	Family and friends
Z	0.222	9.511	5.727	20.557	0.242	0.002	0.082	0.572	6.196	1.722
***p*-value**	0.638	0.002	0.0167	<0 .05	0.623	0.963	0.774	0.449	<0 .05	0.189

Source: own elaboration.

The test results presented in Table 2 show that in four cases the *p*-value is lower than 0.05. It means that there were statistically significant differences in sources of knowledge between males and females, i.e., TV&radio, universities& schools, popular information website, and instant messengers. Thus, hypothesis H1 is partially supported. To show the big picture of the problem analyzed, it was decided to show a frequency analysis of the sources of knowledge for males and females. The results are presented in Figure 2.

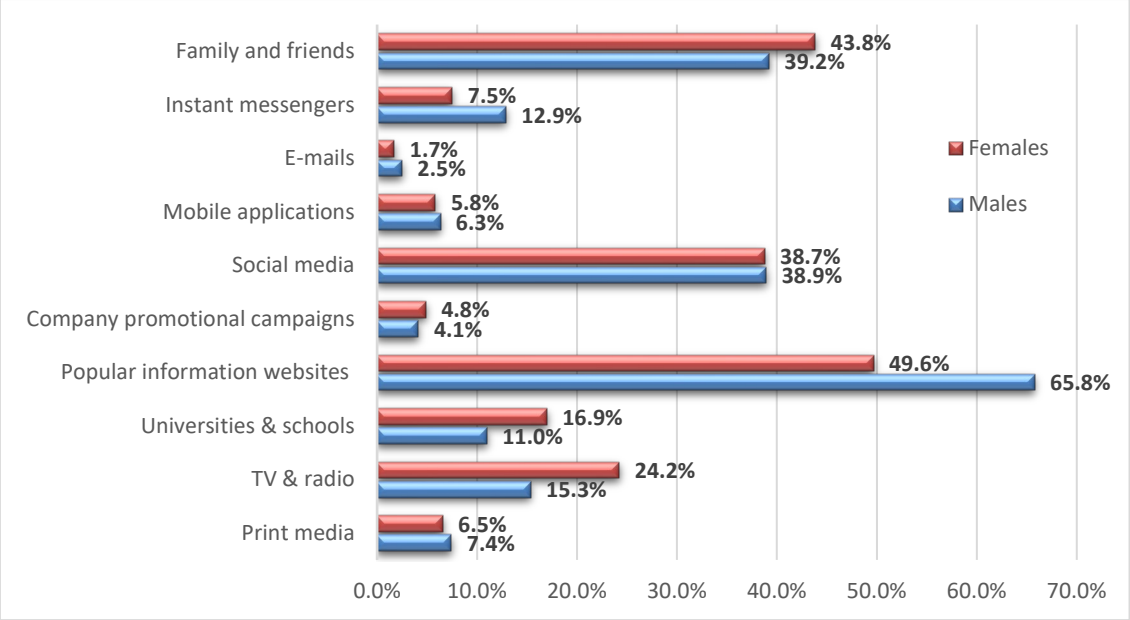


Figure 2: Sources of knowledge about cryptocurrencies for males and females

Source: own elaboration.

The results presented in Figure 2 show that popular information websites are most frequently used as a source of knowledge about cryptocurrencies followed by family and friends. As specified, popular information websites were the source of knowledge for 65.8% of males and 49.6% of females whereas family and friends were the source of knowledge for 39.2% of males and 43.8% of females. On the other hand, results for typical and well-known sources of knowledge that are TV & radio and universities & schools show that a smaller proportion of students use them. Thus, TV & radio were the source of knowledge for 24.2% of females and 15.3% of males whereas universities & schools were the source of knowledge about cryptocurrencies for 16.9% of females and 11% of males. The results show that these are less popular than websites.

4.3 Sources of knowledge about cryptocurrencies for students from two university environments

To test **H2** hypothesis and answer **RQ2**, Chi^2 test was conducted for students from two university environments comparison. The results are presented in Table 3.

Table 3: Chi^2 test results for gender group comparison

	Print media	TV & radio	Universities & schools	Popular information websites	Company promotional	Social media	Mobile applications	E-mails	Instant messengers	Family and friends
Z	0.021	0.415	0.171	1.898	2.097	2.487	0.105	3.796	1.260	13.137
***p*-value**	0.885	0.519	0.679	0.168	0.147	0.115	0.746	0.051	0.262	0.0003

Source: own elaboration.

The test results presented in Table 3 show that only for family and friends the *p*-value is lower than 0.05. It means that there were statistically significant differences in sources of knowledge for students from two university environments for this one variable exclusively. Thus, hypothesis H2 could be rejected. Nonetheless, it was decided to show a frequency analysis for the sources of knowledge for two universities. The results are presented in Figure 3.

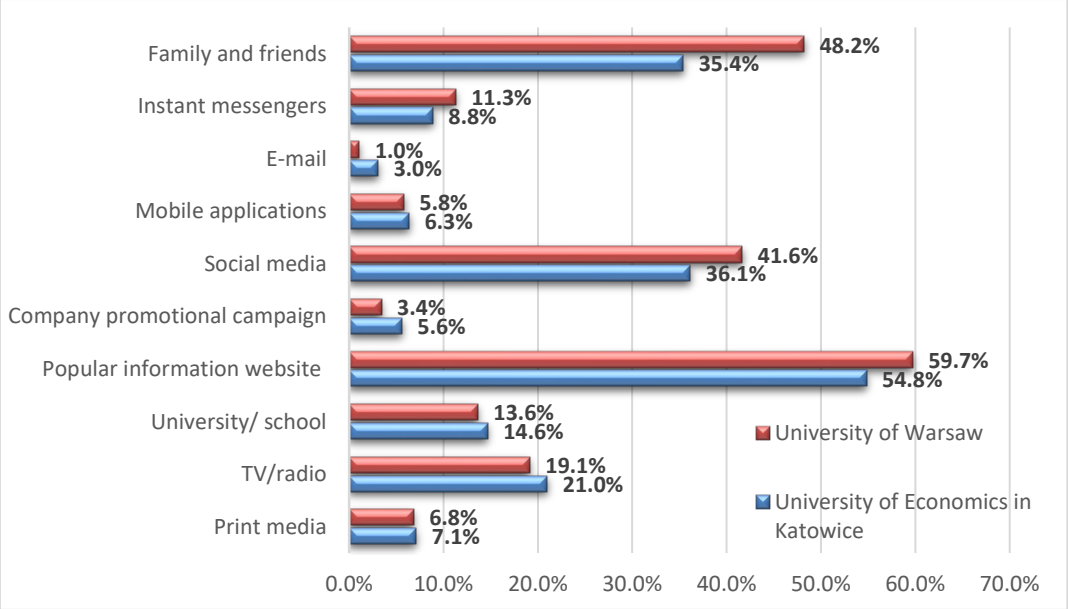


Figure 3: Sources of knowledge about cryptocurrencies for students from two university environments

Source: own elaboration.

The results presented in Figure 3 confirm that the biggest differences pertain to family and friends as the source of knowledge. Thereby, family and friends are the source of knowledge about cryptocurrencies for 48.2% of students of the University of Warsaw and for 35.4% of students of the University of Economics in Katowice. What is more, the results show that the students of the University of Warsaw slightly more frequently used social media, popular information websites, and instant messengers as the sources of knowledge about cryptocurrencies, whereas students from the University of Economics in Katowice slightly more frequently used non-ICT-related sources which are TV & radio and universities & schools. However, the differences for other than family and friends variables are small and even very small.

5. Conclusions

5.1 Research contribution

This paper contributes to extant research on the sources of knowledge for university students from Generation Z, born between 1995 and 2009 (McCrindle & Fell, 2019), by:

- identifying specific sources of knowledge about cryptocurrencies;
- identifying and examining the differences and similarities between males and females in the sources of knowledge about cryptocurrencies;
- identifying and examining the differences and similarities between students from two university environments as to the sources of knowledge about cryptocurrencies.

To date, researchers have mainly explored the sources of knowledge for the development of products and other business-related purposes (Dost et al., 2020; Moaniba et al., 2020). From that perspective, the sources of knowledge are useful for businesses to achieve their goals. Accordingly, this study represents a worthwhile attempt to expand current understanding of the sources of knowledge on specific problems exemplified by cryptocurrencies.

Overall, this study fills the research gap by identify which sources of knowledge are used by young people while searching for specific knowledge such as cryptocurrencies. Our findings confirm the main types of sources of knowledge about cryptocurrencies. Furthermore, addressing changes in the sources of knowledge about cryptocurrencies used by males and females, we confirmed that popular information websites were most frequently used as a source of knowledge about cryptocurrencies; what is more, men used them more often than women. As to the university's environment, we revealed that no matter what the environment is, the approach of students to the sources of knowledge and the ability to use them for their own purposes are similar and no significant differences were indicated. For one variable only, i.e., family and friends, we were able to find

these differences as for students from the University of Warsaw family and friends were a more frequently used source of knowledge than for the students from Katowice. It may mean that metropolitan students are more family-minded. On the other hand, it may source from the fact that Warsaw as a city is surrounded by numerous of small cities and villages and those people do not often have other options than to study in Warsaw and, what is no less important, studying in Warsaw is seen as prestigious and sets them apart (Wasielewski, 2020; Antonowicz & Gorlewski, 2011).

Overall, the results showed that people generally choose well-known ICT, i.e., popular information websites and social media, as sources of knowledge about specific and innovative problems such as cryptocurrencies. Non-ICT related sources such as universities and schools as well as television and radio are less popular. Based on our results, e-mails and promotional campaigns of companies are the least used sources of knowledge. This may mean that neither users nor businesses are sending emails about cryptocurrencies and are unlikely to create promotional campaigns about them.

5.2 Limitations and implications

We directed our survey to young people only. Moreover, Polish students from two universities were invited to participate in our study. Although these universities differ in terms of the Polish higher education market, our results can be interpreted for Poland only, particularly to two regions, i.e. metropolitan and Silesian ones. This, however, does not close the problem and further analyzes and comparisons would be interesting e.g. for the elderly, people from different countries, with different levels of education, etc. This study may be useful to researchers. They can use our approach and develop it for other groups of respondents.

In addition, we can encourage companies to use our results as a basis when making decisions about the sources of knowledge they offer people, especially when the knowledge sources are available online. Our results show which sources are popular and which of them are used by young people while searching for information on specific problems. The results can therefore support companies in identifying which sources are worth attention, and hence in developing projects focusing on those sources.

Finally, we are aware that our paper focuses on the most popular sources of knowledge. However, these sources are constantly changing, also in terms of their popularity. This means that the sources popular today may not be as popular in the near future. On the other hand, new sources may emerge and their popularity may increase, which is difficult to identify at the moment. It also means that the idea behind this paper can be developed and reconsidered in the future according to the new trends and approaches.

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Learning and Energy-efficient Renovation of Residential Buildings: The user Perspective

Anandasivakumar Ekambaram, Evgenia Gorantonaki and Bjørn S. von der Leyen
SINTEF, Trondheim, Norway
siva@sintef.no
jenny.gorantonaki@sintef.no
bjorn.leyen@sintef.no

Abstract: Renovation of residential buildings has gained more attention in recent years. There are several challenges connected to energy efficient renovation of existing buildings. European Commission acknowledges the challenges and emphasizes the need to replicate best practices and learn from lessons. Several research studies have been conducted on the topic of energy-efficient renovation of residential buildings, some of which have highlighted significant aspects that are to be considered in the renovation efforts / projects. One of the aspects is user perspective that encompasses, among other things, user involvement and user behaviour. Knowledge sharing and learning play a significant role in developing and ensuring the user behaviour that is suitable for harvesting the intended benefits of energy-efficient renovation efforts. There can be wonderful energy-efficient solutions that can reduce greenhouse gas emission and promote sustainability. But, if the solutions are not used appropriately by the user, then it will hinder achieving the expected positive effect. As a result, developing and implementing the solutions in the first place will lose its very purpose. This paper looks at the user perspective in energy-efficient renovation of residential buildings and describe the learning-points associated with it. Focusing on these learning-points and the user perspective itself has its implication on wider issues such as policy making and future energy consumption. In addition, this paper summarises basic knowledge on understanding users' behaviour regarding energy and consumption, as well as briefly describes tools and examples of research projects that incorporate the users' perspective in their design. This paper is based on narrative literature study. It touches upon aspects related to the Sustainable Development Goals 11 (Sustainable cities and communities) and 13 (Climate action), at least to a certain extent. This paper is connected to an EU-project called "REZBUILD" (https://rezbuildproject.eu/), which focuses on developing decision and planning support for accomplishing near zero-emission in renovation of residential buildings.

Keywords: User-behaviour, Involvement, Knowledge sharing, Learning, Collaboration

1. Introduction

In renovation projects, we often aim to upgrade the function of the building itself so that it fits requirements for energy, accessibility or change of building use. However, experience and research show that the users are key to their success, as the use of the building may not fit for example the intentions behind the design. Halvorsen et al. (2016) has studied the rebound effect for the use of heat pump in the Norwegian households; even though heat pump is used to reduce consumption, the results showed little or no change. They attributed the effect on "higher indoor temperature and heated living space, less firewood and fuel oil use and less use of night-set-backs or reduced while away from home" (page 1114).

Similarly, Schakib-Ekbatan et al. (2015) describe the mismatch between the energy concept and the use of the building by its occupants. They looked particularly in window opening times both in winter and during the summer for an office building in Frankfurt, Germany, where they found considerable deviation from the predicted times which, in turn, can lead to higher energy demands.

Thomsen et al. (2013) draw on this misalignment of the actual use with the intended use of energy efficient buildings and investigate the causes. Although they underline that further research is needed, they found three main categories: need for control and comfort, lack of previous knowledge, and identity (being proud). Hauge et al. (2011) show the importance of evaluations of energy efficient buildings. They highlight both the mismatch between the predicted and actual use of the buildings while they point out the lack of research. They also review research that has been done on the subject. They name thermal comfort as the most researched area in relation to the users while they suggest that adaptability of the integrated systems is important to the user's experience and behaviour. They also name that having sufficient knowledge as to how to operate the systems of the building as well as training are equally important.

The above description points out the relevance of the role of learning in ensuring the accomplishment of the intended effects of renovation of residential buildings. This paper, which is connected to an EU-project called REZBUILD (https://rezbuildproject.eu/), looks at this topic. In this regard, this paper describes relevant theories and research method. And then, it presents aspects and examples of user behaviour, followed by discussion and concluding remarks.

2. Relevant theory

We will mainly look at sensemaking described by Karl Weick and his colleagues in connection with our discussion on the learning processes. In this regard, we will focus on the following two paragraphs as a key source for our reflection and discussion.

Weick et al. (2005, page 409) defines sensemaking as follows: "Sensemaking involves the ongoing retrospective development of plausible images that rationalize what people are doing. Viewed as a significant process of organizing, sensemaking unfolds as a sequence in which people concerned with identity in the social context of other actors engage ongoing circumstances from which they extract cues and make plausible sense retrospectively, while enacting more or less order into those ongoing circumstances".

The authors (ibid., page 409) further say: "First, sensemaking occurs when a flow of organizational circumstances is turned into words and salient categories. Second, organizing itself is embodied in written and spoken texts. Third, reading, writing, conversing, and editing are crucial actions that serve as the media through which the invisible hand of institutions shapes conduct (Gioia et al. 1994, p. 365). The emerging picture is one of sensemaking as a process that is ongoing, instrumental, subtle, swift, social, and easily taken for granted. The seemingly transient nature of sensemaking ("a way station") belies its central role in the determination of human behaviour. Sensemaking is central because it is the primary site where meanings materialize that inform and constrain identity and action (Mills 2003, p. 35). When we say that meanings materialize, we mean that sensemaking is, importantly, an issue of language, talk, and communication. Situations, organizations, and environments are talked into existence".

Sensemaking is also connected to reflection-in-action (reflecting on an action while engaging in the action) and reflection-on-action (reflecting on an action retrospectively after the action) that Schön (1998) describes. How people perceive things, events, etc., and how they interpret them individually and / or in a social context influence their behaviour.

3. Research method

This paper is based on a narrative literature review (NLR). NLR takes into consideration various studies of a topic, and allows the reviewer to gain an understanding of various views associated with the topic, and to make a holistic interpretation of the studies by using his / her experience as well as existing theories and models (Campbell Collaboration, 2001; Kirkevold, 1997). Jahan et al. (2016), say that NLR does not necessarily require to report more rigorous aspects that characterise structured literature review – aspects such as research methodology, search term, database that was used, and inclusion as well as exclusion criteria.

4. Aspects and examples of user behaviour

The role of user/owner behaviour is important in achieving the desired results of energy efficient refurbishments. Several articles point out this importance.

Sandberg et al. (2017) present an application of a dynamic, stock-driven and segmented dynamic dwelling stock model for scenario analysis of future energy demand. In this regard, they consider a dwelling stock of Norway 2016–2050. The authors emphasize the significance of user behaviour in their article. They explain the significance further by a providing some information related to one hypothesis that they use in their work. The hypothesis is: It will be possible to reduce the energy demand in the Norwegian dwelling stock by some 50% by 2050 – despite strong stock growth – by introducing currently available technology in refurbished and new buildings. The authors say, (ibid, page 230), "The results show that the hypothesis may be confirmed for the theoretical estimated total delivered energy in our most optimistic scenario. However, in this scenario, user behaviour is expected to reduce the saving potential from 51% for the theoretical estimate to 36% for the estimated 'real' energy demand from 2016 to 2050. The policy implications of this is that efforts should be made

to counteract this rebound effect. Unless such measures are taken, the hypothesis will not hold and policy targets might not be met."

Yousefi et al. (2017) look into the influence of occupant lifestyle patterns on the energy performance of the residential buildings that have various building envelopes in different climate zones. The case studied in this regard is an existing multi-family apartment building in Iran. The energy demand of the building before and after renovation was simulated with the help of EnergyPlus for different climate zones. Sensitivity analyses showed that the occupants' behaviour had a strong effect on the building's thermal energy usage. The results indicate that the interaction between the occupants' behaviours and envelope materials is an essential aspect to consider. The results point out, as a consequence of this important interaction, the occupants' behaviours can change the strategy of choosing the envelop material types.

Rodrigues et al. (2018) make as assessment of an innovative external wall insulation system for social housing retrofit in Nottinghamshire, UK. Their article suggests that gaining a better understanding of the occupants' impact on the energy consumption, is an important part of their study. Ozarisoy & Altan (2017) consider occupants' behaviour as one of the three variables to study the application of retrofit strategies to improve conditions within the residential sector in the Turkish Republic of Northern Cyprus.

One of the aspects that can influence user behaviour is users' health related issues. In this regard we will briefly present a study carried out by Underhill et al. (2020). The authors studied indoor and outdoor air quality and health impacts by investigating installation of energy-efficient retrofits in a multifamily housing unit. According to the authors, weatherization retrofits, such as air sealing and insulation, lower residential energy consumption, resulting in reduced fuel and electricity-related emissions, improved ambient air quality, and avoided climate and health impacts. However, retrofits without adequate ventilation may worsen indoor air quality (IAQ) and lead to adverse health effects and costs that offset anticipated economic benefits. Building energy management and climate action plans often omit these potential consequences. "This is a key takeaway for climate action planning – residential energy retrofits must be accompanied by plans for adequate ventilation and filtration, as strict optimization for short-term energy savings may not be beneficial from a health perspective. The substantial increases in monetized resident health costs following interventions that adversely impacted IAQ reinforces the need for holistic approaches to energy-efficient retrofits in climate action and other planning efforts" (ibid., page 7).

Sinnott (2016) looks into the relationship between envelope airtightness, how it is correlated to energy performance and occupant sensitivity pre- and post-energy efficient fabric upgrading of semi-detached social housing in Ireland. With this context, the author points out that occupants generally did little or no effort to stop heat loss through infiltration. The reason is that the occupants were not capable of carrying out the needed work or that they did not have the money to hire a professional to do the work. As a result, the responsibility lies on the local authority.

Reflecting on the occupant's perception, the author concludes that the majority of the occupants were not aware of how important adequate ventilation for their health is. And, they were also not aware of the impact of infiltration on energy use in their homes. Their prominent priority was to have house-related expenses at minimum while they can have an acceptable level of thermal comfort. As a result, they were interested in keeping the heat inside their houses, by blocking up vents or closing window trickle vents. This would in turn lead to limited airflow in the house and harm health and safety.

4.1 Understanding energy-related behaviour

Environmental psychology looks among others into people's behaviour that relates to environmental issues. It looks to understand, measure, and encourage environmental behaviour. Understanding is key to both measure and encourage or change behaviour. What affects it? An important factor is **values** which is defined as "desirable trans-situational goals that vary in importance and serve as guiding principles in the life of a person or other social entities" (de Groot, et al., 2018).

Environmental concerns and ecological worldviews can trigger our guiding system of what to do or not do when environmental issues arise. Social **norms** are another factor affecting environmental behaviour, which relates to people's tendency to act as their fellow others, while it is noted that people are more susceptible to norms than they think (Keizer et al., 2018). **Social identity** is also important as environmental behaviour and attitudes can

be the outcome of group membership and group processes; people can act based on the identity that is prominent (Jans & Fielding, 2018). Similarly, but on individual level, **self-identity** and **impressions** describe that environmental behaviour can be the outcome of what people think of themselves and how people would like others to think of them, which shows that environmental behaviour becomes a symbol (Gatersleben & van der Werff, 2018), a way to express ourselves. Environmental behaviour can also be affected by positive or negative **emotions** that come as a result of the behaviour (Taufik & Venhoeven 2018), as well as **habits** which define the everyday and are automatic behaviours that people do not often realise or think over (Klöckner & Verplanken 2018).

4.2 Need for new ways to look energy-related behaviour

Galvin & Sunikka-Blank (2017) talk about social factors that influence sustainable domestic retrofit undertakings. In this regard, they say that (page 381) "people's views, habits, practices and resources determine whether and how buildings are retrofitted, and influence how energy is consumed before and after retrofitting. Further, in buildings social factors interweave with technical factors such that the two often co-determine each other (Galvin, 2015; Lovell, 2007). Hence to understand energy-related behaviour in buildings it is not sufficient simply to apply basic principles of behavioural psychology. Shove (2014) has argued for a new paradigm to look at energy practices and transformation of consumer behaviour in the context of broader social science rather than previously dominating theories of individual attitude, behaviour and choice based on economics and laboratory psychology. A broad swathe of social theory could offer potential for more effective and legitimate policy-making and do better justice to the diverse, interlocking factors involved".

Pombo et al. (2016) present their reflection on a method called Social Life Cycle Assessment (S-LCA) with respect to dealing with social factors in the assessment processes. This method can be used to assess the social and sociological aspects of products, and their actual and potential positive and negative effects throughout the life cycle.

According to the authors, the social dimension is not fully developed. And they say that none of the studies that they received considered S-LCA. They suggest that further research is required to define the methodology and the impacts of the social analyses, and to incorporate it into life cycle sustainability assessment (LCSA). According to the authors, this would represent a significant step forward in fulfilling a significant need for an integrated methodology that takes into account environmental, economic, and social impacts from a life cycle perspective.

Pombo et al. (2016) also point out that there are other approaches that take into account the behavioural aspects; for instance, Peuportier et al. (2013) provide an approach that include a sensitivity study that deals with the influence of occupants on energy use and other environmental issues.

Several other authors also mention the need for addressing user behaviour in renovation of residential buildings from different points of view – beyond / in addition to technical solutions. Learning can be one such point of view, and it can contribute to obtaining intended effects of building renovation.

5. The relevance of the topic of learning

Studies show that giving adequate focus on the user perspective leads to positive results. We will look at three relevant studies, and see the role of learning in achieving the positive results.

Synnefa et al. (2017) present paper that describes a holistic energy efficient retrofit of low-income, multiple social housing located in Athens, Greece. As a part of their study, the authors applied occupant surveys. The surveys were used to collect and document the following:

- The tenants' perception of the quality of their indoor environment before and after the retrofit measures
- The tenants' views and satisfaction on the retrofit measure and the technologies and solutions that were installed in their apartments and building

Two questionnaires were sent to the occupants of the building used: One for the situation before, and one for the situation after the retrofit. Results of the survey shows that the occupants are satisfied with the retrofit measures. They evaluated all the installed technologies and solutions in terms of improving the indoor environmental quality and gave a positive rating. The occupants also mentioned that their behaviour had

changed in terms of energy and environmental issues after the retrofit. One example in this regard is, more than 90% of the occupants reported that they had used heating and cooling devices for fewer hours after the retrofit. This was also studied and verified experimentally. Reflection-in-action and reflection-on-action (Schön, 1998) could have contributed to trigger the sensemaking process (Weick et al., 2005). When comparing with the words of Weick et al. (2005), the users involve in an ongoing retrospective development of plausible images that rationalize what they are doing. Many occupants (71%) said that they were interested in knowing how they consume energy by looking at the monitors of smart meters that were installed. This interest in knowing can be compared with the words of Weick at al. (2005). That is, the interest in knowing can be seen as an instance of a process of organizing through which sensemaking unfolds as a sequence in which the users, who are concerned with identity in the social context of other actors, engage ongoing circumstances from which they extract cues and make plausible sense retrospectively, while enacting more or less order into those ongoing circumstances.

Sinnott (2016) says that even though there is a growing awareness that occupant behaviour has a significant impact on building energy consumption, there is a need to have more knowledge on how people interact with their houses and perceive their environment. The author says that designers must understand the relationship that people have with their houses and their perceptions of how the dwelling adaption influence their quality of life. Getting a new front door would make the occupants happier from the aesthetic point of view, rather than the fact that the new door could positively influence energy use and comfort. In order to maximize the positive effects of upgrading efforts, there should be several collaborative sessions with occupants before, during, and after the upgrading-work to make sure that the occupants understand why the upgrading was carried out and how they could correctly deal with the new systems or processes. The collaborative sessions could be regulatory or voluntary. These sessions and collaborations can contribute to learning through reflection and sensemaking.

Baumhof et al. (2017) investigate – through a online survey in Germany – the factors which influence the intention of owners/occupiers of single and two family houses to carry out energy efficiency refurbishment measures (EERM). This was done utilizing Vroom's Expectancy Theory. The authors compared three groups:

- "Future refurbishers": House owners who stated an intention to undertake energy efficient refurbishment measures.
- "Non-Refurbishers": House owners who stated a need for such measures but no intention of addressing the need.
- "Refurbishers": House owners who had already completed refurbishment measures.

Based on experiences from their research-work, the authors present suggestions for improving energy efficient refurbishment. Two of them are:

- Conducting campaigns to present best practices in refurbishment projects: When best practice refurbished houses are presented to "Future-Refurbishers", then it could inform as well as motivate them to implement more optimized, holistic and efficient refurbishment measures. The authors further say that this strategy could also target the potentially even more promising group of "Non-Refurbishers", convince and persuade them to carry out necessary energy efficiency measures. House owners representing the best practice refurbishment projects could participate in the best practice campaign to provide additional information to both "Future-Refurbishers" and "Non-Refurbishers", and create a trusting environment. Based on their experience, the best practice house owners could give suggestions and advice, such as financial savings due to the refurbishment measures. The authors mention that this could contribute to encourage and convince "Non-Refurbishers" or "Future-Refurbishers" to undertake (more) EERM.
- Conducting do-it-yourself workshops for low-cost measures or measures which require little effort; for example, measures such as the insulation of problematic spots-like radiator niches and cellar ceilings or checking for drafts at windows. In addition, the workshops could also offer knowledge about changes in legal requirements; for instance, regarding mandatory changes of certain heating systems according to the national / state law. Obtaining know-how, skills and information regarding EERM can unleash a potential multiplier effect among house owners, since the know-how could be spread between friends, family and the neighbourhood.

These two suggestions show the relevance of learning.

Collaboration and social settings – when applied appropriately – can induce individuals to reflect on / question their own frames of reference or mental models, and then learn. In this regard, it is relevant to look at a ladder of inference introduced by Chris Argyris and popularised by Peter Senge (1994). People perceive and interpret the reality differently. Figure 1 illustrates how our observation of something (for example, an event) is transformed into action (Senge et al., 1994) – from an individual's point of view.

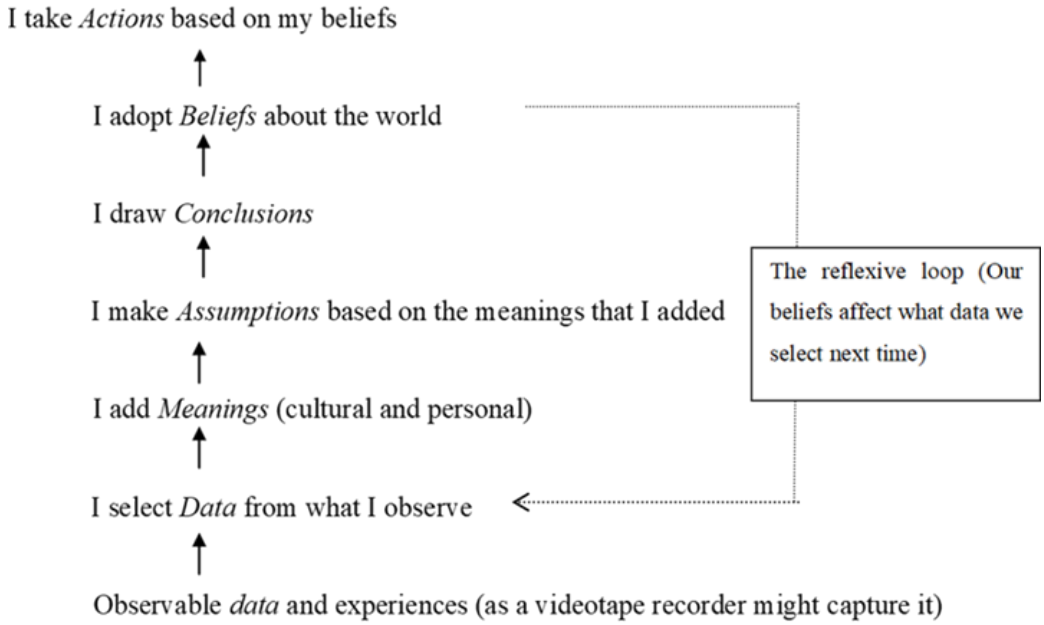


Figure 1: Ladder of inference (Senge et al., 1994, page 243)

What an individual selects from the observable data and experiences, what meanings that the individual adds to the experience, what assumptions the individual derives from the meanings, and so on tend to differ from other individuals who are also exposed to or witness the same experience/event. These differences can be addressed in and dealt effectively through discussions in collaborations. Open discussions can pave the way to identify underlying assumptions behind choices of behaviour. Critical questions and constructive comments can refine and concretize individuals' understanding with the help of discussion. Issues that are under concern can be looked at from different angles in order to get a wider understanding of the issues. Sensemaking is facilitated to materialise learning and knowledge development.

Learning in the design phase is also an important aspect in the user perspective. As we have seen earlier, it is important that designers must understand the relationship that people have with their houses and their perceptions of how the dwelling adaption influence their quality of life (Sinnott, 2016). In this regard, it is relevant to consider an approach called Living labs (LL) and a project where it is applied. ARV is a European project on climate positive, circular communities. Community engagement, environment and well-being is one of the work-packages aiming to integrate the users' perspectives in the project. Using Living labs (LL) as a tool, the project looks at how users respond to the energy concept of the renovation and raise engagement. "Living labs (LL) approaches are known for engaging with user groups in real-life contexts. A living lab is an inclusive space bridging the gap between the social and technical context, with focus on participatory design methodology." More about the project: https://sciencebusiness.net/network-updates/ntnu-collaborative-research-project-climate-positive-circular-communities-wins.

Syn.ikia is another European project on sustainable plus energy neighbourhoods. Novel technologies, good architecture, affordability and citizen engagement are the core of the concept. Even though users are not incorporated here as one single work-package, they are involved as sub-tasks in most packages. Following evaluation methodology and participatory design, the project aims to take the users onboard. More about the project: https://www.synikia.eu/.

6. Conclusion

The user perspective has gained more attention in recent years. Merely focusing on the technical aspects of building renovation may not produce the intended positive effects. Technical solutions may be very good, but how they are used, will count at the end.

Looking at this issue in connection with learning can contribute to ensure the intended positive effects of building renovation. In this paper, we described learning with aspects such as reflection and sensemaking. These aspects are significant in a learning process.

Acknowledgement

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Developing a Training and Educational Programme for Learning Energy-efficient Building Renovation

Anandasivakumar Ekambaram[1] and Nils Olsson[2]
[1]SINTEF, Trondheim, Norway
[2]Norwegian University of Science and Technology (NTNU), Norway
siva@sintef.no
nils.olsson@ntnu.no

Abstract: The building construction industry has a significant potential to develop and apply energy efficient solutions, and hence contribute to address climate and environmental concerns. Energy efficient solutions are applied not only in new buildings, but also in refurbishment / renovation of existing buildings. Energy efficient building renovation has become one of the notable aspects in the building construction industry in Europe. There are several challenges connected to energy efficient renovation of existing buildings. European Commission acknowledges the challenges and emphasizes the need to replicate best practices and learn from lessons. This paper is connected to an EU-project called "REZBUILD" (https://rezbuildproject.eu/), which focuses on developing decision and planning support for accomplishing near zero-emission in refurbishment of dwellings. One of the main intentions of the project is to spread the usage of the solutions / concepts that are created in the project. This spreading can be seen as a dissemination and a knowledge sharing effort. The study that is associated with this paper contributes to this effort by describing development of a training and educational programme to facilitate acquisition of skills by industrialists and research infrastructures for implementing REZBUILD solutions / concepts in a real environment. The paper presents an overall guiding framework to provide an understanding of the wider context of the skill-gap and address the skill-gap in the construction industry. In this regard, an action plan for skill development at company, industry and government levels is used. And then, the paper provides a brief description of four major kinds of skills that are needed in the construction industry. Finally, it describes a structure of a training and educational programme. This structure includes, among other things, suggestions for contents of such a programme and some relevant aspects that are to be taken into consideration. The paper is based on narrative literature study.

Keywords: Refurbishment, Training, Skill, Building construction, Learning

1. Introduction

"Refurbished and sustainable buildings in the EU will help pave the way for a decarbonised and clean energy system, since buildings are one of the largest sources of energy consumption in Europe, responsible for over a third of EU emissions. But only 1% of buildings undergo energy-efficient renovation every year, so effective action is crucial to making Europe climate-neutral (net zero emissions) by 2050. Currently, roughly 75% of buildings in the EU are not energy efficient, yet 85-95% of today's buildings will still be in use in 2050" (https://ec.europa.eu/energy/topics/energy-efficiency/energy-efficient-buildings/renovation-wave_en).

The above description mentioned by the European Commission emphasizes the importance of refurbishment / renovation of both public and private buildings. The European Commission also points out the importance of replicating / sharing effective new solutions that are developed, to address this issue (European Commission, 2015). Research and development (R&D) projects aim to make their contribution in this regard.

This paper is connected to an EU-project called "REZBUILD" (https://rezbuildproject.eu/), which focuses on developing decision and planning support for accomplishing near zero-emission in refurbishment of dwellings. One of the main intentions of the project is to spread the usage of the solutions / concepts that are created in the project. This spreading can be seen as a dissemination and a knowledge sharing effort. The study that is associated with this paper contributes to this effort by describing development of a training and educational programme to facilitate acquisition of skills by industrialists and research infrastructures for implementing REZBUILD solutions / concepts in a real environment.

Some of the important solutions / concepts that are developed in the REZBUILD project are: 3D printing facades, BIPV (building integrated photovoltaics) integration, Super thermal insulation materials, HVAC (Heating, ventilation, and air conditioning) systems by radiant floor, Solar heat pump solution (Solar assisted heat pump – SAHP) and APM (Agile project management) tool.

The paper first describes the research method. It then presents an overall guiding framework to understand the wider context of the skill-gap and address the skill-gap in the construction industry. In this regard, an action plan for skill development at company, industry and government levels is used. And then, the paper provides a brief description of four major kinds of skills that are needed in the construction industry. Having (1) the REZBUILD solutions / concepts, (2) the overall guiding framework (the action plan), and (3) the major kinds of skills as three building blocks, an attempt is made to design a structure of a training and educational programme. This structure includes, among other things, suggestions for contents of such a programme and some relevant aspects that are to be taken into consideration.

2. Research method

This paper is based on a narrative literature review (NLR). NLR takes into consideration various studies of a topic, and allows the reviewer to gain an understanding of various views associated with the topic, and to make a holistic interpretation of the studies by using his / her experience as well as existing theories and models (Campbell Collaboration, 2001; Kirkevold, 1997). Jahan et al. (2016) say that NLR does not necessarily require to report more rigorous aspects that characterise structured literature review – aspects such as research methodology, search term, database that was used, and inclusion as well as exclusion criteria.

3. Relevant theories

Reflection is one of the pivotal ingredients of a learning process. When describing reflection-in-action, Schön (1998) mentions that when professionals find unexpected results of their actions, then they reflect on their action. Their "reflection tends to focus interactively on the outcomes of action, the action itself, and the intuitive knowing implicit in the action" (ibid., page 56). Learning can occur in several ways. Argyris & Schön (1996) describes single-loop learning and double-loop learning. Single-loop learning focuses on modifying the existing knowledge within the realm of the underlying assumptions, frameworks and norms, and double-loop learning that deals with creating new knowledge by questioning / going beyond existing assumptions and norms. From learning, knowledge is developed. Schein (1973) presents three components of professional knowledge: (1) an underlying basic knowledge that is fundamental for developing the relevant practice (2) an applied knowledge that is used to solve day-to-day problems (3) Skills and attitudes related to actual work done for clients by using the basic and applied knowledge.

4. Addressing skill-gap – An action plan

World Economic Forum (2018a) presents an action plan for developing skills that are needed in the construction / infrastructure and urban development industry. This action plan also provides a bigger context as well as an overall guideline for designing a structure of a training and educational programme that can facilitate the acquisition of skills by industrialists and research infrastructures for implementing REZBUILD solutions / concepts in a real environment.

The action plan that are presented by World Economic Forum (2018a) has three levels. Figure 1 illustrates the action plan at the three levels.

We will look at some of the elements in the action plan that are closely related to the topic of this paper. For more detail on each element at each of the three levels, please refer World Economic Forum (2018a).

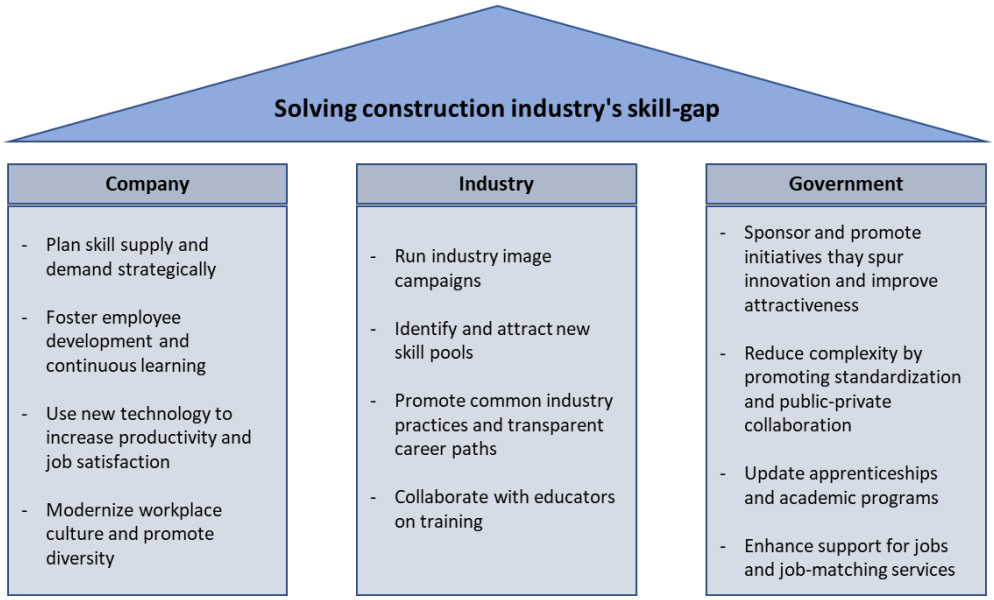


Figure 1: Strategies / action plans to address the skill-gap (World Economic Forum, 2018a)

4.1 Company-level measures

Companies should provide opportunities for their employees to learn and develop. This would make the company a desirable place to work not only for the potential recruits but also for the current employees to acquire new skills that are needed. Learning opportunities can be provided through many ways; for example, through continuing (adult) education at recognized institutions, institutionalizing knowledge sharing, and establishing career programmes that recognize learning and development achievements.

Since the construction industry has been historically viewed as relatively more conservative workplace, there is a need to rebrand it as an industry that characterises purpose-driven thinking, increased flexibility (flexible work-patterns), forward-looking culture, a dynamic performance appraisal practices and agile ways of working. This task will be approached, organised and conducted from a strategic perspective in order to ensure desired outcomes. In addition, construction companies can improve productivity and job satisfaction by adopting technologies, for example, prefabrication, sensors, and mobile collaboration tools.

4.2 Industry-level measures

It is important to work on the image of the construction industry, since the industry is not at the same level compared to other industries. A survey conducted by YouGov shows that two-thirds of the respondents of the survey would never consider a career in the construction industry (UK Construction Week, 2017; World Economic Forum, 2018a). Various efforts can be taken to promote a better image of the construction industry - For example, Build UK and the Construction Industry Training Board (CITB) established a collaboration to start an image campaign. The campaign is called Inspiring Construction (https://builduk.org/priorities/recruiting-training-retaining-talent/inspiring-construction/). The aim here is to attract potential jobseekers to the construction industry by providing relevant and motivating information to them. The construction industry can focus on promoting new technologies that the industry is adopting (for example, 3D printing, augmented reality and virtualization) to students at schools.

New focus areas have gained much attention in the construction industry in the recent years. Two of them are sustainability (energy efficient solutions, near zero carbon emission, etc.) and digitalization. The new focus areas call for / demand skill development in the industry. The World Economic Forum (2018a) says that there is no corporate educators or academia have kept pace with the demand to date. Therefore, it is necessary that the construction industry has to collaborate with universities, professional colleges and vocational training providers to develop relevant curricula for existing and future employees. This issue can be addressed in three dimensions (World Economic Forum, 2018a):

- The first dimension is to identify the skills-gap to have a clear understanding of what skills are needed and how many workers possess those skills. An example that can be mentioned here is an effort taken by two German institutions called, the Federal Institute for Vocational Education and Training (BIBB) and

Institute for Employment Research (IAB). These institutions regularly conduct research to find out supply and demand for workforce skills to provide leading industry and education providers with information about the labour market and professional education trends.

- The second dimension is that the construction industry should provide feedback to the academia / educators on how current curricula satisfy meet the industry's needs. This feedback helps the educators to design and shape future training, both in vocational educational training (VET) programmes and in higher education. In the German Dual VET system, businesses, the government and the society take part in the BIBB committee, which makes sure that the real-world work requirements are a part of the education and training programmes.
- The third dimension is collaboration between the construction industry and higher educational institutions. The collaboration can manifest as R&D or pilot projects.

4.3 Government-level

Juricic et al. (2021) point out in the conclusion of their study on "Review of the construction labour demand and Shortages in the EU", that skill and occupational requirements change over time and are affected by changes such as technological changes. Therefore, updating apprenticeships and academics programmes play an important role in developing skills for current and potential workers in the construction industry to meet existing and emerging demands and conditions. The update can be done in the following steps:

- Find out the skills that the construction industry needs
- Compare it with the contents of the apprenticeships and academic training programmes
- Based on this comparison, determine what new courses are needed
- According to this result, update the educational / training programmes

Updating apprenticeships and academic programmes could pave the way to promote life-long learning which in turn can contribute to increase productivity and competitive advantage. When organizations become learning organizations, then they can achieve and retain competitive advantage (Senge, 2006).

One of the approaches to apprenticeship programmes, which is similar to the existing system in Germany, is to combine on-the-job training with theoretical learning at vocational school. Universities can be encouraged by governments to teach new courses in digital technologies, soft skills (such as communication, leadership, stakeholder management, etc.) and general skills (such as project management, foundational engineering and programming, etc.). This could enable students to become eligible for different types of jobs in the industry.

Soft skills and practical knowledge emerge through practice. Higher extent of practice will lead to acquire soft skills and practical knowledge. On way to achieve this, is hands-on learning. For example, University of Chichester in UK is building an engineering and digital technology park with a project-oriented engineering workshop. This park incorporates a fabrication laboratory, 3D printers and hands-on learning spaces. The intention of building this park is to educate and train students to address business challenges that are emerging in engineering and technology.

There are specialized programmes that provide support to governments to update academic programmes – for example, UNEVOC (World Economic Forum, 2018a). It is a UNESCO centre for technical and vocational education and training (TVET). This centre provides help to the member states of UNESCO in developing and improving TVET systems and implementing skills-development policies and programmes. These policies and programmes are relevant, accessible to all and have a long time span (lifelong).

5. A categorisation of needed skills

The action plan that was described in Chapter 4 can be applied as an overall guiding framework or a foundation to develop a training and educational programme for learning the REZBUILD solutions / concepts. These programmes, which are aimed at developing skills, will be more effective, if they also reflect on and represent the kinds of skills that are needed in the construction / infrastructure and urban development industry. In this regard, we can look at the following categories of future skills that are mentioned by Construction Leadership Council (2019, page 3).

- Digital skills: Development of more widespread digital skills to underpin future, collaboration and productivity improvements within the sector. This must be coupled with 'digital leadership', meaning

that executives and managers across clients, contractors, consultants and the supply chain are committed to resourcing and delivering their projects digitally.
- Technical skills: An increase in technical skills to enable deployment of Smart Construction methods during all stages of a project lifecycle: project initiation, design delivery and operation. This will allow projects to be developed with manufactured products in mind from project inception; rather than designing traditionally and converting the design later.
- Collaborative skills: Development of the necessary collaborative skills to enable individuals to work effectively across teams to plan and to communicate and deliver digitally-enabled Smart Construction projects. As projects become more complex and demanding, the industry will be required to work more closely together than ever before. The transactional and isolated behaviours of the past counteract progress in an increasingly complex and interconnected industry.
- Traditional skills: Maintaining and enhancing traditional skills. These skills will remain in demand as they already face skills shortages and they are essential in maintaining and extending our existing built environment.

The categories of skills reflect and have several connections with the action plan presented in Chapter 3, for example focus on digital skills.

6. Designing a structure of a training and educational programme

Designing a structure of a training and educational programme includes both examples of the content of such a programme, and some important aspects that are to be taken into consideration.

6.1 Content of a training and educational programme

A training and educational programme can take several forms. Scope (to what extent the topics are covered in a training and educational programme), and duration of the programme can vary according to the situation – for instance, according to the need and possibility. We will present one such form as an example based on the description that we have seen so far. This example takes a holistic / systemic view; that is, the programme provides not only the knowledge on the REZBUILD solutions per se, but also topics related to them so that the learner could obtain a holistic understanding that would strengthen his or her skill development. The training and educational programme that we suggest has seven parts. They are:

1. Sustainable construction
2. Energy efficiency
3. Standards, labelling, certifications and policy instruments
4. Current and emerging technologies
5. REZBUILD solutions / concepts
6. Project management
7. Soft skills

These seven parts can be categorized into three categories:

- Background knowledge: The first four parts (Part 1, 2, 3, and 4) could provide background knowledge that is needed to understand the implementation of REZBUILD solutions / concepts better and reap greater benefits of implementing them.
- REZBUILD solutions / concepts: Part 5 deals with the REZBUILD solutions / concepts.
- Methods for effective implementation: The last two parts (Part 6 and 7) are about means or methods for implementing the solutions / concepts efficiently in a real environment. Refurbishment efforts that include the application of the REZBUILD solutions can be seen as projects. By applying project management techniques and skills (for example, organizing and time management) can be helpful to accomplish the desired results in an efficient manner. Generally speaking, implementation of such projects and REZBUILD solutions / concepts in industrial and research infrastructure settings involves several people. Dealing with and managing people effectively require soft skills such as communication, leadership, etc. As a part of the training and educational programme, project management and soft skills ensure accomplishing the desired results of the implementation of the REZBUILD solutions / concepts effectively.

Now, we will see possible contents of these seven parts that constitute a training and educational programme. This description is developed with the help of information and inspiration from other relevant deliverables from

the REZBUILD project, Building up green skills of trainers from the construction industry (Eco-Trainer in the construction industry, 2018), discussions with professionals, academics and researchers, and our own work experiences.

- *Sustainable construction*, as a starting point, can encompass a general description of sustainability in the construction industry – including refurbishment projects and activities – addressing what it is, why there is focus on sustainability in the construction industry, how it is accomplished, etc.; a fundamental description of sustainable construction techniques (for example, passive solar design); a general description of relevant traditional construction topics and techniques, incorporating relevant aspects of bioclimatic design and construction such as climate, ventilation, thermal comfort; and a general description of new technologies applied for the sustainable refurbishment of buildings (for example, insulation and related measures to reduce the energy consumption of buildings).
- *Energy efficiency* can focus on providing more detail knowledge on energy efficient insulation (walls, roofs, windows and ceilings), and heating and cooling systems.
- *Standards, labels, certifications and policy instruments* can provide information on regulations / categorisations that one has to refer to when refurbishing dwellings, as well as policy instruments that provide supporting governmental mechanisms for refurbishment efforts.
- *Current and emerging technologies* can address not only relevant building construction technologies, but also how the technologies affect the construction industry, what companies and the industry can do to deal effectively with opportunities and threats that the technologies bring forth, and how to do it at the strategic, tactical and operational levels. In addition, this part can also include a general description and basics of the digital technologies, for example, Building information modelling (BIM), computer-aided design (CAD), 3D printing, laser scanning, and virtual reality (VR) and augmented reality (AR).
- *REZBUILD solutions / concepts* are the solutions / concepts that are developed in the REZBUILD project include; for instance, 3D printing facades, BIPV (building integrated photovoltaics) integration, Super thermal insulation materials, HVAC (Heating, ventilation, and air conditioning) systems by radiant floor, Solar heat pump solution (Solar assisted heat pump – SAHP) and APM (Agile project management) tool. In the learning session, each solution / concept can be addressed in the following manner:
- Presentation and description of the solution / concept: Characteristics of the solution / concept, rationale behind developing it, requirements for implementing it, a description of how to implement it effectively, information on factors that are to be considered when implanting it, expected and potential impact of it.
- Sharing of experiences (best practices and lessons learned, tips and guidance): Presentation and description of how the solution has been implemented in the three REZBUILD demo-sites and other places.
- *Project management* can include topics related to practical project management from project start to project completion / delivery. Some of the relevant topics that can be taken into consideration are, organizing and project work-structure, contracts, time planning, cost estimation, budgeting, resource allocation, work scheduling, coordinating, communication, collaboration, stakeholder management, uncertainty management, change management, work culture, project delivery, reflection and learning. Reflection and learning can contribute to improve future refurbishment projects – for instance, saving time and cost, and ensuring a better quality.
- *Soft skills* can include the following elements:
- Fundamental principles of organizational behaviour, organisational culture, and social aspects of organization
- Tools, methods and approaches for handling aspects related to organisational behaviour, organisational culture, and the social dimension of the organization effectively
- Special focus can be given to key soft skills, for instance, communication, collaboration, negotiation, conflict management and leadership

6.2 Some relevant aspects to consider

The training and educational programme (physical and / or online participation) can be designed and implemented in various ways and forms depending on the need, availability of resources and other existing conditions. Several aspects are relevant to be considered when the training and educational programme is being planned. Some of them are:

- Level of skills: The level of skills that potential learners have, can determine how the programme can be designed – that is, duration of the programme, choice of topics, the extent to which the topics are

covered, etc. Various skill-levels also point out the necessity to focus on criteria for selecting / admitting potential learner to the programme.

- Learning setting: This is about deciding whether the learning process will be a stand-alone programme or an integral part of a larger learning setting / programme at an educational institution.
- Cost related issues: This is about determining the cost of conducting the programme and learners' participation fee (if any).
- Approving learners' participation: This is about determining the form of approving learners' participation in the programme (following a credit system from an established educational entity or providing certificates for participation, etc.).
- Completion and evaluation of the programme: A learner's completion of the programme can be approved based on either the learner's participation and/or an exam at the end of the programme, depending on the existing conditions of the situation. If the programme becomes a part of a curriculum at an educational institution, then there is a high probability for exams. These exams can be written exams that should be taken within a designated time interval, oral exams, practical exams, in the form of delivering reports at the end of the programme, or some combination of all these alternatives.
- Feedback on the programme: The students / learners who participate in the programme can give their feedback on the programme after they complete it. A questionnaire can be used in this regard. They can also provide information later regarding how this programme has helped them to improve their work / projects. This kind of feedback can be used to reflect and evaluate the programme continuously in order to find possibilities for improvement. This continuous improvement could also lead to identify emerging technologies and learning trends, and include them in the training and educational programme over time. This could attract many people – specially, young people – to learn and try out new, innovative solutions and concepts.
- Duration of the programme: As we have seen in the discussion so far, time period for conducting a training and educational programme (how much time that should be used in each part of the content, etc.) can vary according to the situation and condition, and hence it is difficult to present a specific structure (time-plan, etc.) for a programme.

7. Discussion and concluding remarks

Engaging in an effort to shape the future of construction, World Economic Forum (2018b) says that one of the key reasons for lack of innovation in the construction industry (as compared to other industries) is an ongoing industry-wide shortage of qualified, skilled workers. It points out that this skill-gap will also lead to stagnate productivity (for example, hindering the adoption of new digital technologies) and negative effects on the economy, society and the environment. In order to close the skill-gap and acquire the skills needed to accelerate the adoption of promising new technologies and concepts, there is a need to improve workers' skills, attract new, talented professionals to the industry and promote new technology.

When major actors from the construction industry and ministers of several countries dealt with the issue of transforming the industry in the World Economic Forum Annual Meeting in 2018, they mentioned three most important efforts to address the skill-gap in the construction industry (World Economic Forum, 2018b):

1. Attract new talent and build up required skills
2. Integrate and collaborate across the value chain
3. Adopt advanced technologies at large scale

This description suggests the relevance of adopting REZBUILD solutions in future renovation efforts and of disseminating REZBUILD solutions through training and educational programmes. By sharing its knowledge, the REZBUILD project can contribute to create a greater impact on the construction industry. In this regard, we can think of REZBUILD's contribution to following / materialising the action plan (that we have seen in Chapter 4) and strengthening the four kinds of skills (Chapter 5).

Having (1) the REZBUILD solutions / concepts, (2) the overall guiding framework (the action plan), and (3) the major kinds of skills as three building blocks, we attempted to design a structure of a training and educational programme – a programme that can facilitate the acquisition of skills by industrialists and research infrastructures for implementing REZBUILD solutions / concepts in a real environment. Figure 2 illustrates it.

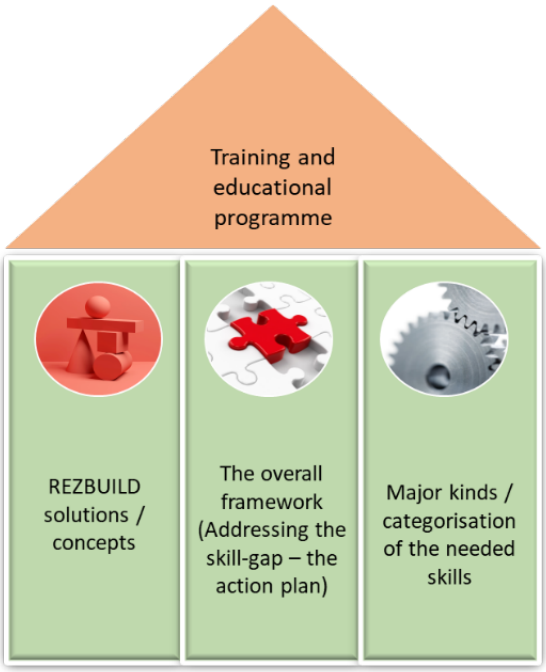


Figure 2: Developing a training and educational programme

It should be noted that the structure of the training and educational programme (for instance, the extent to which the topics are covered in the training and educational programme and duration of the programme) can vary according to the situation. Therefore, what we have presented in Chapter 4, 5 and 6 can be considered as a suggestion that can guide one to develop a training and educational programme according to the current conditions (need, possibility, etc.). This can be considered as a limitation of this paper.

One of the essential factors of learning processes in a training and educational programme is reflection. Reflection on a new knowledge with respect to the current practice can lead the learner to figure out how (or to what extent) the new knowledge can be applied in practice. Schön (1998, page 61) says, "A practitioner's reflection can serve as a corrective to over-learning. Through reflection, he can surface and criticize the tacit understandings that have grown up around the repetitive experiences of a specialized practice, and can make new sense of the situations of uncertainty or uniqueness which he may allow himself to experience". Hence, reflection can lead not only to single-loop learning, but also double-loop learning (Argyris & Schön, 1996). REZBUILD solutions, such as 3D printing, can be considered as an impetus for or a result of double-loop learning.

The training and educational programme presented in this paper reflects – at least to a certain extent – the three components of professional knowledge that Schein (1973) describes:

- Basic knowledge: Part 1, 2, 3 and 4 (of the programme)
- Applied knowledge: Part 5
- Skills and attitudes: Part 6 and 7

Detail of the parts of the programme are mentioned in Chapter 6.

With its solutions / concepts, the REZBUILD project aims to demonstrate, among other things, primary energy reduction, reduction of installation time in comparison with a traditional refurbishment work, and a rapid feedback period. Conducting a training and educational programme will contribute to share and spread the REZBUILD solutions / concepts to others and increase energy efficient refurbishment of buildings.

Further research can focus on implementation of the programme in various contexts, and identify possibilities for improving the content and the implementation of the programme.

Acknowledgement

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dissemination of results must indicate that it reflects only the author's view and that the Commission is not responsible for any use that may be made of the information it contains.

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Awareness, Adoption, and implementation of Building Information Modelling in Small and Medium Enterprises in the Moroccan AEC Industry

Hayat El Asri and Laila Benhlima
Computer Science Department, Mohammadia School of Engineering, Mohamed V University, Rabat, Morocco
Hayat.elasri@research.emi.ac.ma
Benhlima@emi.ac.ma

Abstract: Building Information Modelling (BIM) has gained widespread popularity over the past decade, mainly in the Architecture, Engineering, and Construction (AEC) industry. The adoption of BIM in developed countries is already regulated as opposed to developing and underdeveloped countries. This study aims at filling the knowledge gap as to the adoption and implementation of BIM practices in small and medium enterprises (SMEs), with a focus on the Moroccan AEC industry. The main goals of this study are 1. to determine the BIM awareness level and adoption rate, 2. to assess the familiarity level, 3. to establish the benefits, challenges, and prospects of BIM. The results of this study have shown that BIM awareness is high, but its adoption and implementation are not, though promising as it is exponentially gaining the attention of AEC practitioners.

Keywords: Building Information Modelling (BIM), AEC, Awareness, Adoption, Implementation.

1. Introduction

The construction industry contributes greatly to the GDP and economic growth and development of countries. In fact, "GDP from Construction in Morocco averaged 10665.96 MAD Million from 2006 until 2021, reaching an all-time high of 12844 MAD Million in the second quarter of 2021 and a record low of 5702 MAD Million in the first quarter of 2006" (Trading Economics, 2021). The AEC industry, in general, faces however several challenges from different aspects like costs, workplace diversity, waste, technology adoption, and knowledge sharing.

With all the technological advances that the world has witnessed, it comes with no surprise that the AEC industry was positively affected as well. One of the biggest technology advancements for AEC is BIM. The concept of BIM has, in fact, been around since the 1970s, but has evolved into standards and practices in the last 2 decades. Some countries, like the UK, have regulated its use and made it mandatory for all projects surpassing a certain amount of money. Taking the UK as an example, BIM has been mandated for all public sector projects costing over £50,000, with the minimum level of BIM to be adopted and implemented set at Level 2. This means that public sector projects are to follow BIM standards such as ISO 19650 and PAS1192-2 from the initial stages of their projects. Similar to the UK, a number of countries have a fairly high BIM adoption rate. Table 1 presents some of them. This is, however, not the case for the majority of countries.

Table 1: BIM Adoption Rates

Country	Adoption Rate	Reference
United States	79%	Gerges et al., 2017
United Kingdom	74%	Malleson, 2018
Canada	78%	MaCabe et al., 2018
Australia	67%	Red Stack BIM services, 2016
China	48.8%	Tu et al, 2021

There are 3 BIM levels. Level 0 is the starting point where investigation, feasibility, and planning are carried out. It is also called the scratch point. Then, level 1 is about the design and the start of the construction process. In this phase, 2D and 3D designs are used for vectoring and sharing respectively. Level 2 is what is referred to as the BIM maturity level. In this level, the scheduling and cost estimation of the construction project is done using 4D and 5D. Level 3, the advanced level, is all about sustainability and applications. Figure 1 presents the BIM levels, uses, and maturity level.

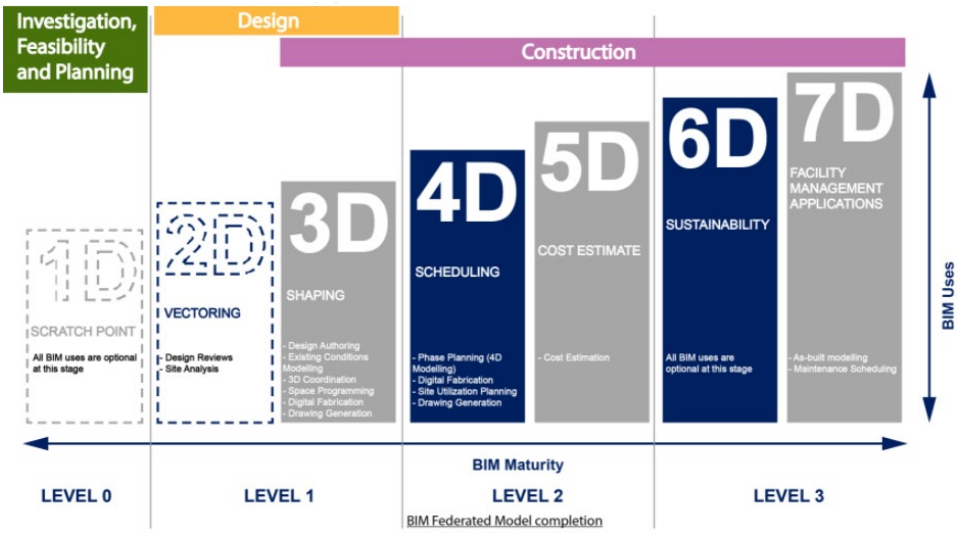


Figure 1: BIM levels and uses (from: AIM, 2019)

The aim of this paper is to showcase the implementation level and adoption rate of BIM practices within SMEs in the Moroccan AEC industry. This paper is structured as follows. Section II presents a review of the literature focused on the adoption and use of BIM in SMEs. Section III discusses the research methodology. Section IV presents the results and discussion. Section V presents the research limitations.

2. BIM Adoption in SMEs: A Review of the Literature

The adoption of BIM has been regulated in some countries, as opposed to others. When it comes to SMEs, their adoption of BIM relies heavily on the required investment and the risk of losing it (Abanda et al., 2014). There are a few studies that explored the implementation of BIM in SMEs.

To start off, Vidalakis et al. (2019) explored the adoption and implementation of BIM in the British AEC industry, focusing on SMEs located in South-East England. The main objectives of the study were to 1. assess the level of expertise in BIM related tools; 2. assess the level of familiarity with BIM implementation support tools; 3. assess the level of familiarity with BIM concepts; 4. Perceive the main barriers to the adoption of BIM; and 5. Perceive the enabling factors to the adoption of BIM. The study has found that 85.8% of the respondents had no knowledge at all of BIM software packages. In addition, the main barriers identified are the high cost of software, licensing fee, and set up, the software interoperability issues, and the lack of in-house skills. From another perspective, the main enablers identified are the knowledge exchange with other businesses, industry initiatives, further guidance and leadership, and further CDP training. The findings of this research indicated that the interviewed SMEs' knowledge in existing BIM support systems is at a particularly low level. It is, however, a continuous and on-going process, and more companies will adopt it in the future.

Similarly, Newton and Chileshe (2012) investigated the awareness, usage, and benefits of BIM in South Australia. The main objectives of the study were to 1. assess the current awareness and determine the BIM adoption rate, and 2. establish the advocated BIM benefits and its impact on project outcomes. A field study was conducted where 29 organizations were randomly selected, and asked to fill in a questionnaire. This latter was made of four main sections: 1. The general demographics of the respondents and awareness and issues, 2. BIM enablers, 3.the barriers and challenges, and 4. the benefits of adopting BIM. This study revealed that only a minority of the interviewed firms, about 17%, use some level of BIM. The top benefits of using BIM, according to the survey results, are improved constructability, improved visualization, improved productivity, and reduced clashes. A few companies have also mentioned: improved quality and accuracy, improved client satisfaction, increased competiveness, and improved information sharing. The most significant implication arising from this study is that the benefits surrounding BIM significantly outweigh its negative aspects.

It should be noted that, to the best of our knowledge, no published / publicized study has investigated the adoption and implementation of BIM practices in SMEs in Morocco.

3. Methodology

3.1 Design Method

This project used a descriptive design method in which a structured survey questionnaire was developed and shared with a large number of managers of AEC SMEs in Morocco. Furthermore, interviews were conducted with 7 top-management executives from 7 randomly-chosen companies that responded to the questionnaire. The purpose of the questionnaire and interviews were to get answers related to both the awareness, the implementation, the prospects, and the challenges of the use and implementation of BIM.

The survey questionnaire was run over a period of 3 months, and was written in 2 languages: French and English, to be sure that the respondents pick the language they prefer and understand the questions thoroughly since the working language in Morocco is French. In addition, the survey was divided into several parts. In addition, filter questions were used to differentiate between BIM and non-BIM users, and therefore allow respondents to get appropriate questions. BIM users, for example, were asked about their proficiency level in BIM, the number of years since he company started using it, the level of BIM used, the number of projects carried out using BIM, and so on, while non-BIM users were rather asked about the barriers to the adoption of BIM, the alternatives used, and the software currently in use.

In addition, and as previously mentioned, the interviews were held with top-management executives only. The goal of these interviews were to get a more in-depth view of what it entails to use BIM from a managerial perspective, how it helped the organization, what concessions had to be made, and what challenges had to be overcome.

3.2 Primary Data Collection

The main source of data in this research is the responses to the survey questionnaire and interviews. This isThe link to the questionnaire was sent to a large number of SMEs in Morocco. These latter specialize in the following areas: architecture, contractors, engineering, consultancy, and project owners.

4. Results and Discussion

The results are presented in this section, in addition to a thorough discussion. This section is divided into four parts. The first part discusses the companies' line and field of business, their size, the number of projects carried out using BIM, and so on, along with the companies' awareness, adoption, and use of BIM practices. The second part focuses on the challenges that companies encounter and factors that influence that. The third part focuses on the advantages of BIM. Last but not least, the fourth part discusses the reasons and factors that influence the awareness, adoption, and implementation of BIM in the Moroccan AEC industry.

4.1 BIM Awareness, Adoption, and Use

To start off, 105 respondents have completed the survey and submitted their answers. Nonetheless, post data cleaning, only 82 responses were considered, and the others were disregarded. The purpose of data cleaning is to only consider reliable and accurate responses. As previously mentioned, the majority of the respondents' companies operate in the architecture or civil engineering industry.

The companies exact field of work varies, but the majority operate in building and public works or architecture. To be more specific, 38% operate in building and public works, 34% in architecture, 11% in civil engineering, and the rest is divided between consultancy, construction logistics, construction materials, and interior and landscape design. Furthermore, the majority of the interviewed companies are small, consisting of 1 to 50 employees. 11, however, can be considered medium large companies with an employee range of 100-250.

Furthermore, the average number of projects carried out with and without BIM differs from one category of companies to the other. The graph below presents the overall number of project and the projects carried out using BIM and the ones without BIM.

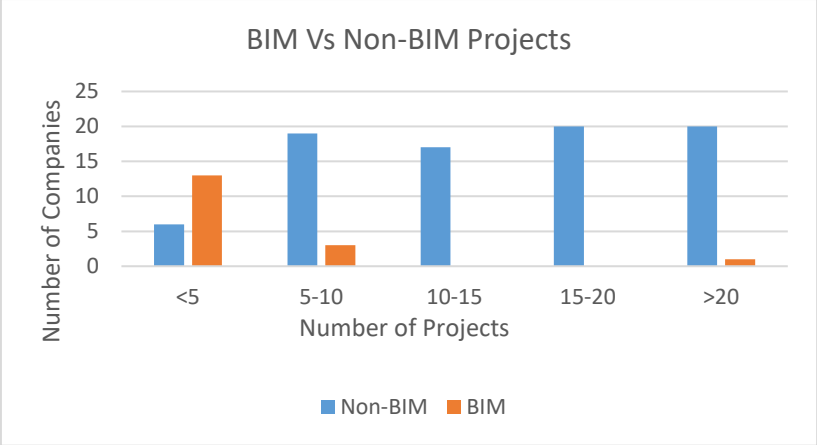


Figure 2: Number of BIM projects per year

It can be noticed that there is a major difference in the annual number of projects carried out using BIM as opposed to the ones carried out without BIM. In fact, 6 companies have carried out less than 5 projects per year without using BIM as opposed to 13 that are carried out annually using BIM. However, all the companies that have voted for this option mentioned that they have only carried out 1 BIM project. Therefore, the 13 projects refer to 13 companies, each carrying 1 project. Likewise, only 1 company has carried out more than 20 projects using BIM.

Regarding the used software, the majority of companies use Autocad, Archicad, and Revit. Table 2 presents the results.

Table 2: Software used

Revit	Autocad	Archicad	Naviswork s	Robot	Bluebeam Revu	3D Max	Primavera	Rhino	DIALux	ProDesign	MS Office	BIM360
12	17	12	2	3	1	1	1	1	1	1	1	1

There are a few companies that use a combination of software. A popular software combination is Revit with Autocad, and Revit with Archicad. There are, however, other software in use like Robot and BIM 360, but not popular among the investigated organizations.

In addition, 55% of the respondents believe that their employees are not familiar with BIM at all. Even for the BIM-users, the companies' proficiency level was mostly limited or general. In fact, only 2 companies have significant expertise in BIM, as shown in figure 4.

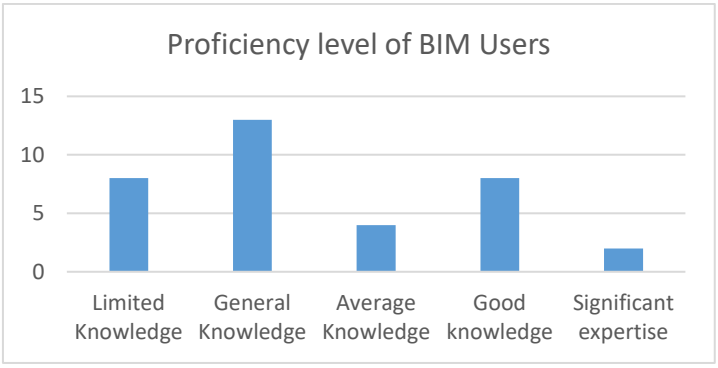


Figure 3: Proficiency level of BIM users

As a follow up to the proficiency level of BIM users, the companies' general level of BIM leaned towards the low side. In fact, 48% are beginners and 39% are intermediate as opposed to 9.7% who believe they are advanced and the 3% that consider themselves experts. The fact that several companies have just started adopting BIM explains why their level is not advanced. In addition, 3D modelling is the level used by most companies, while not a single company uses 5D and 6D so far. Still, only 6.5% of the companies use BIM systematically while 93.5%

use it for specific projects, and only when asked to by the clients. Figure 5 presents the BIM adoption timeline, the company's BIM level, and the modelling level used.

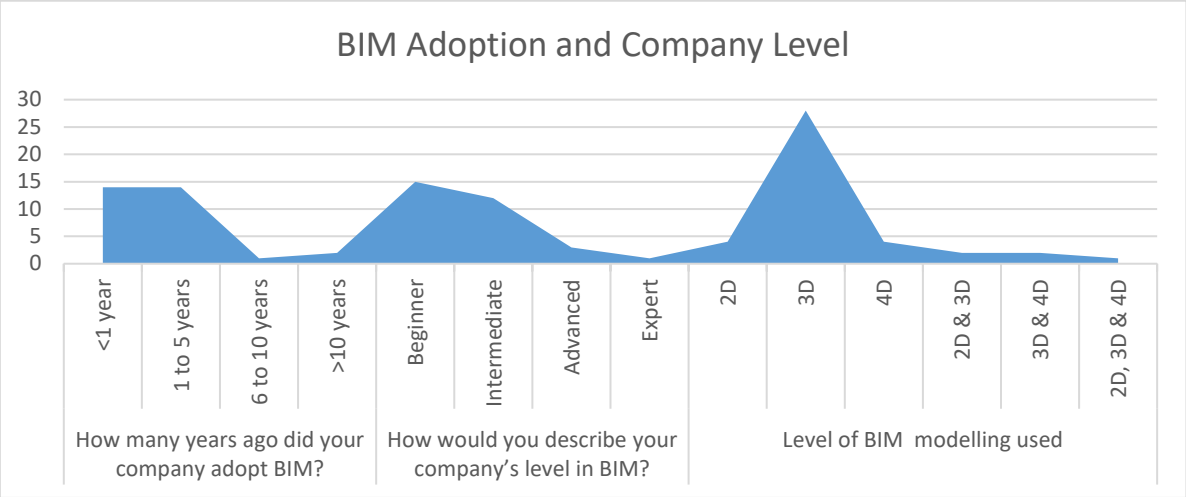


Figure 5: BIM Adoption

Regarding the uses of BIM within organizations, the majority have selected: building system analysis, construction system design, engineering analysis, and structural analysis. Very few are the ones who have selected programming, mechanical analysis, and cost estimation. Figure 6 presents the BIM features, the enabling intra-corporate collaboration features, and the support tools used.

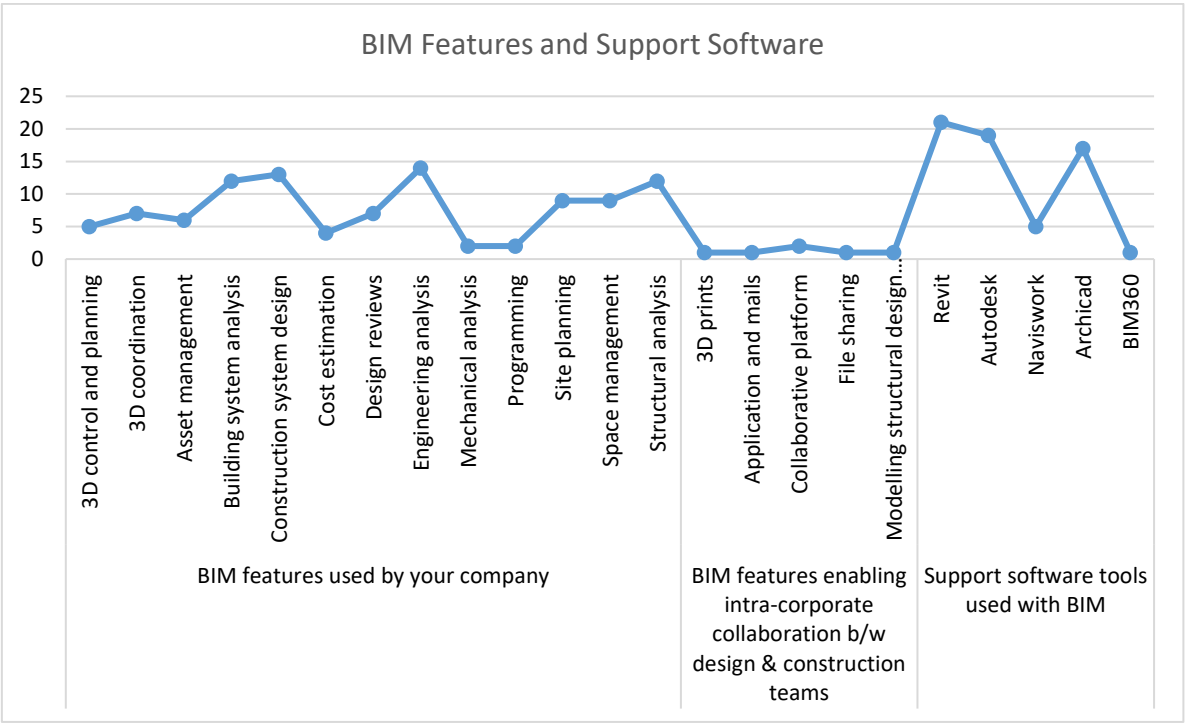


Figure 6: BIM Features and Support Software Tools Used

The most used BIM features are engineering analysis, building system analysis, and construction system analysis, while the least used ones are mechanical engineering and programming. The features for enabling intra-corporate collaboration between the design and the construction team within the same organization are mostly not used. The vast majority of companies do not use any of these features. Last but not least, the most popular software used with BIM are Revit, Autodesk, and Archicad, while only 1 company uses BIM 360.

Regarding whether or not the implementation of BIM lead to some change in management, 80% do have a BIM champion in top management, but only 29% have made some type of change in management to allow for the adoption of this latter.

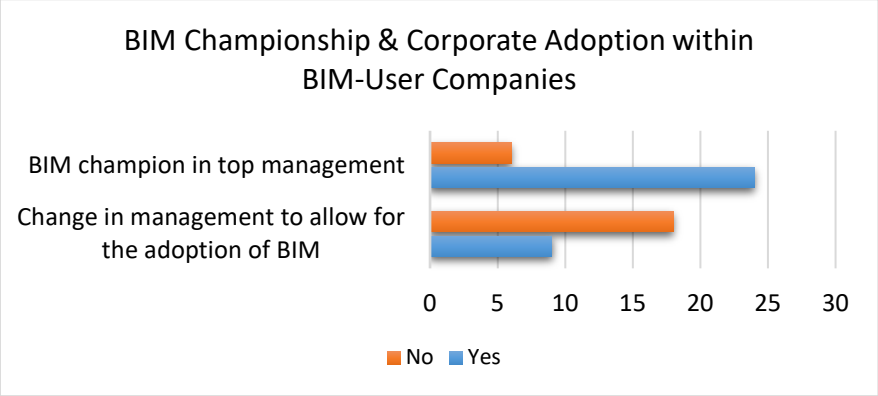


Figure 4: BIM Championship & Corporate Adoption

To conclude this section, we can say that these results are not surprising given the fact that 45% of the companies that have adopted BIM have done so less than a year ago, 45% have adopted it in the last 5 years, 3.5% have adopted it between 5 and 10 years ago, and 6.5% have adopted it over 10 years ago.

4.2 Challenges and Influencing Factors

Several challenges hinder the use of BIM within SMEs in the Moroccan AEC industry. In fact, the most feared challenge with regards to the use of BIM is the need for training. According to some of the comments left by respondents, this is particularly challenging because it is hard to find trainers. In addition, companies also fear the cost of training, mainly if they are required to have all their employees certified. Many companies have actually opted for free BIM lessons available online. The graph below presents the main challenges of using BIM according to the respondents.



Figure 5: BIM Challenges

60% of the respondents believe that the need for training is a major challenge. Likewise, 55% believe that the cost of software is high, and 43% believe that it is too complicated to use. In fact, the majority of SMEs believe that the software they currently use is enough and that they do not need to upgrade and use BIM. From the comments left by the respondents, and from the interview responses, 70% of the non-BIM respondents believe that BIM is unnecessary for SMEs and should only be adopted by big companies. Another major challenge encountered by many SMEs is the non-conformity in the use of BIM. For a project to be successfully carried out with BIM, all stakeholders must use BIM, which, at this point, is hard to achieve. Nonetheless, 11 of the BIM-

users believe that BIM does not have any drawbacks and that they can see its benefits though not used for a long time.

Furthermore, another major influential factor is the lack of BIM qualified professionals in top-management. In fact, only 6 organizations have a BIM champion in top management. Another important challenge mentioned during an interview with a top manager is the clients' lack of understanding. In fact, many clients do not wish for the company to use BIM as they believe it leads to a waste of time and resources. This may be due to the lack of exposure and lack of awareness of BIM and the benefits it can offer.

4.3 Potential Advantages of BIM

Several advantages can be linked to the adoption of BIM within organizations. The most popular advantages of BIM according to the survey results and interviews are the fact that it improves communication between the different stakeholders, improves creativity, reduces conflicts and errors, and improves productivity. Figure 7 presents the survey results as to the advantages of BIM.

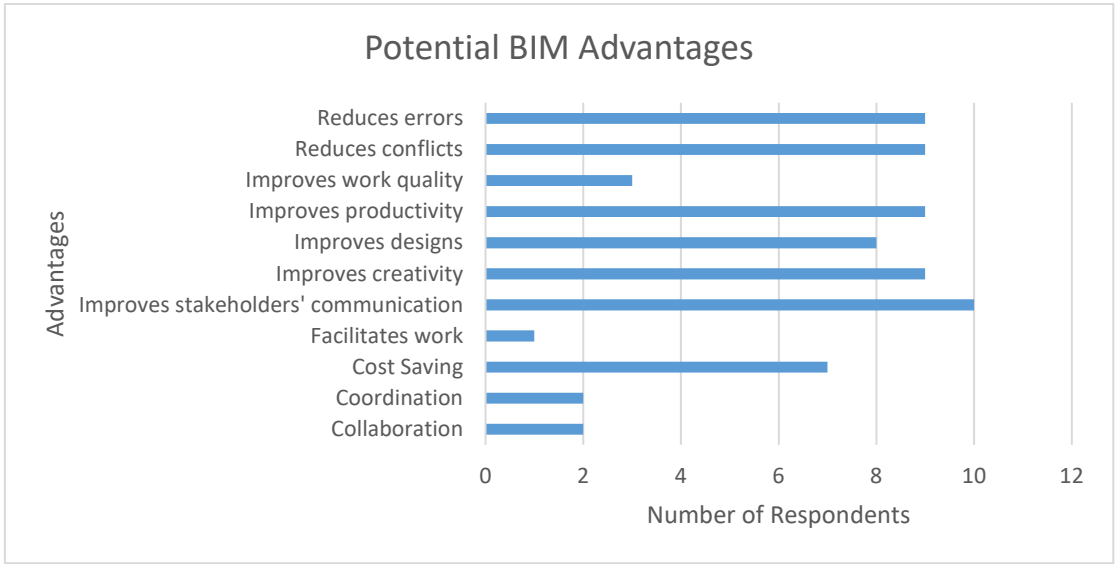


Figure 6: Potential BIM advantages

From the 82 respondents, only 1 company believes that BIM facilitates work, 2 believe that it helps with coordination and collaboration, and 3 believe that it improves work quality. This may be due to several reasons, the main one being that BIM is not regulated in Morocco and is therefore not widely used. This makes it hard for BIM users to successfully carry out a project using BIM practices from start to end. A common struggle is having one stakeholder use BIM, but not the others. This leads to lack of coordination, complications with regards to collaboration between the different stakeholders, among other issues.

BIM has, nonetheless, several advantages during all the stages of the construction process. In the pre-construction phase, BIM helps with several aspects including but not limited to conceptualization (Eastman et al., 2011), site analysis (Azhar et al., 2011), design reviews and cost estimation (Khosrowshahi, 2017). During the construction phase, some of the important advantages that BIM offers include construction evaluation and resource planning (Kjartansdottir et al., 2017) and procurement management (Eastman et al., 2011). Last but not least, during the post-construction phase, BIM provides maintenance assistance (Enshassi et al., 2018), among other benefits. From the survey, however, 50% of the responding companies are not aware of the benefits that come with using BIM.

4.4 Reasons and factors that influence the awareness, adoption, and implementation of BIM

Most respondents did not know what tasks and/or information are not taken into account by BIM processes. However, some have mentioned the adaption to local regulations in morocco, clarity of tools, and the cost of materials among others.

In fact, responding companies believe that the following are not taken into account by BIM processes:

- Adaptation to local regulations in Morocco

- Clarity of tools
- Lack of adaptability
- Material costs
- Lack of experience
- Trainings

The majority of respondents that do use BIM did not know how BIM can enable collaboration between the design team and the construction team within the organization. Very few respondents, nonetheless, have mentioned 3D prints, mails, collaborative platforms, and file sharing.

Figure 8 presents the uses of BIM that would potentially be needed in the future.

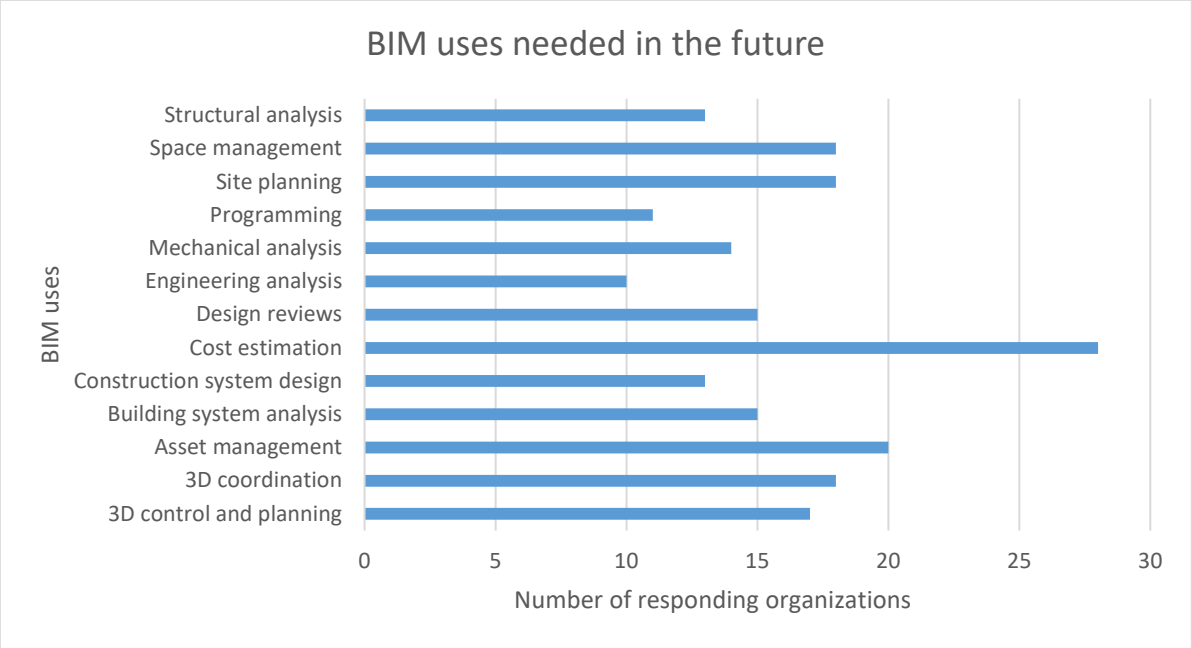


Figure 7: Potential BIM uses needed in the future

All companies believe that using BIM in the future will become crucial, mainly if it gets regulated by the government. It should be noted that, at this time, the majority of the interviewed companies do not have an alternative to BIM and are using what they call the “classical method”.

From another perspective, there are of course some factors that do encourage the use of BIM. During the interviews carried out, the factors mentioned were:

- Government support in acquiring the material and offering staff trainings;
- Experience sharing between BIM users and non-BIM users. This will encourage the non-BIM users to get first hand insight into the advantages that come with using BIM.

5. Limitations

The main limitations of this work is that, although this study provides a general overview of the awareness, adoption, and implementation of BIM practices in Morocco, the results cannot be generalized to all AEC SMEs.

6. Conclusion

BIM has gained popularity in Western countries over the last decade. However, it seems that it is just starting to take off in the majority of developing countries like Morocco. There are several challenges that hinder the acceptance and implementation of BIM practices like the cost of software and the need for training.

Future works include a further study, to be conducted in a couple of years, to determine whether or not more companies have adopted and implemented BIM processes.

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Knowledge Management and Practices of Real Estate Valuation 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: The purpose of this research is to examine knowledge management (KM) and changes in the real estate (RE) valuation (V) profession in the case of Turkey, which is among the countries that are not fully transparent in RE investments, and to compare them with good practise examples. The increase in RE prices around the world, which started with the conditions of the COVID-19 period, while financial institution REV process and also creates dissatisfaction for buyers and sellers. While the world is experiencing an inflationary process, the rapid change in RE values has made information management even more important in V in countries where there is no transparency in RE transactions. In this study, market players, KM in V accessible databases in V, software and web portals for valuers and companies, V workflows, number of RE sales with known transaction price information by year, number of RE sales with unknown transaction price information by year, value objection data by year, KM systems, public data sharing platforms, and legislation are looked at in the context of how they are used in the sample country. Literature research has been conducted in the field of information management since 2001 in the RE sector in the sample country and compared with world examples. In REV, the KM deficiencies needed to make more accurate value estimations for the benefit of credit institutions, collateral financing institutions, buyers, sellers, housing loan institutions, REV companies, and valuers have been researched. With its recommendations, good practise examples in the field of RE and REV in the world in KM are included. This study aims to be a reference source for future studies and discussions in this field by compiling knowledge on how KM is applied and used in the field of REV.

Keywords: knowledge management, real estate, valuation, appraisal, Turkey

1. Introduction

A study in Turkey looked at how KM is used in the field of REV and what benefits it might bring. Within the scope of the research, it has been tested whether a performance increase can be achieved by using the KM of the REV company for the performance system used by financial institutions in measuring REV companies in the field of REV. When 28 RE valuers and nine auditors worked together over the course of nine months, three areas of their work were looked at, and seven areas were looked at for valuers and auditors.

2. Literature review

KM applications are typically used by businesses to increase profit, performance, and functionality. The studies were conducted in IT companies (Reich, Gemino and Sauer, 2014), sales and marketing companies (Bennett and Gabriel, 1999), small-scale businesses (Hankinson, 1997), and even NASA (Sabherwal and Becerra-Fernandez, 2003) KM applications were examined in the literature review. Positive changes have been observed in enterprises that use KM practises and set goals.

The variety of knowledge and information available to a team can increase the number of potential solutions to a problem, resulting in a higher-quality response. Since the employees themselves developed the solution, they will be more receptive to the decision and more likely to comply with it if they were involved in its creation (Gustafson and Kleiner, 1994). The community perspective (Swan et al., 1999) recognises that knowledge is always being negotiated through social networking processes that are interactive.

Companies that used KM extensively were, on average, more innovative, more adaptable to change, and better able to access knowledge than other companies (Chourides, Longbottom and Murphy, 2003). There is a lot of evidence that quality has direct and indirect effects on individual impact, and that KM use has the biggest effect on individual impact of all the constructs (Wang and Yang's, 2016). The genuine differentiating factor for any organisation that is conducive to cross-functionality is how knowledge can be leveraged to enhance the process in question and convert it into tangible value (Mohamed, Stankosky and Murray, 2004). KM in an organisational context does not involve the management of all known information (Quintas, Lefrere and Jones, 1997).

3. REV Market in Turkey

Pagourtzi et al. (2003) identified RE market players as agents, valuers, assessors, mortgage lenders, brokers, developers, investors and fund managers, lenders, market researchers and analysts, shopping centre owners and operators, and other specialists and consultants.

REV is the measurement and reporting of a RE asset as well as the rights and benefits associated with it. IVS (2017) says that a "valuer" is a person, group of people, or company that has the skills, knowledge, and experience to do a V in a fair and professional way.

IVS (2017) defined the following basis of value: market value, market rent, fair value, investment value, synergy value, and liquidation value. Market value is the estimated amount required to exchange an asset or liability as of the V date in a bogus transaction between a willing seller and a willing buyer, as a result of appropriate marketing in which the parties acted knowledgeably, prudently, and without coercion. The three approaches described and described below are the basic approaches used in V. The main V approaches are the market approach, the income approach, and the cost approach.

RE valuers and V companies in Turkey first became official in 2001 (Official Gazette, 2001). As of 2022, there are 8,689 valuers (total of REvaluers and residential valuers) and 145 REV companies. RE valuers who belong to an organisation called the Association of Valuers of Turkey (TDUB, 2022).

According to the JLL Global RE Transparency Index, 2020 data, Turkey ranks 43rd among 99 countries. In the list, countries are evaluated under five categories: highly transparent; transparent; semi-transparent; low transparency; and opaque. Turkey is included in the third category, semi-transparent (JLL, 2020). Farzanegan and Fereidouni (2014) found that the increase in RE transparency did not lead to an increase in foreign RE investors. Instead, foreign RE investors were more interested in the size of the market, the high interest of foreign investors in other areas, and high RE prices. On the other hand, Eichholtz, Gugler, and Kok (2011) observed a decrease in performance in the first years of the research period (1996–2007).

Housing prices in Turkey started to decline in real terms as of July 2017 and this process continued until January 2020 (THPI, 2021). As of March 15, COVID-19 measures started to be implemented in Turkey. In March, housing prices in Turkey increased by 2.85% in real terms. As a result of the government's housing loan interest rate cut through public banks for housing loans, housing prices increased by 10.59% in real terms in June. Real increases reached a peak of 24.14% in November 2021.

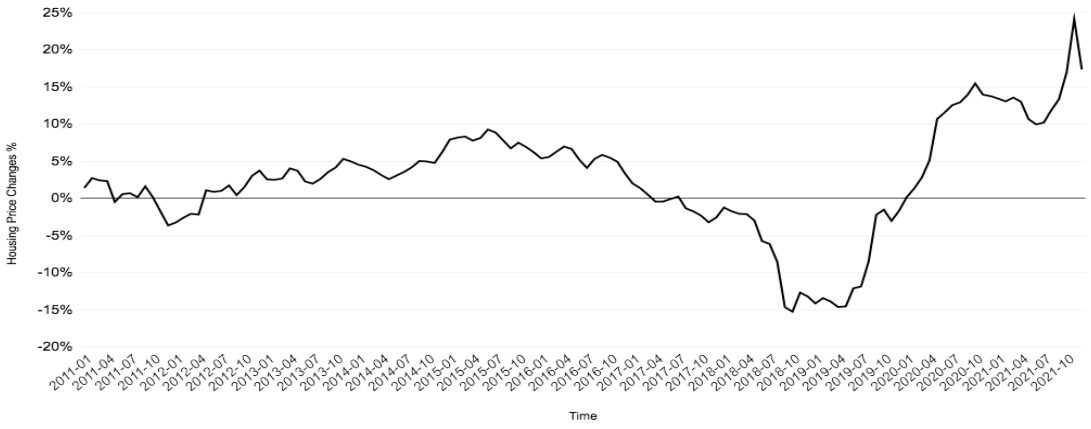


Figure 1: Turkey Year to Year Real Housing Prices Changes, January 2011 - October 2021 (Source: THPI, 2021)

The Turkish property market was in a bubble from 2013 to 2017, and evidence suggests that it burst in 2018. Market data, such as sharp drops in gross mortgage lending, yearly mortgage credit use, and real property prices, support this evidence (Coskun and Pitros, 2022). Many homeowners think they can now afford a home that would normally be too expensive for them during a housing price bubble because they will realise significant additional price gains. Since they anticipate that the rising value of their home will protect them, they won't need to save as much as they would otherwise (Case and Shiller, 2003).

Comparables for sale provide a good observation opportunity for those who are closely interested in RE markets (buyers, sellers, real estate agents, valuers, and institutional investors) about how much similar RE has been sold recently. Smith and Smith (2006) state that in many RE markets, housing prices have risen rapidly in recent years, and some homebuyers have unrealistic expectations about future prices.

Sudden increases in housing prices place buyers, sellers, and valuers in a difficult position. In the face of rising prices, buyers want to complete the RE purchase process as soon as possible; and banks do not want to lose customers as a result of rising customer demand. Because of all of these factors, buyers and banks dislike valuations.

Shulte, Rottke, and Pitschke (2005) state that in terms of the RE market, access to data on average rent, peak rent, rents, supply and demand in the rental market, rents and rates of return on RE in the investment market, purchase and sale prices, costs in the RE and construction market, and credit conditions in the capital markets is required.

Kallio, Falkenbach, and Viitanen (2013) state that REV has become an important service supporting transactions throughout the period of internationalization, and the use of V is thus a matter of relevance for the valuer. International players have made a big difference in the professionalism and development of the valuation service.

In Turkey, 3,020,225 RE transactions were completed in 2021 (TKGM, 2021). There are only 71 transactions with sales price information among all RE sales. These notifications are also made public as they are mandatory. It is not possible to access any other information apart from the requested price information or the estimated sales price information on portals where market information about REV transactions can be obtained. For the requested price information, listing sites such as sahibinden.com, hepsiemlak.com, zingat.com, and emlakjet.com are the portals with the highest number of ads. The "estimated value" can be seen as the values valued by the valuers for the RE put up for compulsory sale on the ilan.gov.tr website, where the sales submitted to the judiciary are announced. It is possible for individuals to bid on RE that is put up for sale on the website https://esatis.uyap.gov.tr/main/esatis/. Individuals can only see the sales value of the RE they follow as a result of the completed tender, but this data is not publicly available.

Comparable sales data is included in the valuer's task environment. This information is frequently incomplete or inaccurate, adding to the environment's complexity. Multiple Listing Services (MLS) data is available to appraisers in the United States. There are no comparable databases for valuers in England. The English valuers were significantly influenced by their knowledge of sale prices. In both comparable sale selection and final value estimation, statistical differences were found between the control (no prior sale price knowledge) and treatment groups (prior sale price knowledge). These findings were similar to those of appraisers in the United States. But valuers' sale selection bias was less than appraisers', and valuers' final value estimate bias was more than appraisers' (Diaz and Hansz, 2002).

Tax legislation deficiencies in the RE sector, as well as the determination of the RE tax value below the market value, result in tax losses and evasion. However, international REV standards say that the market method should be used to figure out the value of recently sold assets, which means that the method should be used and given more weight (IVS, 2017).

4. Knowledge Management and REV Market in Turkey

The purpose of his company's KM and sharing system is to "facilitate communication across all of the organization's boundaries, so that the entire company works together to help everyone be the best they can be." (Buckman, 1998, p.11). Understanding knowledge is the first step toward properly managing it. Concerns about knowledge sharing emphasise communication flow and documentation. A focus on knowledge skills leads to the search for more efficient ways to make, adapt, and use knowledge (Allee, 1997, p.71).

The fundamental characteristic of assisting employees in sharing their knowledge is that it occurs at the most organizational level possible (DeTienne and Jackson, 2001). According to McDermott (1999), the most difficult aspect of most KM initiatives is changing organisational culture and people's work habits.

According to CoreLogic data, V values are 13% lower than actual sales prices, and this disparity increased to 19.7% in May 2020 during the COVID-19 period. As a result of this disparity, buyers must make a 5–10% larger down payment than expected. There is a time lag between when RE valuers get their sales data and when they do their Vs because house prices change quickly (Friedman, 2021).

Market players (financial institutions, guarantee companies, institutions, and individuals) object to REV reports for a variety of reasons when examined separately from RE prices. According to data from Istanbul REV (IGD, 2022), 23.94% of residential V reports were revised between 2017 and 2021.

RE valuers in Turkey prepared 1,288,862 V reports in 2020. The banking sector is the biggest buyer of RE V services in Turkey, making up 92.74% of the market (TDUB, 2020). Banks, participation banks, and savings finance companies will make up Turkey's banking sector by 2022. As of 2022, Turkey has 51 banks, six participation banks, and seven savings finance companies (BDDK, 2022).

Financial institutions (banks and participation banks) use software to monitor REV processes. In Turkey, 40.5% of banks use Invex (Invex, 2022), 37.8% do not have software or it is not known whether they have software, 16.2% use their own software, and 5.4% use Etcbase Gys (Etcbase Gys, 2022).

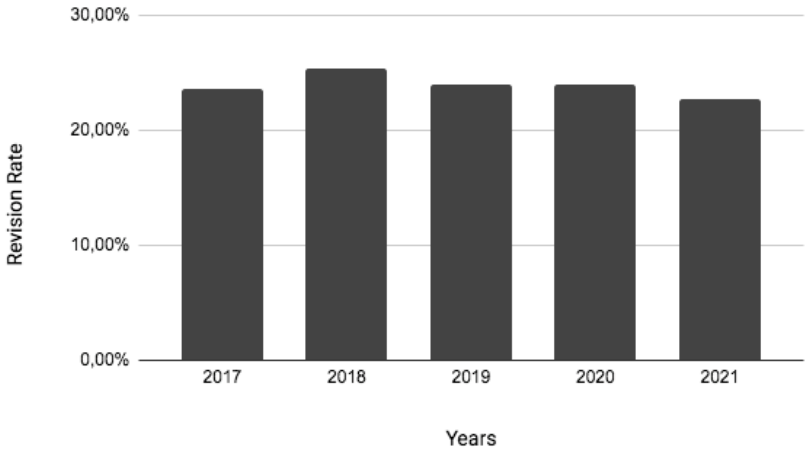


Figure 2: *Revision Rate of V Reports by Years of IGD (Source: IGD, 2022)*

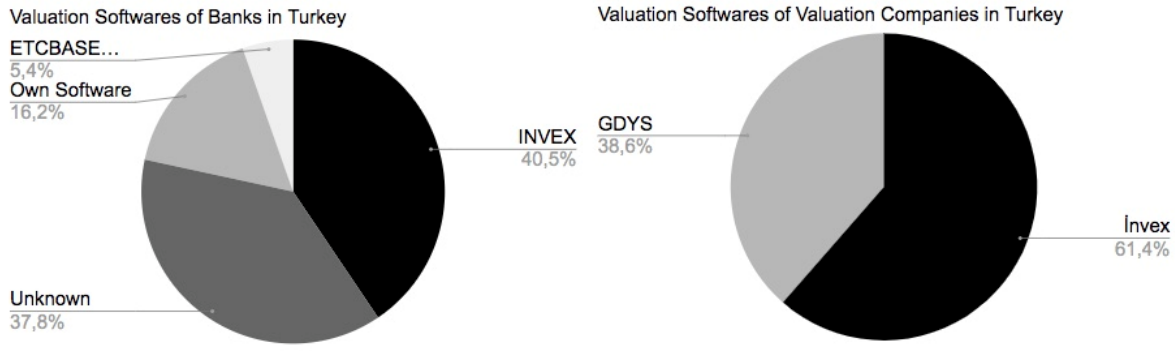


Figure 3: V Software of Banks and V Companies in Turkey (Source: Authors)

Table 1: RE Valuers Use Different Platforms and Software for Each V (Source: Authors)

Name of Process	Definition of Process	Link, Web or Name of Application
GIS	Location, parcel information	https://parselsorgu.tkgm.gov.tr/
CEI	Compulsory earthquake insurance	https://www.dask.gov.tr/e-services/portal/calculatePremium
NARS	Address system inquiry	https://adres.nvi.gov.tr/Home
e-Development Plan	Zoning plan controls	Municipal websites
Valuation Process Software	Appraisal company CRM	Invex, Gdys
Bank Valuation Process Software	Bank valuation process CRM	Invex, Etcbase Gys, Own software or unknown
WebDeed	Encumbrance and deed review	https://webtapu.tkgm.gov.tr/
Listing Sites	Research	Sahibinden.com, HepsiEmlak.com, HepsiJet.com ,Zingat.com
Satellite image	Structure measurement and location	Google Earth, Google Maps, Yandex Maps etc.
Environmental Plan	1/100,000 scale plan review	https://mpgm.csb.gov.tr/1-100.000-olcekli-i-82132
Construction Cost	Construction cost calculation	https://www.resmigazete.gov.tr/eskiler/2022/02/20220218-11.htm
Bank Specification	Bank's practice regulations	Various documents
Photo Editor	Editing photos	Various softwares

When the REV software used by 145 REV companies (TDUB, 2022) registered with TDUB is examined, 61.4% of the companies use Invex (Invex, 2022) and 38.6% use Gdys (Gyds, 2022) software.

For security reasons, the software of the company that supplies software to financial institutions and REV companies is not integrated with the software of V companies. The absence of these integrations contributes to the V process in bank systems in the V process; it causes operation officials, valuers, auditors (V report control officer) and responsible valuers to repeat the same transactions both in the V company software and in the bank V software. These repetitive processes can cause errors and loss of time.

RE valuers and auditors have to use a lot of software in the REV process. They have to examine more than one web page, and they have to follow more than one regulation and list. The 13 items in the table 1 are the basic programs, software, and web pages that valuers use for each V.

5. Methods

The study analysis methodology was structured as follows: first of all, the performance scorecards of financial institutions were examined and performance criteria were created based on the scorecards. The data available in the REV software was examined. In addition to the existing data, the necessary data for performance measurement was also entered into the system. At the end of each month, the one-month performances of RE valuers and auditors were taken from the REV management system and compared with the performance scorecards from financial institutions. The results obtained were shared through one-on-one interviews with both RE valuers and auditors. Actions to be taken for the next month were determined, and common targets were set for the next month.

Financial institutions monitor the performance of REV companies they work with and RE valuers, auditors, and operating units working in REV companies. It shares these follow-up results with V companies within its own sharing programs. The underlying reason for financial institutions' sharing their scorecards is that service providers provide better service. The importance of performance scorecards for REV companies is that they can get more jobs if they improve their performance criteria.

When the performance tables on which financial institutions evaluate REV companies are examined, common features can be seen in the expectations of financial institutions. Time follow-up, revision follow-up, and technical follow-up are all common features. Time tracking includes sub-criteria such as time spent on company operations, time spent with valuers, time spent in audit, and time spent in revision. Revision tracking consists of the sub-criteria of time spent on the revision, whether there is a revision, the reason for the revision, and the revision rate. Technical follow-up consists of the sub-criteria of whether there is a problem in the V and the reason for the problem.

Table 2: Sample List of Performance Criteria for V Companies (Source: Authors)

A Bank	B Bank	C Bank
Passed in Process Officer Avg. Duration	Gross Time in Valuation Days	Job Count Score
Value Passed Av. Duration	Net Duration of Valuation Days	Time Points
Inspector Avg. Duration	Total Elapsed Time Net Day	Problem Report Score
Valuer Passed Av. Duration (Revision)	Total Elapsed Time Gross Days	Actual Attribute Score
Inspector Avg. Duration (Revision)	Has the Revision Process Happened?	Return Score
Average Total Time in the Firm	Is there an appeal process?	Region Coefficient Score
Time Points	Time Given to the Valuer for Report Submission (Days)	Deed Number Score
Valuer - Auditor Score	Time in Valuer (Days)	Report Performance Score
Operation and Branch Score	Time taken for Valuation Company Approval (Days)	Return Rates by Reason for Return
Technical Score	Were There Any Problems With Valuation?	Problem Reports Number of Reasons
Period Score		Delivery Score of Jobs

IGD is one of the V companies using Gdys software. In the Gdys system, there is a lot of information kept for each REV request. From the moment the REV request is entered until the transaction is completed, the information from the time when the valuers accept the transaction until the time when the valuers deliver the transaction is kept in the Gdys system. The errors seen in the REV report uploaded to the system by the valuer, the auditor's points given to these errors, and how long the process was held by the auditors are kept in the Gdys system. Revision requests by the customer to the report controlled by the auditors, and which of these revision requests are accepted, are kept in the Gdys system.

As described by Demarest (1997), for knowledge to result in some form of beneficial commercial performance, it must be distributed to other parts of an organisation. IGD wants to make improvements as a result of their performance scorecards, primarily to identify the problems in order to make improvements. Complaints from customers and performance scorecards of financial institutions were used in identifying the problems. In order to create solution suggestions, performance scorecards were evaluated with the participation of the employees. Areas for improvement were determined, and it was decided to follow up the process with mutual negotiations. Two main areas were selected for improvement; valuers and auditors. It has been decided to follow the following criteria for valuers: revision rates, on-the-job errors, on-the-job V number of normal transactions, number of faultless transactions, average valuer score, and average valuer time. It was decided to follow the following criteria for the inspectors: daily report check average, report check time average, revision rate, and number of reports checked per working hour.

6. Analysis, results and discussion

Analyses were carried out for nine months with 28 people working as valuers and nine people working as auditors, and the first analysis results were shared with the two teams a month later. At least two supervisors and analysts attended the meetings with each valuer and auditor, which were held on the same day each month.

Socialisation plays an important role in KM at the group level, and socialisation should be supplemented by more formal techniques (Sabherwal and Becerra-Fernandez, 2003). The results were communicated to everyone who would attend the meeting the day before the meeting. At the meeting, first the performance of the individuals for the previous month was evaluated, and then the performance data that diverged from the general average was evaluated one by one. In the evaluation phase, mistakes made in the previous month's transactions, customer objections, revisions, late works, and appreciated works were examined.

Skyrme and Amidon (1997) stated that companies can improve their overall performance by sharing effective methods and the knowledge of their best people and departments. Meetings organised with the target groups for the next month were determined by taking opinions and suggestions into consideration. The performance results for the previous month and the targets for the next month were written down and delivered to the employees at the end of the meeting. Also, the opinions and ideas that were shared at the meeting were written down and sent to the management.

Interviews were held (August of 2015-April of 2016) regularly every month for nine months. Performance reports received from financial institutions and in-house performance reports were compared and calibration between reports was made. It was observed that there were time differences in these examinations. It was decided that the best way to measure time would be to use internal time measurements as a guide.

At the end of the nine-month improvement period, the results for the auditors compared to the previous six-month period are as follows: The auditors' performance (Table 3) was improved; the average number of daily controlled reports increased from 5.30 to 7.25, and a 36.79% performance increase was observed. The average report control time duration of the auditors decreased from 5.72 hours to 5.38 hours, and a performance increase of 5.94% was observed. The rate of changes to the reports dropped from 27.5% to 18.1%, and performance went up by 34.18%.

Table 3: Performance Changes by Auditors and Valuers (Source: IGD, 2022)

Period	The Criteria for Performance Changes by Valuers							The Criteria for Performance Changes by Auditors		
	On the job Appre-ciation	The Rate of Normal Opera-tion	The Rate of Error Free Process	Average Valuer's Score	Average Valuer's Time	The Revision Rate of Reports	Work Error	Amount of Controlled Reports Daily	Report Controlling Time on Average	The Revision Rate of Reports
Previous	0,07	31,1%	36,8%	-8,92	20,23	28,1%	1,69	5,30	572,2%	27,5%
Later	0,04	68,2%	72,4%	-3,73	21,53	18,6%	0,54	7,25	537,8%	18,1%

At the end of the nine-month improvement period, the results for the valuers are as follows, when compared to the previous six-month period. Revision rates decreased from 26.0% to 18.6%, and a performance increase of 28.46% was observed. On-the-job errors decreased from 1.85 to 0.54, and a performance increase of 71.2% was observed. On-the-job appreciation decreased from 0.06 to 0.04, with a performance decrease of 33.33%. A normal transaction rate increased from 30.5% to 68.2%, and a performance increase of 123.61% was observed. An error-free transaction rate increased from 35.3% to 72.4%, and a performance increase of 105.10% was observed. An average valuer's score increased from -9.14 to -3.73, a performance increase of 59.52% was observed. The average valuer's time went up from 20.7 to 21.5%, and their performance went down by 3.86%.

As a result of the study, improvement was achieved both for RE valuers and auditors in all ten performance criteria. An increase in the number of reports checked daily by the auditors and a decrease in the number of revised V reports were achieved, resulting in a performance increase of more than 30%. However, there was a lower performance increase compared to the other performance increases in the work times of the auditors. RE valuers have achieved performance increases in many areas, and over a 100% performance increase has been observed in some criteria. In addition, it was found that the report preparation time of the valuers was 3.86% longer than it was before.

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Relational Capital and Technology Brands Over Time

G. Scott Erickson[1] and Helen N. Rothberg[2]
[1]Ithaca College, Ithaca, USA
[2]Marist College, Poughkeepsie, USA
gerickson@ithaca.edu
hnrothberg@aol.com

Abstract: Study examines alternative metrics for assessing relational capital. Associated with intellectual capital, relational capital has to do with knowledge about external relationships. It is chiefly knowledge about customers, but also includes knowledge concerning all external entities such as regulators, collaborators, and others. Relational capital is not widely studied. It's not even included in some popular metrics such as VAIC but is increasingly important in a digital world dependent on customer information, customer interactions, and customer relationships. The concept of brand equity is very similar though from another discipline and not often discussed with or related to the relational capital framework. But by bringing similar disciplines closer together, we can learn things that allow a better understanding of both. Brand equity is particular important to reference because a number of consultancies offer metrics for measuring it, particularly for firms with powerful brands. As a consequence, any alternative metrics suggested will have some baseline for comparison once brand equity is included. This study explores alternative metrics for relational capital, specifically using web-scraping sentiment analysis software to examine select brands. In this case, the study replicates previous work on technology brands, looking at key indicators for the top worldwide smartphone brands. The previous study examined them over a five-week period in early 2021, and this study continues the research with similar results from early 2022. Key metrics include sentiment (positive/negative), influencers, platforms (social networks, blogs, forums), location, and volume. Brands identified as more valuable by other metrics show more interest and more stability over time though all brands do show the potential for a change in value in response to circumstances.

Keywords: Intellectual capital, relational capital, brand equity, smartphones, sentiment analysis

1. Background/Literature Review

Brand equity and relational capital are two fields focused on much the same concept but from different viewpoints. Branding is a core part of marketing, with a strong brand viewed as a key competitive asset. Brands are a communication mechanism, with a recognizable name, symbol, logo, or other device used to remind a customer of the range of personal experiences and word-of-mouth associated with it. When the personal experiences and word-of-mouth are positive, the brand brings that all back in a rush. And the customer's positive associations encourage continued purchases, often at a price premium.

1.1 Brand Equity

Branding concepts, as noted, are central to marketing and have developed a strong theoretical basis. Relational capital relates more to the intangible assets of the firm and their potential to establish unique, defensible competitive advantages. We'll discuss each in turn.

In marketing, branding discussions begin with Aaker (1991), establishing that brand value comes from consumer perceptions of higher quality. Brand value evolved into brand equity, measurable in theory but somewhat elusive in practice. Aaker (1996) proposed brand equity's components as brand awareness, brand association, and brand loyalty. The more consumers that know the brand, have positive associations, and so tend to favor the brand at purchase, the more brand equity it carries. Keller (1993) had previously shown the importance of brand awareness and brand image, also suggesting recognition followed by positive experiences would then lead to a higher brand value.

Even so, how these inputs actually determine brand equity continues to be a question. In a sense, it's up to the market and what each consumer decides the brand is worth. If possible to add all of those together, a value would be available but that approach, of course, is impossible. Seggie, et al., (2006) and Ailawadi, et al., (2003) proposed price differential as an indicator of brand value, but even that measures only what loyal customers do pay, not what they would. So individual perceptions of value are still not fully captured.

Commercial approaches also exist as brand equity is seen as important contributor to competitiveness and, by extension, firm value. These are proprietary to their creators, usually consultancies, with details not fully shared. They can also differ markedly in their valuations and often include only very large firms. But they do provide

some sense of what values might be for brand equity of exemplary firms. Interbrand and Kantar, for example, both release annual estimates of brand equity for top global firms.

The core problem from a measurement perspective is the intangibility of brand equity. It isn't a value found in regular financial reporting. Goodwill is a related concept and is found on balance sheets but only applies at the moment a firm is acquired (at a premium above its market cap, termed goodwill) and is then set in time. Further, it includes all intangible assets. Brand equity can be a big part of the total intangibles but separating its individual value out from total goodwill is problematic. And, of course, goodwill can then be outdated almost as soon as its value is settled.

The theme throughout this discussion is that we have a conceptual idea of what brand equity is and how it benefits an organization. But there is no perfect metric for evaluating it. In such situations, of course, triangulating with multiple methods is a possibility, and we'll talk more of that after exploring the similar concept of relational capital.

1.2 Relational Capital

Intellectual capital (IC) came out of accounting, trying to capture the value of the intangible assets in the organization. The related field of knowledge management (KM) concerns better understanding of these intangible assets and then managing them to better effect. And for competitive advantage. Essentially, the knowledge in employees' heads has value and may be the primary unique, sustainable resource available to firms seeking enduring competitive advantage. That idea flows from the resource-based view of the firm (Barney, 1991; Wernerfelt, 1984) and its concept of competitive advantage accruing from unique resources. To the extent the workforce is the most unique resource available to any organization, if it is particularly knowledgeable, it is a competitive advantage. This knowledge-based view of the firm then supposes that the collective knowledge of that workforce can be better managed, with the idea of firmly establishing the organization's superior performance (Grant, 1999; Teece, 1998).

Part of better management comes from fully understanding the knowledge assets. Both IC and KM have a role in this, start first with KM. Knowledge management is about identifying key knowledge, defining its nature, and managing it appropriately. The key difference defining the field for almost thirty years is between explicit and tacit knowledge (Nonaka & Takeuchi, 1995). Explicit knowledge is easily defined, captured by the firm, codified, and shared between employees. Tacit knowledge is harder to express, harder to capture and codify, and shareable but generally on a person-to-person basis rather than at-scale. As might be surmised, explicit knowledge works well with formalized documents and IT systems (Matson, et al., 2003). Tacit knowledge works well with person-to-person interactions (Brown & Duguid, 1991). Both are dependent on the culture of the organization and its role in establishing trust and the motivation to share knowledge (Nahapiet & Ghoshal, 1998).

IC, as mentioned, came out of accounting and is much more focused on assessing the nature and level of knowledge assets in the firm. The basic structure is usually recognized as including human capital, structural capital, and relational capital (Bontis, 1999; Edvinsson & Malone, 1997). Human capital is individual job knowledge, structural capital is organizational systems and knowledge, while relational capital is knowledge about interacting with those outside the organization. Relational capital was often termed customer capital in early models. While other external parties are included in relational capital (Roos & Roos, 1997), the key relationships, of course, continue to be with customers.

Despite the heavy interest in brand equity, as just discussed, relational capital metrics have not been a well-researched area. Early firm-specific templates including the Balanced Scorecard (Kaplan & Norton, 1992) or Skandia Navigator (Evinsson & Malone, 1997) had a customer metric but later research hasn't looked into it consistently or in much detail. More broad-based metrics that can be used to easily compare multiple firms have also had some limitations. The original IC metric based on easily collected and analyzed annual reports, Tobin's q (Tobin & Brainerd, 1979), is a remainder after subtracting tangible assets from the firm's market capitalization. To the extent it measures IC, it only looks at the full number, not the human, structural, and relational capital components. Pulic's VAIC (Pulic, 2000) does take it a step further with estimates of human capital and structural capital but does not include relational capital (it's lumped in with structural)

Even though much of the IC community does focus on human capital, this lack of attention seems like a mistake. The massive brand equity estimates seen in some firms suggest something more is there. Moreover, customer-

related data and knowledge have been growing rapidly in recent years with the advent of Customer Relationship Management (CRM) systems able to track interactions with individual customers and provide recommendations, offers, and communications unique to each. The value from close customer relations and the attendant big data will only continue to increase in coming years.

Even without widely accepted measures, the IC community has not totally ignored relational capital and, especially, its link to brand equity. Similar to the case made with brand equity, relational capital has been shown to be enhanced by continuing positive interactions between the firm and customers (Chang & Tseng, 2005; de Castro, et al., 2004). With repeated interactions comes a better understanding in the firm of the individual customers, what they want, and how they can be satisfied. The perspective differs but some of the relationship capital literature acknowledges the customer engagement connection (Sussan, 2012; Stahle & Stahle, 2012). Although relational capital is a wider concept, including relationships with all "publics external" to the firm, IC scholars recognize its value as largely dependent on what we call brand equity in the other context (Gupta & Bhasin, 2014).

1.3 Digital Technologies

Into this environment, new possibilities based on innovative information and communication technologies (ICTs) have arisen. As we all know, digital technologies are ubiquitous and brands are increasingly employing them for communications (including two-way) and other interactions with customers. And, as noted above, users' feelings about a brand can be discerned, in part, from activity and comments on the firm's own digital media properties.

More formally, from the literature, ICTs provide complex networks of contributors, and, vitally, those users can often be individually identified (Lechman, 2017). User interactions, including social media, are one of the applications generating considerable data through ICTs (Kaplan & Heinlein, 2010), data and information related to and capable of becoming knowledge assets (Sigala & Chaikiti, 2014; Levy, 2009).

The link between basic data and information vs. more highly developed knowledge (or intellectual capital) has been long recognized, going back to the DIKW hierarchy (data, information, knowledge, wisdom) of Ackoff (1989) and others. The hierarchy suggests growth, that basic data eventually becomes more valuable wisdom after being subject to analysis. But in our current world of big data, data and information are now often seen as valuable assets in an of themselves. Though even more valuable if analyzed for deeper insights.

This view of data, information, knowledge, and wisdom (or intelligence) as all valuable intangible assets has gained some currency with a move away from the hierarchy. Without a ranking of the intangibles, each can be seen as different but still potentially useful and valuable, as in the Cynefin framework (Kurtz & Snowden, 2006). This actually squares well with traditional KM, where tacit and explicit knowledge are both valuable but have different characteristics and different levels of sharing potential. Further refinements of the intangibles range, from data/information to explicit knowledge to tacit knowledge to insights/intelligence (Rothberg & Erickson, 2017; Simard, 2014) cement this view. Knowledge assets have value but so do data/information. And, again, ICTs generate a lot of potentially interesting and useful data/information. Can that contribute to the intangible assets of the organization, to intellectual capital? Or even more specifically, can data/information shed light on relational capital and brand equity?

One particularly intriguing use of the new capabilities of both ICTs and data/information is digital media, especially in terms of brand equity and relational capital. While not capable of measuring knowledge in and of itself, the broader view of intangible assets does specifically evaluate intangible assets. If intellectual capital can be seen to include not only knowledge but also data, information or even intelligence, by extension so can relational capital. Digital media includes customer databases and customer relationship management (CRM) systems constantly taking in data concerning individually identified customers. That deep a relationship and understanding of customers will usually add considerable value to the organization and its competitiveness. Firms can also capture customer comments, including about brands, through formal channels or through social media. In the case of social media, commenters are often brutally honest about their feelings (Liu, et al., 2017; Royai, 2002). Consequently, unfiltered perceptions come through, providing a particularly useful perspective on brand equity (Rizun & Kucharska, 2018). Further, while all organizations monitor comments on their own digital properties, current technology also allows collecting postings about brands from virtually everywhere. That capability promises rich databases with potentially deep insights about brand equity and relational capital.

2. Methodology

This study takes advantage of some of those new digital media collection capabilities to take a look at selected brands in a specific tech industry. In this case, we analyzed smartphone providers, specifically the top five global brands: Apple iPhone, Samsung Galaxy, Xiaomi, Oppo, and Vivo. An earlier study was replicated in order to observe changes over time, so results presented here were gathered over two five-week periods, July 5 to August 9, 2021 followed by February 15 to March 21, 2022. Salesforce's Social Studio was used to gather the data, collecting weekly reports on each brand. The search terms were the main brand for Xiaomi, Oppo, and Vivo and the phone brands for Apple (iPhone) and Samsung (Galaxy). Apple and Samsung, otherwise, would have returned too many non-smartphone comments, including opinions on apples as a fruit.

Social Studio returns a variety of results. The volume of comments is included, providing an idea of the level of interest in the brand. Social Studio also assesses whether posts are positive toward the brand or negative, termed sentiment analysis. Sentiment analysis is based on a proprietary rubric assessing whether key words in text surrounding the brand is generally pro or generally con. Though not a perfect metric (sarcasm is dreadfully misclassified), sentiment analysis is relatively reliable over a large sample and consistent over time.

Social Studio also tracks the platform used for the comments, including Twitter, Facebook, YouTube, blogs, forum posts and replies, reviews, and others. Once again, the level of comments are reported, and individual posts can be captured (and studied with text analysis, if desired). The influence of top posters is also included. Based on a 0-100 scale, an influencer's degree of reach is measured. As a result, a brand with top influencers with high scores will see their comments have greater impact and reach more followers than those with low scores. Finally, Social Studio tracks the country of origin, when it can be determined, and language of the user, providing some idea of the geographic or cultural source of the comments.

The brands chosen, besides being from a tech industry that we know has high levels of intellectual capital based on previous studies (Erickson & Rothberg, 2012). Further, the two most-recognized brands in the US, Apple and Samsung, have brand valuations reported on both the Interbrand and Brandz lists discussed earlier, Apple at $200.7 billion and Samsung at $62.3 billion in 2021 Interbrand lists. In addition, Xiaomi shows up on the top Chinese brands Interbrand list, with a valuation of $8.3 billion.

3. Results and Discussion

Results are presented in Table 1 (earlier period) and Table 2 (later period). As indicated, these results include the average rating of the top 10 influencers, total volume, platform, sentiment, and language. Both the averages themselves and the range of the results below them, the latter showing the variability. Only the main platforms (Twitter, YouTube, forums/forum replies) are included as these were the top three for all the brands in almost all time periods. Languages were more varied and so show more options over time rather than a consistent, more limited number across all the brands.

Table 1: Smartphone Brands, Sentiment and Related Metrics (2021)

Metric		Apple iPhone	Samsung Galaxy	Xiaomi	Vivo	Oppo
Influencers		98	98	95	84	97
Volume		164K	299K	36K	17K	18K
(Range)		52K	355K	9K	16K	29K
Platform	Twitter	46.0%	44.6%	34.0%	15.1%	32.8%
	(Range)	6.2%	16.5%	21.2%	13.0%	25.6%
	YouTube	27.4%	42.1%	37.7%	79.5%	43.1%
	(Range)	4.0%	8.8%	15.8%	13.5%	34.7%
	Forum	10.5%	8.7%	26.7%	1.2%	16.0%
	(Range)	1.8%	5.0%	7.5%	0.7%	17.5%
Sentiment	Positive	77.3%	78.5%	83.5%	87.8%	84.2%
	(Range)	2.4%	35.6%	9.4%	10.3%	11.2%
	Negative	22.7%	21.5%	16.5%	12.2%	15.8%
Language	English	57.0%	52.5%	26.9%	65.2%	45.6%
	Japanese	10.4%		14.5%		
	Spanish	6.2%	6.0%	15.0%		8.4%
	Portuguese				5.7%	
	Indonesian		6.7%			

Metric		Apple iPhone	Samsung Galaxy	Xiaomi	Vivo	Oppo
	Hindi/Bengali				6.4%	
	Chinese					8.4%

In reviewing each indicator, we'll look at both periods and then any changes across them . For the earlier period, the average rating for the top influencers at Apple (98), Samsung (98), Xiaomi (97), and Oppo (91) are all very high, indicating substantial reach for their most engaged posters, generally a positive for a brand. The average for Vivo (79) is a little lower, showing a difference, but still relatively high. For the later period, the pattern is very similar. All the brands except Vivo (84) are at least above a 95 average ranking. The brands all consistently have highly ranked top influencers, slightly higher for the most valuable brands.

Volume of digital media activity, of course, is a very important indicator of engagement with a brand. In the earlier period, posting volume shows the clearest difference between the brands, ranging from very high at Samsung (259K per week, on average) down to 15K per week at Vivo and 7K at Oppo. Of considerable interest and replicating previous research using this methodology, the variability of these results also varies sharply. Apple and Samsung both have a ranges only a fraction of average volume while the others have ranges close to their average values (and so are much more variable/less consistent on a relative basis). For the later period, both Apple and Samsung are even higher, Samsung reaching an average of almost 300K per week. Xiaomi is noticeably lower. Once again, range is also noticeably different with Apple and Xiaomi varying only a fraction of their average value. Samsung changed quite a lot in its volume and, especially, in the range but much of that was due to a single week when volume hit 550K. Otherwise, volume was more tightly bunched, as in the previous period. The outlier demonstrates an important capability of the methodology, to spot one-off readings and to be able to explore in more detail (e.g. new product launch, promotional event, adverse publicity?). The comments the software also gathers could be studied in more detail to determine what circumstances are impacting the brand's metrics, particularly given evidence of a dramatic shift.

Table 2: Smartphone Brands, Sentiment and Related Results (2022)

Metric		Apple iPhone	Samsung Galaxy	Xiaomi	Vivo	Oppo
Influencers		98	98	97	79	91
Volume		259 K	259K	90K	15K	6.9K
(Range)		151K	119K	71K	15K	5.1K
Source	Twitter	65.0%	55.6%	47.3%	19.0%	41.6%
	(Range)	5.9%	28.3%	21.7%	27.9%	27.2%
	YouTube	21.8%	33.3%	28.1%	67.5%	26.4%
	(Range)	4.6%	22.2%	13.9%	21.7%	7.9%
	Forum	6.9%	5.0%	19.6%	1.1%	16.1%
	(Range)	1.2%	3.0%	8.2%	.8%	9.7%
Sentiment	Positive	77.1%	88.9%	81.4%	87.3%	88.1%
	(Range)	12.6%	7.7%	15.1%	16.3%	12.5%
	Negative	22.9%	11.1%	18.6%	12.7%	11.9%
Language	English	40.3%	57.9%	24.1%	72.2%	32.0%
	Japanese	16.2%		14.8%		36.9%
	Spanish			10.9%		3.7%
	Portuguese		3.6%		4.2%	
	Indonesian		5.3%			
	Hindi/Bengali				8.0%	
	Arabic	16.1%				

The social media platform metrics include Twitter (social chatter), YouTube (video), and forums (more engaged discussion). In the earlier period, the dominant platform is Twitter, with a plurality of activity for all the brands except Vivo. For Vivo, YouTube is substantially more active. Xiaomi and Oppo show uniquely higher results in the forums. The later metrics are generally similar though Twitter's influence declines except for Apple and Samsung while YouTube is more prominent for all the brands except Apple. Xiaomi and Oppo again have noticeably higher use of forums. What does this mean? On the surface, the high-value brands with devoted fans (Apple vs. Samsung) continue to have spirited debates on Twitter. Given the nature of Twitter, those probably aren't conducted with any real depth to the discussion though that could be explored. The YouTube activity is likely to have more to do with videos, making videos, what product is used for making videos, and so forth, in some ways a more use-oriented exchange ("shot on iPhone 13"). And the forums offer opportunities

for more in-depth discussions, beyond the simplest aspects of brand image. The patterns are again largely stable over time, and the methodology would allow deeper looks into the exact exchanges on these platforms, both their nature and their depth.

Sentiment might be the key indicator in terms of brand value. As noted above, the software assesses the context and language of the posting, rating it positive or negative regarding the language surrounding the search term. So when the tweet, for example, mentions the Apple iPhone, is it a positive comment or a negative one? The early results are quite interesting as all of the brands have positive ratings in the 80% range, often the high end of the range, except for Apple—the most valuable brand in the world. Apple comes in noticeably lower than the others. The later ratings confirm the general theme but with the addition of Samsung as a second major brand with relatively lower positivity. Even more interesting are the ranges. While Apple has lower positives, it also has a much more stable sentiment in the early period (as does Samsung, but not to the same degree). The latter period shows relatively similar and stable sentiments for all of the brands, again with the important exception of Samsung. But, as already established, there is a blip in the metrics for Samsung in the later period which may also impact the sentiment results. Beyond the blip, the higher rated brands tend to be noticeably more stable in the sentiment ratings, in a given measure and over time.

One important aspect of sentiment is its connection to volume. While Apple's positive sentiment percentage is lower than the other brands (as is Samsung's in the later period), that is a percentage of a much large volume. So Apple's 77% of 259K posts equates to almost 200K positive comments in the more recent data. Compare that to Vivo. Vivo had 87.8% positive sentiment, but that comes from a volume of only 17K, roughly 15K positive comments. So even with the lower percentage, Apple's positive sentiment numbers actually dwarf the smaller brand's (200K vs. 15K).

Finally, the language results provide some sense of where the brands have resonance. The Social Studio software also tracks location, but that metric has quite a number of incomplete readings. Language is the fuller data set and location can often be inferred (Portuguese and Brazil, English and the US/UK/more widely, etc.). In the earlier period, English is dominant for Apple, Samsung, and Vivo. English is also prominent for Xiaomi and Oppo but their language results are far more variable and represent considerably more languages/locations. These patterns are also reflected in the later period results though Apple's English percentage is lower and Chinese noticeably higher. The later period also shows considerable change in Oppo's geographic areas of strength as the Japanese numbers fall off sharply while the Chinese are higher. There are some consistencies for both periods in pockets of data for some of the brands (Vivo in India and Brazil, Samsung in Indonesia, Apple in the Middle East). Add it all together and an interesting picture emerges of brands aimed at the US and European markets against those with much wider targets. As with some of the earlier metrics, noticeably different results (e.g. a steep rise in Indonesian postings) could be easily explored for details on what might be driving the outcomes.

4. Conclusions

The objective of this study was to explore how alternative metrics can shed light on knowledge asset values, particularly assets like relational capital lacking widely accepted existing methods. Once we identify, through multiple studies, what results and patterns we associate with high-equity brands, we can more reliably start to apply such relational capital metrics.

Here, the brands known to have really high (Apple, Samsung), high (Xiaomi), and lower (Vivo, Oppo) brand equity can be compared and contrasted. Brand equity appears to correlated with consistently high volume on digital platforms over time. Surprisingly, higher brand equity is not associated with positive sentiment percentages (though raw numbers are high simply because of the massive volume) but do tend to be much more stable over time. The less highly rated brands are considerably more variable over time in terms of volume, sentiment, and, sometimes, platforms. Language and location can also vary but a consistent pattern is less obvious.

The methodology also allows deeper, more qualitative analysis of the comments behind the volume, sentiments, and overall discussion. Consequently, when blips do appear in the relatively consistent brand metrics over time, they can be investigated, allowing ever deeper understanding of what really influences brand value and relational capital. If so, relational capital can not only be more readily measured but the influences on relational capital, what makes it change, can also be better understood.

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From Knowledge Management to Career Management and Related Concepts: Conceptual Model

Rafael Ferreira, Paula Peres and Ana Cláudia Rodrigues
School of Accounting and Administration of Porto (ISCAP), Porto, Portugal
rafael.torres.ferreira@gmail.com
pperes@iscap.ipp.pt
anarodrigues@iscap.ipp.pt

Abstract: Knowledge is a crucial factor for organizations' competitiveness in today's labour market and, through knowledge management, Human Resources Management (HRM) can be more useful and effective. For several reasons, Career Management is one of the HRM categories less structured and cared for by organizations. However, having information for the proper management of employees' careers is relevant and considered of high importance, given the impact it has on the development and retention of employees. The employees' development includes increased knowledge, skills and abilities by each individual, which boosts the progression of his career. Managing knowledge from a perspective that accommodates career management seems to be structural for both organizations and their employees. Based on this premise, this article reviews the literature articulating five concepts: two from the knowledge theoretical field, such as Knowledge Management and Organizational Memory, and three from the HRM field, facing the topics of Talent Management, Career Management and People Analytics. The five concepts are explored, as are the relationships between them. The aim of this article translates into the interrelational description of the five concepts, to understand their common aspects and, thus, expand the approaches to Career Management. The concepts were linked in pairs, due to the absence of literature that addresses the five concepts simultaneously. The theoretical analysis allowed the construction of a conceptual model, which enables understanding of the conceptual convergences and divergences in the organizational and personal ecosystem, supported by local and global knowledge. The model presented will be useful to guide organizations in creating broad Knowledge Management systems, focusing on the people, thus enhancing their management and development. At the same time, it will also be useful for all employees since the model presented aims to contribute to the capitalization of their potential and personal achievement capacity within the organization. Future research may empirically validate the pertinence and applicability of this conceptual model.

Keywords: Knowledge Management; Human Resources Management; Career Management; Conceptual model

1. Introduction

Knowledge generated in an organization during its existence is a crucial factor for maintaining competitiveness in the labour market. Thus, organizations should seek strategies that enable effective management of the existing knowledge (Barros, Ramos and Perez, 2015). Therefore, the concepts of Knowledge Management (KM) and Organizational Memory (OM) arise, which are directly connected, since OM constitutes a considerable fraction of the KM (Sudharatna, 2015).

KM interrelates with the Human Resources Management (HRM) activities (Wahjosoedibjo, 2009). In this article, some of these activities will be explored, particularly Talent Management (TM), Career Management (CM) and People Analytics (PA), along with the existing relationships with KM.

The purpose of this article is the interrelational description of these five concepts, identifying their similarities and presenting them in a conceptual model that aims to help organizations develop KM systems focused on Human Resources (HR), benefiting them and their organizations.

2. Knowledge Management

Knowledge can be based on information that is found in data. Knowledge distinguishes from data, since data is characterized as a property of things, while knowledge corresponds to a property of individuals. Knowledge also differentiates from information, since it is impossible to observe directly and its existence is inferred through the individuals' actions (Boisot, 1999).

Knowledge Management (KM) can be described as the objective of management that conceives, designs and manages the idea of knowledge, being used for the long-term benefits of organizations (Darroch and McNaughton, 2002). Consists of a systematic and integrated approach to identifying, managing and sharing all

organizations' assets, including databases, procedures and document policies, together with previously unpronounced experience and expertise that employees hold (Barron, 2000).

KM focuses on achieving a given result rather than worrying about how that result is achieved. It translates into a structure within which organizations perceive all processes as knowledge assets (Paramasivan, 2003). It lists any intentional set of practices and processes created to optimize the use of knowledge, namely to increase the efficiency of production, distribution and use areas of knowledge (Young, 2013).

KM can be perceived as a policy of providing the right knowledge to the right people, in due time, to stimulate in these individuals a culture of knowledge sharing, along with putting that knowledge into practice to try expanding organizational performance (O'Dell and Grayson, 1998; Tayal, Coleman and Li, 2015). KM intends to explore information from organizations to increase productivity, new value, greater competitiveness and incentive to exchange knowledge (Davies, 2000).

There are four fundamental processes in KM, namely knowledge creation/acquisition, knowledge storage/retrieval, knowledge sharing/transfer and knowledge application (Alavi and Leidner, 2001; Kayworth and Leidner, 2003; Zaim, 2006; Fong and Choi, 2009; Turner, Zimmerman and Allen, 2012).

KM needs the help of Organizational Memory (OM) to make the process more integrated and sophisticated (Lestari, Muhdaliha and Putra, 2020). Competent management of the OM will influence the effectiveness of KM in organizations. OM is a significant portion of KM integrating its four processes (Sudharatna, 2015).

There is a direct relationship between KM and OM, since KM provides the dissemination, explicitness and storage of knowledge, while OM dedicates to the creation and maintenance of knowledge (Freire *et al.*, 2012). Therefore, it is pertinent to address the concept of OM.

2.1 Organizational Memory

Knowledge formed in organizations over time is one of the main factors to remain competitive in the labour market and, thus, organizations must be aware and seek strategies that allow preserving the accumulated knowledge. Knowledge preserved in organizations during their "lives" is called Organizational Memory (OM) (Barros, Ramos and Perez, 2015). OM is stored information (Walsh and Ungson, 1991; Guercini, 2012) that comes from organizations' history (Walsh and Ungson, 1991) and the individuals' interaction and history who constitute it (Guercini, 2012). Can be used to aid current decisions, activities and behaviours (Walsh and Ungson, 1991; Stein and Zwass, 1995; Guercini, 2012), resulting in more or less high levels of organizational effectiveness (Stein and Zwass, 1995). OM is perceived as a method of acquisition, retention, recovery and access to experience, skills and know-how for organizational purposes (Walsh and Ungson, 1991; Hatami, Galliers and Huang, 2003). Day (as cited in Li, Zhuang and ZhongYing, 2006) states that OM associates with a repository of collective perceptions in policies, procedures and routines that can be recovered when necessary. OM is a network structure composed of individuals, artefacts, processes and interconnected experiences that establish the contents and knowledge structure, which have been stored over time and are grouped according to organizational needs (Freire *et al.*, 2012). For OM to be useful, organizations must guide their strategies towards establishing a conducive environment to share relevant knowledge, ideas, information and experiences among employees (Barros, Ramos and Perez, 2015).

OM is created and preserved on a technological structure subject to constant update, requesting new requirements and actions favouring a processes' architecture flexible to change. Thus, an organizational culture with rational, interdisciplinary and standardized capacity for action becomes fundamental (Damian and Cabero, 2020).

OM provides support to the individual and organization's development. For the individual, through the combination of knowledge and learning with the organization's experiences and actions over time. For the organization, from the use of accumulated knowledge that helps in the decisions to be made, along with the development of new solutions (Barros, Ramos and Perez, 2015).

3. Talent Management

Talented individuals are people who manage to make a difference, demonstrating their natural potential in the current and future organization's performance. Organizational talent is unique and influenced by several factors

such as industry, organization nature, organization members and group level implication (Chartered Institute of Personnel and Development, 2007). Three thought currents related to Talent Management (TM) were identified. The first current consists of labelling regular Human Resources Management (HRM) practices as TM, with a few differences, greater speed or globality in organizations. The second current focuses on the concept of talent pools and considers TM as a process to ensure an adequate flow of employees throughout the organization. The third current centres on talent, without any consideration for specific positions or organizational boundaries (Lewis and Heckman, 2006).

TM is the process from which organizations' employers anticipate and meet human capital needs (Cappelli, 2008b). In contrast, the author criticizes that TM should be intended primarily to meet these human capital needs. Therefore, should focus on assisting the organizations' overall goal, generate profit (Cappelli, 2008a).

TM involves all HRM processes, with emphasis on attracting, developing and retaining talent (Lewis and Heckman, 2006; B. Davies and B.J. Davies, 2010).

The importance of TM is due to the employees' involvement, who believe in its relevance to inclusion in organizations (Hughes and Rog, 2008). A well-planned TM strategy can enable the overcoming of organizational obstacles, together with propelling the success (Rowland, 2011).

Thus, designing and offering a convincing value proposition to employees, personalized career plans, competitive compensation and healthy work-life balance are elements of a successful TM (Stahl *et al.*, 2007).

4. Career Management

A career is considered a sequence of positions, jobs, activities (planned or not), attitudes and behaviours, related to work experiences and tasks, that an individual performs throughout his life cycle, involving elements of progression, commitment and personal development (Super and Hall, 1978; Clark, 1992; Hall, 2002).

Career Management (CM) consists of the dynamic process in which individuals gather information about their tastes, dislikes, strengths, weaknesses and the labour market, develop achievable objectives, develop and implement strategies to meet the objectives and seek to obtain feedback, to enhance decision-making (Greenhaus and Callanan, 1994). Additionally, this process should include a monitoring stage for the previously defined career objectives and strategies (Greenhaus, Callanan and Godshalk, 2000).

Recently, CM was defined as the process that helps understand the organization's employees' career opportunities, along with outlining a professional path within the organization (Kasemsap, 2017).

CM is vital for an organization to achieve strategic objectives and for employees to link to a sense of purpose and motivation. If these needs are not met, consequences will occur, such as turnover, decreased individual and organizational performances and a decline in the employees' skills (Clark, 1992).

Employees, managers and organizations have separate roles that they must play in a CM system. Employees are responsible for self-evaluating, creating plans in the organizational reality context and conducting development activities. Managers should support employees in understanding organizational needs and requirements. Organizations are responsible for providing resources and structures needed to help the process (Gutteridge, Shore and Leibowitz, 1993).

5. People Analytics

The current society, more digitized, has an interest in the vast amount of data and analytical techniques (Raguseo, 2018). Understanding and developing organizations' HR is an essential part of this trend (Sullivan, 2013; M. Edwards and K. Edwards, 2016). Extensive use of data, statistical and quantitative analysis, explanatory and predictive models and fact-based management to drive actions and decisions is called Data Analytics (Davenport and Harris, 2007). Since data is ubiquitous in organizations, it can help employees make agile and accurate decisions, and the science behind Data Analytics about people is called People Analytics (PA) (Bishnoi and Poonam, 2020).

PA concerns the method of analysis that can facilitate executive managers' decision-making about employees (Cornerstone, 2018). It has a varied choice of data collection types associated with people and productivity's financial ratios, individuals' values measurement, employees involvement degree, HR processes effectiveness and efficiency measurement, competencies measurement, among others (Mayo, 2006).

A typical PA model has five steps to help construct a people analytical approach for any organization (Tursunbayeva, Lauro and Pagliari, 2018). The first step is tracking data, which includes extracting data from numeric, textual, audio, video or image resources. Data is transformed into useful information, which will be loaded and merged with other sources. Later, data is stored in a database. This step includes supervising live data in the contemporary environment. The second step is analysing, which includes using Business Intelligence (BI) tools such as Power BI and data mining to analyse substantial amounts of data. The third step is modelling, which involves formulating a model that can make predictions and optimization through advanced analytical tools. The fourth step is equivalent to deciding on existing or recently developed models to assist in decision-making about repetitive processes. The fifth stage is the action, which is decision guided, according to the specific organization (Tursunbayeva, Lauro and Pagliari, 2018).

Stipulating the relationship between what people do and organizational outcomes and, subsequently, designing strategies based on this information is the primary purpose of PA (Tursunbayeva, Lauro and Pagliari, 2018).

6. Theoretical model (relations between concepts)

6.1 Relation between Knowledge Management and Talent Management

Competency Management, TM, Human Resources Development, KM and other Human Resources Management (HRM) activities are interrelated concepts (Wahjosoedibjo, 2009).

TM's principle can favour and improve KM in organizations (Whelan and Carcary, 2011). Knowledge is understood as a considerable organizational asset and has been perceived as a source of competitive tools (Kiessling and Harvey, 2006). Most competitive advantages have a tacit nature, implied in people's actions and experiences, which makes it difficult to imitate or even formalize and share in organizations. Consequently, to whom the TM process is entrusted, it is necessary to recruit individuals with tacit knowledge and experience, invest in their training and development and retain them in the organization (Mcdonnell, Gunnigle and Lavelle, 2010).

Chartered Institute of Personnel and Development (as cited in Poorhosseinzadeh and Subramaniam, 2013) found that organizations are strengthening their focus on TM to create, disseminate and retain knowledge. Therefore, organizations will have a better understanding of the interaction between TM and KM, which will lead to a more effective TM (Whelan and Carcary, 2011).

6.2 Relation between Knowledge Management and Career Management

CM is the personal and organizational responsibility for the professional evolution of employees, by increasing their knowledge bases and providing them with a progression in the organizations' hierarchy. The nature's change of work, directed to knowledge, resulted in a transition in careers' design and management, together with new approaches' evolution of CM at the individual and organizational level (Baruch, 2006).

Employees perceived as valuable are, consequently, developed more proactively by organizations (Hirsh, 2006). This process often includes a more active organizational role in planning and facilitating career changes for individuals. In contrast, knowledge workers have the primary responsibility to develop their own careers (Baruch, 2006). Organizations encourage employees to develop careers through personal choices, providing them with flexibility and opportunities to improve individual learning skills, to conceive and share knowledge in organizations (Gope, Elia and Passiante, 2018).

Besides the diversity of CM strategies, a variety of career paths may emerge at the individual level, while KM becomes progressively more relevant for HRM and, more specifically, CM (Iles, Yolles and Altman, 2001).

6.3 Relation between Knowledge Management and People Analytics

PA is associated with HR practices, since it allows to evaluate the relationship between these practices and organizational outcomes, concerning attrition rates, turnover rates, customer satisfaction rates and profit

(Lawler, Levenson and Boudreau, 2004; Boudreau and Ramstad, 2006). HRM activities are linked to KM (Wahjosoedibjo, 2009). Consequently, the relation between KM and PA becomes evident.

Although KM practices generate knowledge effectively with the help of analysis techniques (Shabbir and Gardezi, 2020), there is a shortage of literature regarding the connection between the concepts of PA and KM.

6.4 Relation between Career Management and Talent Management

CM is one of the biggest challenges HRM can currently face, due to the changes taking place in the world at economic and technological levels. These changes have provided increasing complexity in modern careers and TM is closely related to CM (Milhazes, Ribeiro and Gomes, 2021).

The development and management of the progression of employees with potential, through various functions, govern the concept of TM. It is the organization's responsibility, on a global scale, to attract, select, develop and retain key talents, so that they are aligned with the organizational strategy priorities (Ribeiro and Gomes, 2017). This TM is criticized, since it becomes impossible for some organizations to take advantage of their assets without knowing the employees, along with their characteristics and specificities. Thus, TM is directly linked to all HRM practices, including CM (Collings, Scullion and Vaiman, 2011, 2015; Sanchez and Levine, 2012; Ribeiro and Gomes, 2016, 2017).

6.5 Relation between Career Management and People Analytics

Organizations that apply analytics in career building begin by using HR data to trace trajectories that individuals have followed in the past. Since conventional careers, based on the hierarchical organization chart, have faded, organizations begin to analyse the numerous ways in which individuals evolved, to highlight the paths options available to employees. This career mapping, in the most elementary way, uses historical data to display what previous employees of a certain function have done, enabling individuals who are currently in this role to visualize the set of plausible options for the next steps, regarding career changes. In other cases, organizations identify the positions that sustained a particular function, to reveal the diversity of paths that employees can follow, to reach the position they aspire to. Regardless, analytics is being used to discover options, in favour of individuals' advancement and growth, which are not detected by formal organization charts, but instead by the employees' and managers' decentralized decisions, building careers within the organization (Bidwell and Stefano, 2019).

6.6 Relation between Talent Management and People Analytics

With the exponential development of technology and the existence of an enormous amount of data about people, the use of analytical tools in HR functions has become a reality, to improve the performance of these functions, namely to boost their role in organizations through PA (Canais, 2016).

PA uses data to provide introspections to organizations' management in decision-making about acquisition, placement, promotion, compensation and retention of talent (Walford-Wright and Scott-Jackson, 2018). PA is emerging as a tool of TM, to offer organizations' managers a way to manage talent. The use of analytics modernizes TM's traditional decision-making, which is based on experience and intuition. Today's digital leaders understand technology differently, i.e. they see it as something that enables them to see through the problem, directly to the solutions, and that data can help them to be more effective (McQuivey, 2013).

6.7 Conceptual model

A conceptual model (Figure 1) was constructed based on numerous keywords selected from the concepts explored previously.

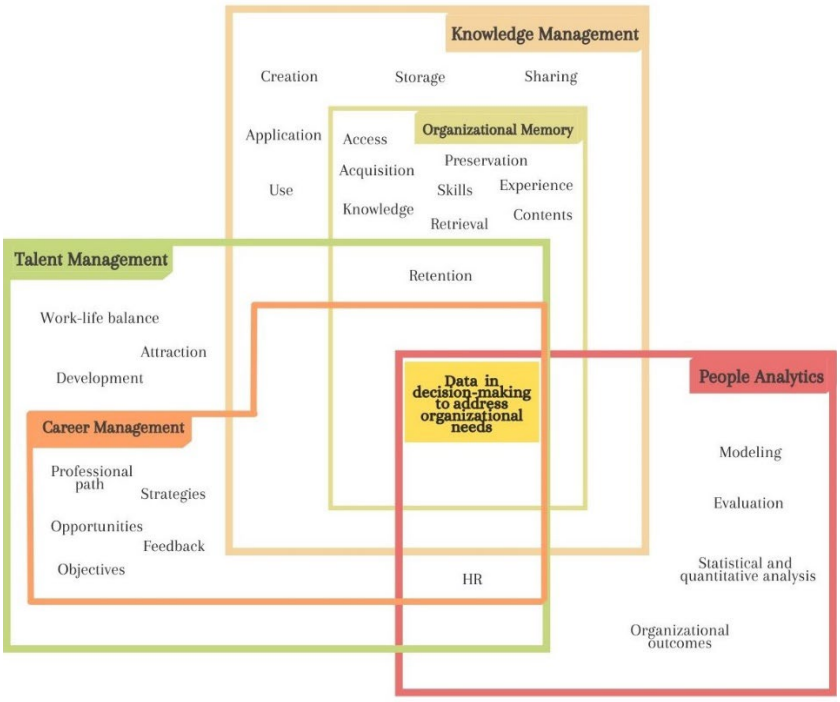


Figure 1: Conceptual model

The common ground for all these concepts is the use of data to facilitate decision-making according to the organization's needs. Through knowledge, individuals or statistical and quantitative analysis, these five concepts intend to assist the organization's management to make consistently more effective decisions, always aiming to address organizational needs and purposes.

Since Organizational Memory (OM) consists in a substantial portion of Knowledge Management (KM) (Sudharatna, 2015), the shared terms of these concepts appear in the OM section, them being "Knowledge" and "Retrieval". Both concepts seek to preserve the existing organizational knowledge, considering that knowledge was become a major asset in creating competitive advantages.

The term "Retention" arises from the relationship between OM and Talent Management (TM), seeing that both look to retain assets in the organizations. The one difference is that OM focus mainly on knowledge (Walsh and Ungson, 1991; Hatami, Galliers and Huang, 2003), while TM concentrates on individuals (Lewis and Heckman, 2006; B. Davies and B.J. Davies, 2010).

TM, Career Management (CM) and People Analytics (PA) share the term "HR", given that these concepts are embedded in Human Resources Management (HRM), which spotlights the individuals of an organization, providing them with the tools and conditions to develop their skills and contribute to the organization's success.

7. Conclusions

In the concepts addressed during this article, it is possible to identify the premise that translates into the need to attract, manage, develop and retain individuals (and their knowledge) who have organization value (Lewis and Heckman, 2006; B. Davies and B.J. Davies, 2010), to achieve the strategic results, facilitate decision-making and, consequently, generate profit, long-term benefits and increase the competitiveness of organizations, in order to thrive in the labour market.

Career Management (CM), Talent Management (TM) and People Analytics (PA) are encompassed in the Human Resources Management (HRM) area and, according to Wahjosoedibjo (2009), KM is directly related to HRM. KM can specifically favour and improve TM (Whelan and Carcary, 2011). There is also an evident relation between

KM and OM (Freire *et al.*, 2012). Thus, a connection between all these concepts exists, which allows ensuring new opportunities and challenges for organizations that invest in these processes to help achieve organizational and personal objectives, contributing to organizational development.

One final highlight about these concepts consists of a common goal, which is to stimulate a sense of belonging in the individuals and promote a sharing culture in organizations (O'Dell and Grayson, 1998; Tayal, Coleman and Li, 2015). This requires having a purpose, motivation, increased and improved skills, efficiency and effectiveness in organizational processes and, also, recognition and development of valuable employees' potential to organizations.

The conceptual model was designed to demonstrate the relationships between the five concepts and, consequently, the knowledge and HR fields, making it easier for organizations and their employees to recognize advantages and opportunities in developing KM systems that are people-centred, specifically exploring approaches to Career Management and aiming to create new competitive advantages in a labour market that already considers knowledge as an indispensable asset.

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Threats to Future Knowledge: The Impact of the Pandemic on Organisational Recordkeeping

Fiorella Foscarini[1], Ragna Kemp Haraldsdottir[2], Seren Wendelken[3], Charles Jeurgens[4], Yu Jing Tey[1], Gillian Oliver[3] and Viviane Hessami[3]
[1]University of Toronto, Toronto, Canada
[2]University of Iceland, Reykjavík, Iceland
[3]Monash University, Melbourne, Australia
[4]University of Amsterdam, Amsterdam, The Netherlands
fiorella.foscarini@utoronto.ca
rh@hi.is
seren.wendelken@monash.edu
K.J.P.F.M.Jeurgens@uva.nl
jing.tey@mail.utoronto.ca
gillian.oliver@monash.edu
viviane.hessami@monash.edu

Abstract: This paper reports the outcomes from the first phase of an international research project investigating the impact of the COVID-19 pandemic on organisational recordkeeping. Recordkeeping is a critical component of organisational knowledge management, as the making and keeping of records as evidence of organisational activities and transactions enables core memory and accountability functions over time. Working from home during the pandemic has disrupted routines of records creation, storage, and management, and will likely result in substantial black holes in future knowledge. The objective of the first phase of our study was to find out what records-related initiatives were underway in academic settings and in archival institutions in the initial stages of this global crisis. We conducted an environmental scan, which showed that much attention was being paid to documenting the pandemic (e.g., collecting and preserving social media discussion, promoting the use of diaries by citizens); however, the provision of advice and standards for organisational recordkeeping at a time when regular access to organisational systems could not be guaranteed was largely missing. In the second phase, we designed a survey aimed at capturing the experiences of recordkeeping professionals who worked from home for varying lengths of time in Europe, North America, and Australasia. It is expected that this comparative study will help us envision a "new normal" for the time when the current health emergency is over. This paper concludes with a discussion of how our environmental scan and literature review have informed the multilingual survey that is currently underway.

Keywords: Archival studies, COVID-19, Comparative study, New normal, Organizational knowledge management, Records management

1. Introduction

The purpose of recordkeeping is to ensure that evidence of organisational activities and transactions is created, captured, kept for as long as necessary, but not retained when no longer required. Recordkeeping is, therefore, a critical aspect of organisational knowledge management, which includes consideration of how records as "persistent representations of activities" (Yeo, 2007) contribute to sense making, decision making, and knowledge creation (Choo, 2006). Records are regarded as authoritative evidence of what happened, and thus recordkeeping is essential to ensuring accountability and demonstrating transparency. The global COVID-19 pandemic caused unimagined disruption to workplaces, with employees often having to work from home, meetings being conducted online, and many ad hoc processes and workarounds developed to accomplish tasks dependent on organisational virtual and physical infrastructures. All this has affected the routine of recording, managing, and storing evidence of business transactions, and may hinder knowledge accumulation, distribution, and transformation.

The purpose of this paper is to discuss the initial findings of an international research project currently underway to investigate the impact of working from home during the pandemic on the processes of creating and managing records within organisations, and to raise awareness of the potential future consequences for memory and accountability. A recent study investigating the main challenges faced by archival education in the context of North American graduate archival programs highlighted the importance of conducting further research into how COVID-19 will change professional work, how the "new normal" will look like, and how this will affect archival

education (Poole and Todd-Diaz, 2022). In line with this observation, we are interested in the opportunities and challenges that await recordkeeping professionals, based on the forced experience in which everyone has been pushed to the online environment more than ever before. With that in mind, we planned to first examine how records professionals and archival institutions – which are, in most countries, responsible for the provision of advice and guidance on recordkeeping to organisations – responded to the pandemic, and which initiatives were taken to safeguard recordkeeping values during the pandemic, when people had to work from home on a large scale.

The paper begins by explaining the disciplinary context of recordkeeping and the theoretical context which informs this research project. This is followed by an explanation of the two phases of the project, namely an environmental scan followed by an online survey of records professionals. The next part consists of findings from the first phase, showing how these findings guided the development of the online survey. The discussion considers impacts and possible consequences on organisational recordkeeping, and the paper concludes with an indication of the next steps and practical applications of our study.

2. Recordkeeping

For thousands of years, human beings have been relying on various forms of recollection of what was said or done at earlier moments (from marks on rocks and knotted cords, to written texts and images). With more sophisticated methods of recording and more complex societies, the reliable creation, exchange, and preservation of trustworthy information became a necessity (Yeo, 2018). Recordkeeping hence emerged as a set of concepts and techniques, but also tools, systems, and technologies, that would allow people to capture, organise, store, select, dispose, access, and use the evidence of their activities for a variety of purposes. The 20th century saw the elaboration and consolidation of Western models and methods for the management of records throughout their life cycle (e.g., Brenneke, 1953; Schellenberg, 1956; Jenkinson, 1957; Cencetti, 1970), that is, from the moment of their creation as by-products and instruments of practical activities to their "archivalization", i.e., "the process of selecting records for retention in an archive" (SAA, n.d.). In the 1990s, a new conceptualization of records, the "records continuum model" (McKemmish and Piggott 1994; Upward 1996), made its appearance, and later became the foundation of a new, holistic and dynamic understanding of recordkeeping, much more attuned to the needs of digital records, known as "recordkeeping informatics" (Upward et al. 2018).

The international records management and archival community agrees that today's disruptive technologies and the interconnected work processes that rely on those technologies require a radical rethinking of what constitutes a record and how organisations can remain accountable when nothing appears to be fixed and stable around them. The international standard for records management ISO 15489 (ISO 15489-1, 2016) builds on the notion of the records continuum and of recordkeeping as a comprehensive enterprise. With its emphasis on the idea that every organisational actor has some recordkeeping responsibility, and that each entity has to decide what they accord record status to, ISO 15489 defines records as "authoritative evidence of business events or transactions" having authenticity, reliability, integrity, and usability as key characteristics. In order to manage records as records, recordkeeping professionals (e.g. archivists, records managers, information officers, documentation specialists) apply methods, such as records classification, appraisal for records retention and disposition, archival arrangement and description, which all rely on the creation and management of metadata (ISO 23081-1, 2017). The international standard insists that metadata for records is essential "to indicate and preserve context and apply appropriate rules for managing records" (ISO 15489-1, 2016).

In our research, we recognize that the complexity of this networked age, where records come in all forms and media, may last for a nano second, and reside in multiple spaces at the same time, calls for an approach to recordkeeping that takes into consideration not only what may exist as official, formal record of business activities, but also any workarounds and local, "stabilized-for-now" practices that attest to how individuals, organisations, and machines process information and knowledge (Oliver and Foscarini, 2020). In other words, following recordkeeping informatics ideas, we understand recordkeeping as a basis for an organisation's accountability framework, and conceive the latter not as a static, taken-for-granted structure, but as an always negotiated social and ideological construct that shapes and is shaped by all kinds of evidence of our "acting together" (Foscarini, 2014).

COVID-19 has accelerated and complicated many of the information-related processes and attitudes that were already in place in most organisations before the pandemic (Oliver et al., 2021). Electronic management of born-digital records, digitization of physical resources, use of cloud computing for online collaboration and virtual networking, remote access to organisational information systems, these are just some of the recordkeeping practices that, in the first quarter of 2020, suddenly became an unavoidable necessity for everyone. As in any emergency situation, there was no time to plan the move from in-person to online, and some workplaces were better prepared than others to adapt to this change. Some may have surrendered to chaos; others have likely developed new policies or updated existing ones to deal with the unusual circumstances; others again may have sought advice from their local archival authorities. In most countries, national or regional archival institutions are responsible for providing guidance on how to manage records, and in some cases, also to inspect that recordkeeping laws and regulations are properly followed (Oliver et. al., 2021).

Two years after our world has been turned upside down by this unpredictable event, we still do not know what impact the pandemic has had on organisational accountability frameworks, the recordkeeping systems supporting such frameworks, and the future knowledge of our activities and transactions which relies on those systems (Choo, 2006). In the next section, we describe our overall research objectives and the methods used to operationalize them.

3. Research Design

To address our overarching research question – i.e., how has the COVID-19 pandemic impacted organisational recordkeeping? – we decided to start with a review of existing initiatives (e.g., surveys, academic papers, industry reports) focusing on changes to work practices – particularly those directly or indirectly relevant to the management of records and archives – during the initial stages of this global emergency. Our environmental scan took place in the summer of 2021 and included materials published in English between March 2020 and July 2021. The questions guiding this first phase of our study, were:

- What inquiries have been or are being conducted to find out how the pandemic has impacted work practices?
- Are there any ongoing or closed surveys looking at records and archives management during the pandemic?
- What kinds of guidance (if any) have national or local archival institutions been providing to support recordkeeping during the pandemic?

The materials identified as of interest to the project (27 sources overall) were organised using the following categories: Field/Discipline; Survey included (Yes/No); Source and scope of study; Document type; From records management/archival sectors (Yes/No).

The most relevant sources (nine from records management/archival sectors, and nine from other sectors, including psychology, education, and corporate consulting) were described in an annotated bibliography, and used as a basis for the second phase of our study. As explained in the next sections, the results of our environmental scan were rather disappointing. Most archival authorities did not show much concern about the fact that the usual and ordinary course of business was being profoundly altered by the pandemic, and this would have consequences for the records created. Thus, we thought we should learn more about the kinds of work arrangements that organisations or individual employees enacted or put up with during these unusual circumstances. This brought us to design our own survey, entitled "Records Management and COVID-19: Towards a 'new normal'," which, at the time of writing this article, is being administered to recordkeeping professionals in Europe, North America, and Australasia.

Questions in our survey revolve around the respondents' experiences working with organisational records and systems from home in comparison to their pre-pandemic experiences. The findings will help us answer the overarching research question mentioned above, identify any lessons learned from the pandemic approach to recordkeeping, as well as imagine new ways of managing authoritative information resources in distributed work environments.

The survey was developed in English, and then translated into Dutch, French, Icelandic, and Italian by members of the research team, who also obtained ethics approval by their respective universities. We have been using Qualtrics (www.qualtrics.com) as a platform for this multilingual survey, which is administered by the Institute

of Social Science at the University of Iceland. The survey is designed to take a comparative look at the experiences of information professionals in Iceland, the Netherlands, Italy, Canada and New Zealand. The analysis and discussion of this survey's results might suggest that we extend the survey to other countries (and languages). Furthermore, we plan to conduct in-depth interviews with survey respondents who may have expressed an interest in participating in a follow-up study.

4. Phase One – Findings

4.1 Documenting COVID-19

In this section we briefly discuss selected articles, policy documents and initiatives that emerged from a literature scan. We also provide some insight into how the archiving profession in a few countries has responded to the pandemic. When we look at archival institutions, it can be observed that archives worldwide were calling on citizens to document their lives in the pandemic. The Society of American Archivists (SAA) stated that archivists always must deal with gaps and silences, "[b]ut with history unfolding around us, we have a chance to contribute to minimising those silences and creating a documentary record that is aware of itself" (SAA, 2020). In that respect the pandemic offered a tremendous opportunity to immediately record for later purpose. In May 2020 SAA published an annotated resource list of many initiatives by academic institutions, historical and cultural societies, including guidance on how to conduct such documenting activities. Most initiatives of archival institutions were limited to calling on citizens to record aspects of their lives in the pandemic with the aim of making these documents part of institutional collections. The list mentions a few initiatives that go beyond documenting. The authors of this article share Ananya Chakravarti's concern about the one-sidedness of the collections that are now being formed (Chakravarti, 2020), and agree with the more substantial approach taken by Canadian archivists.

At an early stage of the pandemic, the Royal Society of Canada established a COVID-19 taskforce and working groups tasked to prepare policy briefings with the aim of providing policymakers with evidence-informed perspectives. Since then, numerous reports with policy recommendations in different societal areas have been published. One of these working groups published the policy briefing "Remembering is a Form of Honouring: Preserving the COVID-19 Archival Record" in which the authors paint a bleak picture of Canadian archival institutions in this respect (Jones et al., 2021). The report qualifies the collection and preservation of records as patchwork. The argument relates to the narrow focus of archival institutions on the official government records and the lack of strategy and resources to guarantee that non-governmental COVID-19 records will be preserved, and thus do justice to a multitude of voices in society, including marginalised ones. Many of the issues the authors address existed before the pandemic, but COVID-19 has made these problems apparent. The report recommends policy changes in three areas: funding of memory institutions, capacity to preserve digital records, and ensure archival research governed by ethical procedures.

As an alternative way of securing documentary evidence of the pandemic, government agencies and other public institutions subject to archival law have been issuing guidelines and specific retention schedules. An example of this approach is the guidance developed by the University of California Records Management Committee to help identify the administrative COVID-19-related records including their retention periods (University of California, 2020). Dutch policy goes a step further by declaring the pandemic a so-called "hotspot" (an extraordinary event that deserves to leave a detailed record). Consequently, usual administrative retention periods for COVID-19-related documents are automatically labelled for permanent retention (Nationaal Archief, 2020).

4.2 Archival work during the pandemic

LYRARIS, an international non-profit organisation serving archives, libraries and museums, released a survey in June 2020 aimed to collect trends and archival practices during the pandemic. 45 states in the USA were represented in the survey with a total of 253 responses (Klettlinger, 2020). The primary goal was to provide guidelines on how to safely collect archival material despite the pandemic. The results showed that the greatest obstacle was the limited physical access to the archives due to building closures. Some archives allowed their staff to enter in shifts while socially distanced from one another. This allowed for the opportunity to drop off donated materials. These donations were collected as archivists were concerned that historical records would otherwise be lost or as stated: "we encountered many folks who spent their at-home time cleaning and were searching for appropriate ways to dispose of their discoveries. That's why we wanted to continue to accept donations, since we feared that the alternative was the artefacts' destruction." (p.11). While collection of paper material was limited in comparison to earlier times, digital collecting continued as usual. Still, preservation of

digital data was challenging as many staff members were using temporary solutions as they were not able to access servers from their institutions due to lack of remote access. Respondents indicated that they were better aware of the need to improve their digital preservation practices by revising workflows and creating or updating policies. It was also seen as an opportunity to advocate for more resources to improve infrastructures and support digital collections. Born digital materials were 88% of the most collected material (p. 14) and the documentation of current events was the primary motivation for 50% of the respondents during the pandemic as it was an opportunity to collect unique materials of historical value. Hence, the results show that the most comfortable format to collect during the pandemic was digital as it allowed employees to work remotely with little to no social contact.

Similarly, the National Archives of the United Kingdom, conducted a survey across England, Scotland and Wales into the impact of the pandemic (The National Archives, 2020). 203 responses were received, mostly from local authorities (36%) and higher education (19%). The main purpose was to capture a national picture of how COVID-19 was disrupting archive services in order to better plan necessary support for the sector and "to understand the reality of this sudden change to our normal ways of working" (p.1). During the first months of the pandemic most service recruitment had been paused or frozen while lockdown was in place which caused restructuring of services. Survey questions focused on funding, impact on recruitment and innovative workarounds. Most respondents (78%) expected reduced income and funding, many (67%) had their employees working from home and some (38%) were utilising social media channels to engage with their audiences. Some also mentioned their campaigns to collect content relating to the pandemic, such as diaries. Access to digitised content was available by some of the archives (10%) while a few (3%) indicated that their service had no digitised content.

4.3 Impact of the pandemic on records management

Surveys conducted in North America and Scotland likewise sought to understand, or at the very least draw attention to, the impact on records and information practices and how these practices changed in response to, or as a result of, the pandemic. A private sector survey by Iron Mountain noted the top five challenges to records and information management programmes as being: shift to remote employees; preparing for office re-entry; continued compliance with regulations; technology; and cybersecurity (Iron Mountain, n.d.). The survey results suggested that respondents intended to focus on a range of technical and social approaches to meet those challenges, including the use of Cloud-based solutions, process automation and reconsideration of existing office layouts.

The COVID-19 Impact on Recordkeeping in Scotland survey conducted by National Records of Scotland sought to capture a national picture of the pandemic's disruption to public authorities, inform plans for sector support, and understand changes to ways of working. Interestingly, over 50% of respondents considered the impact of COVID-19 arrangements on records and information management services as an opportunity to raise the profile for those services rather than perceiving the changes as a threat or challenge to their function (National Records of Scotland, 2020a). The survey found that 100% of respondents, a group largely made up of Local Authority and Health and Social Care sectors, had not yet adapted retention and disposal schedules to ensure the capture of Scotland's COVID response, thereby creating a risk of information loss and subsequent non-compliance with statutory and regulatory obligations. The rapid adoption of "new technologies, software and communications" that were not part of the "existing records management infrastructure" were seen to contribute to that risk (National Records of Scotland, 2020b).

5. Phase Two - Status

5.1 Analysis of research from outside the records management sector

Our phase one findings reveal that little impetus was placed on understanding how information professionals have been impacted in their everyday work lives. This gap in understanding has informed our comparative study. It is evident that COVID-19 altered the conduct of information management work and service provision, with many institutions implementing a range of limitations around physical access to collections with digital access, collection and communication becoming part of the "new normal". However, this was coupled with an apparent lack of practical advice or standards being issued from archival authorities. More broadly, this suggests a cultural shift within the everyday work environments of information professionals worthy of further research.

Several surveys and research papers from outside the records management/archival sector, which have surfaced through the environmental scan, have supported our survey design process and helped us formulate some of

our questions. These non-records management-related publications focused on how various workplaces across industries had been affected by the pandemic. We identified nine references as most relevant to our research interests. These references were sourced from private to public sectors, from corporate consulting reports to national census surveys. Kniffin et al.'s article (2021) was particularly useful to frame our approach to creating the survey questions. These organisational psychologists categorise the pandemic's impact on the workplace and on workers, and list various moderating factors, thereby showing what kind of mitigating factors should be taken into consideration when assessing the impact of the pandemic on working from home.

Among the nine references identified through our environmental scan, seven incorporated the use of surveys. The Canadian Workforce of the Future survey conducted by PricewaterhouseCoopers (2020) displayed insights using data visualisations that conveyed a strong narrative of the impact of COVID-19 on the workplace. While a survey by McKinsey & Company (Lund et al., 2020) offered a comprehensive documentation of results across multiple countries, and how comparisons across variables can be meaningfully conveyed. Another survey conducted by the Boston Consulting Group focused on employee sentiments about the future of work (Dahik et al., 2020) which included questions about productivity, wellbeing and work tools used. Together, these corporate consulting surveys provide a good framework for variables to consider in the context of the impact of the pandemic on work processes. The national census surveys that we consulted provided analyses with more emphasis on social factors. For instance, the StatCan Working from Home: Productivity and Preferences Questionnaire (Mehdi and Morissette, 2021) asked about barriers to productivity one might face at home, and compared the data across many variables such as sex, age, education, occupation skill level, marital status and presence of children.

5.2 Contextualising the comparative study

Through the environmental scan detailed in phase one and a brief overview of some initiatives in the regions covered in our study, risks to compliance from information loss and newly implemented work-from-home practices can be seen to be a global concern amongst records and information professionals. For instance, in Australia, guidelines from archival authorities stressed that when working remotely, the obligations to create and manage records of all business activities remain the same and provided advice for employees to enable them to fulfil their recordkeeping responsibilities while working from home. In Iceland, the National Archives insisted on the same issues but provided limited advice (National Archives, 2020a) other than around matters such as electronic consent on municipal council minutes (National Archives, 2020b). Whilst in the Netherlands, advice on cyber risk and the responsibilities of working from home were issued soon after mandatory work-from-home directives were given (Nationaal Cyber Security Centrum, 2020). The Public Record Office of Victoria made available the most detailed advice for employees, managers and heads of departments in May 2020. The guidance showed an awareness of the risks of creating, managing and sharing information in a digital environment that may not replicate the pre-pandemic experience or tools employed for communication and information sharing (The Public Record Office Victoria, 2020). This awareness was repeated in the range of considerations Archives New Zealand suggested information professionals respond to with their practice (Archives New Zealand, 2020). Alongside these examples of high-level guidance, there was also some evidence of more granular advice responding to specific information and records systems in place and the expectations of workers to meet institutional information requirements. The University of Toronto Archives and Records Management Services (UTARMS) issued guidance considering the work environment at home, record/document tracking, email management, control of physical records, and revision of existing information procedures (McCutcheon and Klumpenhouwer, n.d.).

While some advice from authorities was evident across the regions covered by our study, there is however little to explain how that has flowed into the practice and experience of professionals in the new work-from-home reality. The ISO white paper, Insights on Records Management Challenges While Working Remotely, released in March 2022, reveals the ongoing need for a focus on the realities of work-from-home in COVID-19 times (ISO, 2022). We are anticipating that with phase two and further phases of our project, we will start to understand more fully how information professionals have experienced the early stages of the pandemic and what implications they envisage or have perceived through that new everyday work life. We anticipate that a range of risks, challenges and opportunities will reveal themselves.

6. Discussion

Recordkeeping is an essential part of organisational knowledge management as it enables core memory and accountability functions over time. When thinking about how to shape those qualities of authoritative evidence,

accountability and memory, we see a gap between the theoretical and conceptual approach on the one hand and the implementation of archiving functions in practice on the other. While the digital turn has long shown that the traditional view of archiving is not enough to shape and ensure authoritative information resource management, we see that the archiving practice still strongly adheres to the traditional view of records which must be properly managed as collected end products. This picture also arises from the analysis of the literature related to archiving in times of COVID-19. While the pandemic has pushed society into a digital mode on an unprecedented scale, the literature we reviewed mainly emphasised the importance of the activities of archival institutions seeking to document the unique event, rather than reflecting on the impact of 'total digitality' in work and life on the recordkeeping processes themselves and going beyond the traditional tasks of collecting, preserving and accessing the collected materials. Despite the few critical voices, such as Chakravarti (2020), it is striking that we have encountered little reflection from recordkeeping professionals, working in collecting institutions, on this form of documenting in which citizens are massively encouraged to record their experiences and observations during the pandemic. In their call for citizens to document their lives, many initiatives offered lists of questions that could serve as a "tool" to determine what kinds of issues would be worthwhile to record and preserve. It is a questionable form of institution-driven archivalization in which archival institutions affect record-making based on predefined ideas of what to document.

Although we do see some initiatives in which attention is paid to responsible archiving during working digitally from home, including the provision of guidelines and advice, the picture that emerges from the surveys analyzed in our environmental scan is that concerns of professionals are mainly related to disposal, often emphasising that the obligations to create and manage records of all business activities have not changed. At the same time, little is known about the experiences of information professionals who had to fulfil these responsibilities in their daily work. It is not only interesting to look back at how information professionals shaped their work during the pandemic, but it is very important that we gain more knowledge and insight into their experiences, because it seems that partial working from home is taking on a structural form in many organisations. Where the office used to be the centripetal centre for employees towards which information management was geared, the new office is taking on a more distributed character. This is the underlying reason for conducting a survey among information professionals in different countries. Their experiences, knowledge and insights will provide important inputs for answering the question of how authoritative information resource management could be organised in a distributed work environment. This touches on the essence of designing and organising recordkeeping processes and goes beyond the equally important but traditional aims of documenting a special period or of ensuring that documents are preserved.

7. Conclusion

The impact of the pandemic and consequent working from home arrangements for many employees worldwide is likely to have contributed to increasing reliance on digital channels to achieve organisational goals. However, this digital transformation may result in an absence of evidence, the information that documents business activities and provides accountability, which is an essential component of transparency. The archives and records community has the professional responsibility to ensure that recordkeeping occurs, and that the information is created and maintained in such a way that it can be kept for as long as required but no longer than necessary. Our research questions for this first phase were targeted at the archival authorities, aimed at finding out whether they had undertaken any investigation of the impact of the pandemic on workplaces and what kinds of guidance they had issued. Our preliminary findings suggest that the pandemic itself, and its impact on society, was the main focus of attention for archival authorities rather than how to ensure organisational recordkeeping when employees were predominantly working from home. We hope that the gaps we identified through our environmental scan help organisations develop work practices that prioritize essential recordkeeping activities and acknowledge the employees' needs. The next step in our research is to investigate the experiences of recordkeeping professionals in the Netherlands, Iceland, Italy, Canada and New Zealand via an online survey to collect baseline data, and to provide the basis for in-depth interviews.

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How Innovation Is Created: A Conceptual Framework From a Knowledge-based View

Qiang Fu
Institute of Technical Education, Singapore
Fu_qiang@ite.edu.sg

Abstract: Based on the knowledge-based view (KBV), knowledge is the most significant strategic resource of an organization. From a strategic management standpoint, connecting knowledge and performance is one of the most vital undertakings of any knowledge-based theory of an organization. However, most existing studies in this field left many questions unanswered. Although many researchers have recognized the importance of knowledge production in generating an organization's competitive advantage, they have failed to establish a solid causality between organizational behaviors in knowledge creation and firm performance, and hence the mechanisms remain unclear. This study argues that the innovation process is characterized by the generation of new knowledge, where creative problem solving and new product development can occur and yield innovation results. Idea management and intellectual property, innovation process, and innovation portfolio and project management represent broad innovation processes. Thus, this study proposes a new conceptual framework to investigate the link between broad innovation processes and Small and Medium Enterprise (SME) performance. This novel perspective sheds light on how new knowledge generation, i.e., innovation, in the innovation process directly impacts SME performance, thereby connecting knowledge and firm performance via innovation processes.

Keywords: innovation, innovation process, framework, knowledge-based view, SME performance

1. Introduction

Today, the importance of knowledge for the success of organizations is widely recognized (Lubit, 2001). Knowledge is becoming the key resource of organizations (Gao et al., 2008) and a deciding factor for business performance (Schiuma et al., 2012), and it is being considered the most valuable asset of an organization (Gituma, 2017). Dlamini (2017) highlighted that knowledge has become a highly complex asset, which has been receiving special treatment from management, unlike other resources. Given that knowledge-based view (KBV) is a management concept that helps organizations achieve competitive advantage, it must be carefully managed (Huges et al., 2017). Although the importance of knowledge creation is widely recognized by the academic community, evidence on how knowledge is created in organizations (Yang et al., 2010) and how to effectively manage (Yang et al., 2010) or evaluate (Chen & Edgington, 2005) the knowledge creation process remains limited. Despite the recognition of the importance of knowledge creation in developing a firm's competitive advantage, researchers have not been able to establish a strong causality between organizational knowledge creation behaviors and firm performance, so the mechanisms remain obscure (Brockman & Morgan, 2003). Extant literature failed to capture the importance of knowledge creation as a hidden driver of innovation in the knowledge economy, which is reflected in the recent increasing wave of calls to investigate the relationship between knowledge creation and innovation and, thus, linking knowledge and firm performance through innovation processes (Brockman & Morgan, 2003). This study attempts to address the above issues in the ensuing sections.

2. Knowledge-based view of a firm

Knowledge-based view (KBV) is an extension of a firm's resource-based view, which assumes that knowledge is a firm's most important productive resource, resulting in varying levels of firm performance (Kogut & Zander, 1992; Grant, 1996).

Major technological developments, particularly information and communication technologies (ICT), are leading to profound changes in society and the economy. For example, the OECD (1996) described today's economy as "a knowledge economy" or a knowledge-based economy. According to the World Bank (2016), the knowledge economy is characterized by a well-educated population, an economic and institutional system that provides incentives for the creation and transfer of knowledge for growth and prosperity, a dynamic information and communication infrastructure, and an effective innovation system.

Kogut and Zander (1992) developed the initial KBV by proposing that "the central competitive dimension of what organizations know how to do is to create and transfer knowledge efficiently within an organizational context" (p. 384). Hence, an organization is viewed as an institution for integrating knowledge or learning. Therefore, the

firm's ability to produce unique or low-cost products/services is owed to its superior knowledge (Grant, 1996). The KBV assumes that knowledge is the most important strategic resource of an organization. Through the transfer or creation of knowledge, organizations become more efficient and effective in utilizing scarce resources. Successful organizations are able to constantly create new knowledge, disseminate it throughout the organization, and quickly translate it into new technologies, services, and products (Nonaka, 1994). As a result, knowledge is increasingly viewed as an important source of competitive advantage (Grant, 1996; von Krogh & Roos, 1996).

The literature review revealed some salient features of the KBV. First, successful firms are able to draw on explicit and tacit knowledge to create and disseminate new knowledge throughout the firm (Polanyi, 1966). Nonaka (1991) compared the two by emphasizing that explicit knowledge is viewed as formal, systematic, codified procedures and universal principles, whereas tacit knowledge comprises insights, intuitions, and hunches of individual employees based on practice and experience. Both can be transformed into commercially useful products and services. Second, Kogut and Zander (1992) distinguished internal from external knowledge.

They further explained that internal knowledge is created by the organization through knowledge reorganization and experimentation, whereas external knowledge comes from external sources through acquisitions, networks, and joint ventures. However, with the proliferation of open innovation, this line is becoming increasingly blurred (Chesbrough, 2006). Third, knowledge is held by individuals and the social context within an organization (Simon, 1997). In the knowledge economy, human capital is crucial because employees are no longer merely an element of the production system, but rather owners, creators, and controllers of knowledge (Kogut & Zander, 1996).

Grant and Baden-Fuller (1995) stated that knowledge is acquired by individuals and, in the case of tacit knowledge, is also stored by individuals. In addition, knowledge is expressed and made explicit when members work together in a social setting, i.e., a team, group, organization, or network (Simon, 1997). Organizations should therefore be understood or viewed as a social community that specializes in the creation and transfer of knowledge (Kogut & Zander, 1996; Nonaka, 1994). This subject is also discussed in the literature as "organizational learning" (Huber, 1991; Powell et al., 1996). Such learning is embedded and mediated by various elements in an organization, including hierarchical culture and personality, schedules, archives, approaches, frameworks, and the organization's workforce (Kitchlew, 2015). Some researchers argued that learning is considered the most critical asset of an organization because learning-based assets are usually difficult to imitate, socially complex, and heterogeneous, and therefore are the real determinants of sustainable competitive performance of the organization (Kitchlew, 2015). Fourth, knowledge should be understood in the organizational context for value creation. KBV is based on a constructionist perspective, which assumes that knowledge can only be managed by creating enabling conditions rather than being completely controlled (von Krogh, 1998). As knowledge is the most important source of revenue, it can be portrayed with the concept of "intellectual capital" (Roos et al., 1998). Firms can align their strategy to what an organization knows or develop knowledge to support a strategy to ensure that they fully benefit from knowledge and capabilities in value creation (Zack, 1999). The above section synthesizes KBV research work and lays the foundation on which the theorization of broad innovation process is unfolded in the next section.

3. Theorization of broad innovation process

In terms of the KBV, recent studies of the innovation process have shifted their focus from the control of firm-specific knowledge as a static resource to the acquisition, conversion, and use of firm-specific knowledge (McEvily & Chakravarthy, 2002). Some researchers have also explored how the innovation process can be accelerated through knowledge creation (Bettis & Hitt, 1995).

Innovation process is commonly understood as the process that leads to the creation of innovations at firm level, which is well documented in the literature in various ways, such as the "innovation decision process" (Rogers, 2003), the "organizational innovation process" (Amabile, 1988), the "innovation process model" (Schroeder et al., 1989), and the "intraorganizational innovation process" (Saren, 1984). This is how innovation creation has been traditionally managed, which is a common concept accepted in the academic community. However, some scholars observed that the current understanding of innovation process in the literature is relatively generic, whereas innovation is quite complex and includes diverse influencing factors (Dodgson & Hinze, 2000). Hence, this research posits that such generic concepts will give rise to opportunities to examine the innovation process from specific/or different perspectives. If we consider a broad-based innovation process as the creation of new

knowledge, the co-creation of knowledge from specialized and tacit individual knowledge assets requires a new way of management with different rules (Amabile, 1998). As knowledge work is increasingly organized in projects, short-term task forces, and temporary cross-functional teams (Blomqvist, 2008), how innovation is organized and managed should be examined beyond the traditional general innovation process.

Idea management and intellectual property (IMIP) involves generating, collecting, and evaluating ideas to be used in the innovation process and protecting those ideas (Flint, 2002; Khurana & Rosenthal, 2002). Based on the KBV, knowledge always begins with the use of the individual's mind and all innovations start with the creation of ideas (Nokana, 1994), which is conceptualized as a change in the existing knowledge structure (Niamh, 2013). Thus, "idea management" plays an important role in this process (Fu, 2018). How can such ideas be managed by deploying the right techniques and appropriate platform so that some of these ideas can be successfully applied, resulting in the generation and application of new knowledge and the creation of value, must be determined. Such knowledge creation is closely linked to an organization's competitive advantage (Gupta et al., 2016). Hence, the protection of intellectual property of the new knowledge will help sustain the competitive advantage, thereby becoming a part of this process (Fu, 2018). Such perspective was reaffirmed by Peeters and van Pottelsberghe (2003) who further emphasized that intellectual property protection is an important dimension of the innovation process. Based on the KBV, this also reflects the transformation and/or creation of tacit knowledge (lying dormant in people's minds) into explicit knowledge (documented and protected as part of knowledge management and organizational learning) (Fu, 2018).

Innovation project and portfolio management (IPPM) are important tools or methods for managing innovation projects and processes (Cooper & Edgett, 2008). Project management methods address how to "do the projects right," whereas project portfolio management was developed to address how to "do the right projects," i.e., how to select and prioritize multiple projects or balance the number of incremental and radical innovation projects. Usually, the specific innovation strategy followed by a company is clearly reflected in its innovation project portfolio in which project portfolio management plays an important role in this process (Dervitsiotis, 2011). Mudrak et al. (2005) examined the dynamic interaction of organizational activities and suggested that the success of innovation projects depends on the ability to align innovation project activities with the supporting environment. This is consistent with the observation of other researchers from the KBV that when organizations innovate, they do not simply process information, but create new knowledge and information from within to redefine problems and solutions while adapting to and reshaping the environment (Nonaka & Takeuchi, 1995). Similarly, Perez-Freije and Enkel (2007) highlighted that IPPM are parts of the innovation process from innovation control and management perspective. Therefore, IPPM are considered part of the broad innovation process, reflecting the organization's ability to directly manage innovation activities.

Such perspective is also shared in the KBV literature, in which knowledge is recognized as a critical organizational attribute for promoting innovation (Dougherty, 1992) and knowledge creation as the ability to develop new and useful ideas and solutions relating to new products, services, and procedures (Nonaka, 1991). From the knowledge perspective, an innovation process (the generation of innovation) is characterized by the creation of knowledge required to understand how the innovation came about or is managed (Quintane et al., 2011). The knowledge that is created during the innovation process makes it possible to understand innovation as new knowledge creation and innovation process as methods or approach to manage innovation.

Collectively, IMIP has played an important part in the innovation process as it involves generating, collecting, and evaluating ideas to be used in the innovation process and protecting those ideas. IPPM are important tools or methods in not only managing innovation projects, but also the entire innovation process. Therefore, this study argues that the a broad innovation process shall include not only the innovation process, but also IMIP and IPPM, as this broad innovation process creates new knowledge and such new knowledge would not have been conceived, created, and captured before it has gone through this innovation process. The broad innovation process, from the knowledge management perspective, captures new knowledge creation not only in the form of innovation creation, but also through innovation management in the innovation process, i.e., how new knowledge is created and how new knowledge is applied to create value.

4. Innovation - as a process and an outcome

Kogut and Zander (1992) indicated that the central competitive dimension of organizations is the efficient creation and transfer of knowledge in an organizational context. A growing number of researchers explicitly

argue that knowledge creation is at the heart of organizational innovation (Quintane et al., 2011). Other researchers have also uncovered that an organization's ability to transform and exploit knowledge may determine its level of innovativeness, e.g., introducing new problem-solving methods or new products in response to market demand (Tidd et al., 2005). Thus, the processes by which knowledge is created and used within organizations are at the core of firm performance and value creation.

The knowledge literature states that innovation and knowledge creation are fundamentally intertwined (Niamah, 2013). Gold et al. (2001) regarded innovation as "the creation of new knowledge from the application of existing knowledge" (p.190). Heffner and Sharif (2008) stated that innovation is a kind of combination of knowledge and entrepreneurship. Other researchers specifically noted that innovation amounts to the use of new knowledge to provide a new product or service that is desired by customers (Albers & Brewer, 2003). Dvir and Pashar (2004) argued that innovation is a process of turning knowledge and ideas into value. Therefore, the innovation process as a process and as an outcome must be further understood from a knowledge creation perspective.

4.1 Innovation as a process

Defining innovation as a process allows researchers to examine the constituent activities of innovation, or what activities constitute innovation (Greve & Taylor, 2000). This process is generally referred to as the "innovation process," as previously discussed. Wolfe (1994) stated that studies on the innovation process are categorized into two, namely, the stage model and process research. Stage model research views innovation as a series of stages that unfold over time and as a process from initiation to the implementation of specific changes (Cooper, 1999, Tidd & Bessant, 2005). The stage-gate process introduced by Cooper (1990) has the most distinct and orderly phases. Many other scholars contend that innovation is best understood from the interactive process perspective, that is, a dynamic ongoing process in which institutional structures and actions are inextricably linked (Edwards, 2000). Moreover, researchers have acknowledged that many feedback loops and cycles occur before the process progresses, suggesting that organizational learning also occurs in the process (McDermott & Handfield, 2000). Interestingly, some scholars support the process view when examining disruptive innovation, viewing it as dynamic changes and the interconnection of events and actions rather than static outcomes (Langley, 2007; Petzold et al., 2019). That is the process-oriented view of innovation.

4.2 Innovation as an outcome

Defining innovation as an outcome helps identify what constitutes an innovation. In addition, innovations are classified into different categories used for further research and analysis (Eric et al., 2011). The most commonly observed outcome-based innovations are the number of patents and their derivatives (Whittington et al., 2009). Some researchers have also proposed the adoption of innovations as an indicator, which is widely used in innovation practice and its related academic research (Bell, 2005; Leiblein & Madsen, 2009).

However, patents or adoption measures are not featured in the traditional process-oriented innovation literature, as these measures are limited and therefore applicable to the innovation outcome (Eric et al., 2011). In the process-oriented literature, innovation is generally defined as activities (Armor & Teece, 1980; Terziovski, 2010) or events (Van de Ven & Polley, 1992), and most researchers measure the innovation process as a function of its outcome (Eric et al., 2011). For example, Armor and Teece attempted to overcome the difficulty of measuring innovation activity by using R&D expenditures as a proxy, whereas Terzovski (2010) measured outcomes of the technical, design, production, administrative, and commercial activities that constitute innovation. Most recently, in a published paper, entitled, Innovation management research method: Embracing rigor and diversity, the authors observe that, from a research methodology perspective, in treating innovation as an outcome, innovation management research has typically overlooked many potentially important topics and methodological approaches (Ritala et al., 2020). As such, there exist methodological opportunities for researchers to focus on innovation as an ongoing process, e.g., process studies that emphasize the activities of individuals, teams, and organisations, and so on, rather than as an outcome (Bresman, 2013). Consequently, reconciling the two research streams, i.e., innovation as a process and innovation, as an outcome seems to be challenging, but it is an issue that must be addressed.

Given that innovation is essentially new knowledge creation (Abou-zeid & Cheng, 2004), conceptualizing innovation from a knowledge creation standpoint is possible. Knowledge creation is a process in itself, regardless of the form in which the knowledge is created (Eric et al., 2011). Some research highlighted that the knowledge creation process is crucial for innovation given that it involves selecting and implementing new ideas, products,

or organisational developments, and solving unexpected problems (Soo et al., 2004). Thus, the process of knowledge creation is defined by its outcome: it is a process that generates new knowledge which could not have been conceived and created prior to the innovation process (Eric et al., 2011). Therefore, the close connection between the knowledge creation process and its outcome sheds light on how we can manage innovation (as new knowledge). Hence, this study postulates that innovation can be viewed and researched as a process and an outcome concurrently. Such fresh perspective can pave the way for studying innovation as new knowledge creation in an organization through new lens. This application will be an important assumption to the future development of the conceptual framework.

5. Development of conceptual framework

This section discusses the conceptual framework of innovation—as a process and an outcome—and its impact on SME performance.

5.1 Innovation and SME performance

Organizations with high innovativeness will be more successful in responding to customers' needs and in developing new capabilities that allow them to achieve better company performance and superior revenue (Calantone et al., 2002). Generally, innovation (through innovation process) is linked to positive company performance (Lawson & Samson, 2001; Smith et al., 2008). IMIP can also generate revenues for organizations (Elton et al., 2002), and the application of Innovation Project and Portfolio Management helps improve company performance (Cooper et al., 1998; Matheson & Matheson, 1998). Oirere (2015) reported that innovation positively impacts financial performance, profitability, and market share of SMEs. Roos (2016) discovered that innovation improves the manufacturing efficiencies of SMEs by reducing productivity costs. Specifically, Rosenbusch et al. (2011) also established through meta-analysis that innovation process outcomes positively affect SME performance. Thus, it is hypothesized that innovation (through innovation processes) will positively affect SME performance.

5.2 Innovation process and outcome and company performance

Based on the KBV, innovation process (the generation of innovation) is characterized by new knowledge creation (Quintane et al., 2011), where creative problem solving and new product development can transpire and generate innovation results (Tang, 1998; Anbari & Kwak, 2004). Through literature review and theorization of innovation process, broad innovation process encompasses innovation process, IMIP, and IPPM. As aforementioned, this study argues that innovation can be studied as a process and an outcome, indicating that the impact of innovation process on company performance and its outcome must be explored. Hence, it is hypothesized that innovation process and outcome will impact company performance.

5.3 SME performance research gap

Increased innovation performance enhances customer value relationships and positive financial outcomes (Dekoulou & Trivellas, 2017). Although some researchers discovered a positive link between innovation outcome and SME performance (Rosenbusch et al., 2011), others found contrasting results (Amara et al., 2008; De vrande et al., 2008). Essentially, the innovation results/outcomes (and its impact on company performance) are what matters, and it appears that SMEs are still grappling with the fact that they must better understand how innovation activities and innovation management can influence/impact company performance (Fu, 2018). Innovation is critical to achieve operational efficiency (Hsueh & Tu, 2004). Companies with greater innovativeness are more successful in achieving better financial performance (Calantone et al., 2002). Nofal et al. (2014) observed that the overall performance of the organization should reflect in the company's operational and financial performance. As such, it can be proposed that operational and financial performances are part of SME performance.

Therefore, this study broadly hypothesizes that innovation processes and their outcome positively impact the operational and financial performance of SMEs, as shown in Figure 1.

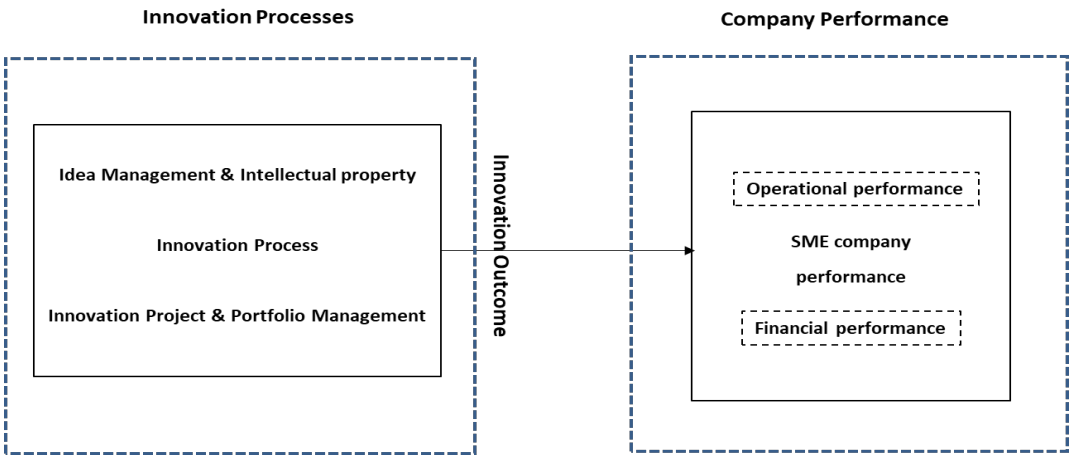


Figure 1: Proposed conceptual framework on innovation and its impact on SME performance (source: author)

6. Discussion and conclusion

Looking at innovation through the lens of KBV provides some novel insights that differ from the traditional view of the organizational innovation process.

The key outcome of innovation is innovation performance, which is realised through innovation processes. The ideal definition of innovation performance include a linear and holistic approach and encompass all determinants of the development and diffusion of innovations (Edquist et al., 2018). In typical innovation process literature, extant concepts relied on the input–output relationship and a process view to describe innovation performance (Linton, 2009). Their focus is on innovation as a process per se, i.e., stage model and process research, and innovation performance is the outcome generated from an innovation process, which includes the development and implementation of innovation activities (Chen & Huang, 2009). Such perspective is certainly comprehensible, given that innovation frequently involves progression from one thing (such as a new discovery or idea) to another (implementation/adoption) through intervening processes (development) (Ritala et al., 2020). Viewing innovation on the basis of KBV, some researchers asserted that innovation is essentially about knowledge (Tidd et al., 2005), and new knowledge is created and used through innovation activities (Trott, 2005). Therefore, this study closely examined what activities constitute innovation (as new knowledge creation) and proposes that, in addition to the traditional generic innovation process, IMIP and IPPM are critical innovation activities, as those are key activities featuring new knowledge creation and its application to create value (Andreeva, 2009). Furthermore, the new knowledge creation in this process contains not only innovation per se, but also how innovation process is managed to engender innovation. Therefore, the knowledge creation process is crucial for innovation through the selection and implementation of new ideas, products, or organizational developments, and solving unexpected problems or meeting unmet customer needs (Soo et al., 2004). This new perspective sheds light on how innovation is created on the basis of KBV.

Given that an organization's ability to transform and exploit knowledge will determine its level of innovativeness (Goh, 2002; Tidd et al., 2005), taking a KBV of innovation processes will help better understand "transforming knowledge" (through new knowledge creation) and "exploiting knowledge" (through value creation and capturing). As a result, it will be easier to assess an organization's level of innovativeness on the basis of its causality. Bu examining the broad innovation process, generation of new ideas and creative problem solving will converge into new product development processes and yield innovation results (Tang, 1998; Anbari & Kwak, 2004). One of the problems encountered by a traditional innovation process approach is its generic nature and, when taking a process perspective, it fails to capture innovation outcomes (Fu, 2018). Nevertheless, if we view the innovation process as encompassing not only the innovation process, but also ideas management, intellectual property, and innovation project and portfolio management, we can discover and incorporate more valuable insights into innovation as an outcome. The answer to the question of what constitutes an innovation (innovation's definition as an outcome) may be found by examining innovation processes in greater detail. IMIP will certainly be able to capture the number of patents and their derivations (Whittington et al., 2009). It will also cover the starting point or front end of any innovation, creating ideas and how such ideas should be managed. Separately, IPPM will reflect which are the innovations adopted or adoption of innovations, a widely adopted outcome measure, and the resources allocated to such innovations (Bell, 2005; Leiblein & Madsen,

2009). Moreover, it can provide insights into how many innovation projects are underway, at which stage, their success rates, the ratio of radical and incremental innovation projects, and so on. All of these innovation activities reflect the true nature of knowledge work, which is increasingly structured around projects, temporary task forces, and temporary cross-functional teams. Collectively, the broad innovation process will be able to capture innovation as a process and innovation as an outcome in its original concept. Therefore, on the basis of the KBV, this study postulates that innovation can be seen and thus researched as a process and an outcome.

Such fresh perspective offers new lens and opportunities to research innovation. As a result, specifically, on the basis of the KBV, this research proposes a conceptual framework pertaining to the impact of innovation on SME performance (refer to Figure 1), under which all the new perspectives and discoveries are integrated by: 1) conceptualizing innovation processes to include: innovation process, IMIP, and IPPM; 2) conceptualizing innovation as a process and an outcome; and 3) proposing innovation processes positively impacting SME performance. The pointer 2) will strive to answer the questions as to what innovation activities constitute and what constitutes an innovation as discussed earlier on.

As we know, from a strategic management perspective, connecting knowledge and performance should be one of the most important aspects of any knowledge-based theory of the firm. However, this is the area where the current body of literature leaves the most questions unanswered. Although many scholars recognized the importance of knowledge creation in developing competitive advantage of a firm, they have not been able to draw a strong causality between the organizational behaviors in creating knowledge and firm performance and hence, the underlying mechanisms remain unclear (Schulze & Hoegl, 2006). In this study, on the basis of the KBV, a new conceptual framework is proposed (refer to Figure 1) to examine the broad innovation process, including, idea management and intellectual property, innovation process, and innovation portfolio and project management, and their direct impact on SME performance. The findings of this study can shed light on how new knowledge creation in the innovation process directly impacts SME performance and hence connects knowledge and firm performance through innovation processes. It can help better understand how knowledge creation is effectively managed (through studying innovation as a process) or evaluated (through studying innovation as an outcome). Specifically, this study aims to contribute the following novel insights into literature. First, a new conceptualized innovation and its impact on SME performance conceptual framework, in which, for the first time, innovation process and outcome will be taken into consideration as part of innovation performance to directly impact SME performance. Second, based on the KBV, broad innovation process will include key innovation activities, i.e., idea management and intellectual property, innovation process, and innovation project and portfolio management. This is a new research angle worth exploring. Such fresh perspective provides new lens to viewing innovation as a process and an outcome. It also contributes to the understanding of new knowledge creation in the innovation process by recognizing not only innovation as new knowledge creation, but also new knowledge about how innovation is managed. Third, theorizing the innovation process and developing a conceptual framework around it will expand the KBV knowledge repertoire and help the research community better understand how innovation emerges from the KBV. Fourth, research results for the innovation–performance relation of SMEs are inconsistent and sometimes even controversial. As a result, empirical testing of the proposed research framework will contribute to the development of the innovation–performance relation of SMEs.

Overall, the proposed conceptual framework must be empirically tested and validated to enrich the concepts of KBV theory and innovation management. Although this proposed framework focuses on SME firm-level innovation, this study acknowledges that innovation involves individuals, teams, organisations, networks, platforms, ecosystems, communities, and industries, as well as broader environments, such multiple layers of innovation, which will make the research on innovation management challenging from the concept and empirical study perspectives (Gupta et al., 2007). However, this study only covers an the organizational or firm-level perspective of innovation on the basis of the KBV, which is an obvious limitation of the proposed study and can thus serve as a future research direction.

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Sharing Information on Employment Conditions in Social Media by Representatives of Different Generations, and the Image of the Organization

Joanna Gajda
Częstochowa University of Technology, Częstochowa, Poland
joannagajda@vp.pl

Abstract: Social media is becoming an increasingly popular source of information for Internet users. They set up their accounts on the well-known and most frequently used social networking sites in order to use them, inter alia, to exchange information on professional matters. By posting your opinions and comments about the employer, various photos or videos from the workplace, they have a positive or negative impact on the creation of the company's image. The article aims to identify the users' activity in social media in terms of sharing information about their workplace. The article presents the results of the research on: verification of the situations that determined the involvement of the respondents in the publication of negative opinions about the employer; identifying the motives for posting information on working conditions; specification of the types of entries from the company's life that affect its image. This article is an attempt to answer the question whether belonging to a specific generation group and the professional status of an employee influence the generation of positive or negative actions in social media, which translate into the company's image. The considerations carried out as part of the article were based on literature studies and the analysis of the results of surveys conducted in the fourth quarter of 2021 on a group of 530 people (representing 3 generations) from the Śląskie Voivodeship in Poland. The Baby Boomers generation did not take part in the study.

Keywords*:* information, sharing information, social media, representatives of generations, company image

1. Introduction

Over the past few decades, many communication channels used in building the image of the organization have been improved. Due to the development of modern technologies, social media have made their mark in today's reality. They contributed to modifying the activities of companies that focused their information activity on making their messages available in the public space and possible supervision over the reception they encountered in its environment (Zbrzyzny, 2011). Users of social networking sites can use their popularity to publish information about their place of employment, supporting the employer's activities or damaging their image. In the literature on the subject, we can find a division of generations into four groups (Opalińska, 2018):

1. Baby Boomers generation (the generation of post-war baby boomers) - born in 1946 - 1964.
2. Generation X - born in the years 1965 - 1979.
3. Generation Y - born in 1980 - 1994.
4. Generation Z - born after 1995.

The author would like to point out that the article focuses only on selected aspects of sharing information by representatives of different generations in social media in the context of employment. This means that the presented issues are not complete and do not exhaust the entire topic, but are a contribution to further research and theoretical considerations in the discussed area. There is also no doubt that the issues raised are one of the most important. The results may have practical application in shaping the strategy of dealing with undesirable activity of employees in social media. The solution in this case may be the introduction of appropriate regulations in the workplace, specifying what behaviors in the field of social media are not accepted by the employer.

2. Literature review

2.1 The concept of information and the essence of sharing it

B. Stefanowicz defines the notion of information as a mapping of reality that is carried out in the most detailed possible way, and it is supposed to refer to its objects, events, phenomena, processes (Stefanowicz, 2013). As J. Gleick notices, information should be equated with the message, communication, message, set of data that make up knowledge. Additionally, it is connected with notifying and communicating understood as informing (Ejdys, 2017). At this point, it is worth quoting the position of T. Stonier, according to which a person experiences information by giving it, receiving, transmitting, searching and remembering (Buczkowska, 1999). It should be noted that the importance of information is constantly growing due to the fact that it is a valuable resource, and what's more, also a commodity (Babik, 2000). Therefore, it is evident that more and more importance is attached

to the sharing of information by employees of the organization, regardless of their generational affiliation. Sharing information in an organization can be broadly defined as its exchange or dissemination among people employed in the organization. The purpose of disseminating information is to transform the already existing information resources into new information and their better use (Świgoń, 2015). Information is shared through direct communication with the use of information and communication technologies. Information exchange takes place as part of the daily private and professional activity of individuals or a group of people in which they are willing to engage (Świgoń, 2017).

2.2 Shaping the image of the employer in social media

The presence of a company on a competitive market is related not only to its financial results. Today, a company's market position is determined by social acceptance in various spheres of its activity. The content of information that the company's key stakeholders provide to the environment about its activities largely affects the image of the employer (Zbrzyzny, 2011). The image of an employer is defined in the literature as "an image shaped in the awareness of current and potential employees based on their personal experiences or information reaching potential members of the organization from people employed by a given employer and disseminated by him via social media" (Baruk 2009, p. 13). K. Stopczyńska (2015, p. 168) defines the concept of social media as tools and websites that enable their users to interact with each other at any time through the messages they generate. They constitute the basis of the communication system within which the relationship of the organization with its environment takes place. They constitute a forum for the exchange of opinions and experiences by providing information (Wyrwisz, 2015). Companies should be aware of the widespread availability of social media, which means that a negative entry about the company may trigger many more, which may harm the company's image (Szwajca, Prandzioch, 2018, p. 81). This is associated with a serious risk related to the company's exposure to breach of the confidentiality of information, disclosure of its secret, increasing the risk of losing its good image among stakeholders (Głuszek, 2013). Therefore, companies should protect themselves against the irresponsible activity of employees in social media by creating their own policies regulating issues related to the company's operations, which will protect the company and the employer himself against loss of reputation. The Labor Code provides support for activities aimed at protecting the company's image in public space. According to its specific provisions, the employee is obliged to keep the information of the workplace confidential and to protect the positive image of the employer. Moreover, the employer is liable for disciplinary or official liability for exposing the employer to damage by losing his good name. In order to prevent undesirable activity of an employee in social media, hiring an employee should be associated with the need to familiarize him / her and sign a confidentiality clause (Leśniak, 2021).

3. Methodology

The aim of the presented research is to identify the activity of representatives of various generations undertaken in social media in the field of sharing information about the company and the employer. The research problem of the article is: Representatives of what generation and what employment status share information on social media more often when assessing their employer and employment conditions? What motives motivate them to undertake such activity? As part of the research problem presented above, the following research questions were formulated:

1. Is there a difference, and if so, how is the use of social media different in terms of posting about the workplace by different generations and people with an employment status?
2. Do belonging to a specific generation category and employment status affect the motives for posting employment information on social media?
3. Is there a relationship between the generational affiliation and employment status, and situations that may indicate the willingness to give the employer a negative assessment in social media?

The research was carried out in the fourth quarter of 2021 among respondents from the Silesian Voivodeship in Poland using the CAWI method. In order to reach people with a specific profile, the online research panel mypanellab.com was used. A tool such as mysurveylab.com made it possible to place the survey in the form of a web form (CAWI) on the Facebook profile to people of different age groups and to collect responses via email. 1,050 invitations with a link to the survey and individual one-time access were sent to the study participants. Ultimately, 530 correctly completed questionnaires were obtained from people representing three generations. The Baby Boomers generation did not take part in the study. The characteristics of the research sample are presented in Table 1.

Table 1: *Representatives of different generations and people with different employment status visiting the employer's profiles*

Description	X		Y		Z		Sum	
Company employee	59	11%	101	19%	42	8%	202	38%
Former employee of the company	30	6%	78	15%	21	4%	129	24%
A person currently not working	39	7%	72	14%	88	17%	199	38%
Sum	128	24%	251	47%	151	28%	530	100%

Source: own study

The research sample included 530 respondents. The obtained results were subjected to the χ2 independence test in order to check whether:

- there is a statistically significant correlation between individual responses and the respondent's age group,
- there is a statistically significant relationship between the individual responses and the respondent's employment status.

In both cases, it was assumed that the null hypothesis (H0) assumes that there is no statistically significant relationship, while the alternative hypothesis (H1) indicates that such a relationship exists. The study was carried out at the significance level of $\alpha = 0.05$. Their results are presented in the tables.

For the purposes of the conducted research, the following research hypotheses were formulated and verified:
H1: Younger (Y and Z) generations as well as employees and former employees of the company have a greater share in posting on social media about the workplace.

H2: Generational affiliation and employment status are factors that differentiate the motives for sharing employment information on social media.

H3: Generational affiliation and employment status are correlated with the perception of situations that determine negative employer reviews in social media.

4. Results

In order to verify H1, the correlations between the type of posts about the place of employment shared on social media and belonging to a generation group and the type of employment status were examined. Hypothesis 1 was confirmed. The results are presented in Table 2.

Table 2: *Type of entries regarding the workplace posted on social media by employees of different generations*

Description	**X**	**Y**	**Z**	**χ^2**	**α**	**H**	**E**	**FE**	**NP**	**χ^2**	**α**	**H**
Bragging about professional successes	10 %	33 %	20 %	33,84	0,05	H1	32 %	19 %	12 %	131,17	0,05	H1
Publishing photos of important events in the life of the company	15 %	24 %	14 %	6,13	0,05	H1	27 %	14 %	12 %	59,23	0,05	H1
Introducing a negative opinion about the employer	3%	36 %	16 %	138,73	0,05	H1	7%	19 %	28 %	170,61	0,05	H1
Entering positive entries about the employer	20 %	20 %	16 %	56,94	0,05	H1	36 %	4%	17 %	206,85	0,05	H1
Providing comments under the employer's official entry	18 %	25 %	21 %	27,95	0,05	H1	27 %	14 %	24 %	5,83	0,05	H0
Using recordings from integration meetings outside the workplace	16 %	22 %	2%	107,96	0,05	H1	19 %	12 %	10 %	28,35	0,05	H1
Comments on the employer's current activities	18 %	38 %	10 %	86,67	0,05	H1	31 %	15 %	20 %	33,32	0,05	H1
Others - I do not share	9%	2%	2%	89,76	0,05	H1	2%	4%	6%	13,49	0,05	H1

Source: Own study

The χ2 test showed that the type of entries made available on social media in each examined case showed a statistically significant dependence on the age of the respondent and his employment status, with one

exception, which is providing comments under the official entry of the employer. In this case, the test showed no correlation with the respondent's status.

The research results show that the representatives of generation Y (33% of responses) and Z (20% of responses) boast about their professional successes to a greater extent than people belonging to generation X (10% of responses). This is probably due to the fact that each generation has different needs and preferences regarding the use of private channels on social media. Apparently, Generation X does not want to use them to share information about their professional life. They approach this topic with a great deal of caution. This may mean that they are more open to communicating different topics to other people. The research shows that generation X (15%) is more likely to publish photos of important events in the company's life than their younger colleagues from generation Z (14%), but generation Y is the leader in this regard (24%). When analyzing the respondents' responses, it should be noted that the young generations - Y (36% of responses) and Z (16% of responses) will not hesitate to use online media to introduce unfavorable statements about the employer. It is worth remembering that posting entries that undermine the employer's good name will have an impact on the deterioration of the company's image in the eyes of its stakeholders. On the other hand, much less negative information about the company will be posted online by people from generation X (3%).

The obtained results indicate that the older generation is perhaps aware of the consequences of violating the company's image right, which poses a threat to the employer's interests. It probably also means that generation X is characterized by a higher level of emotional stability when introducing opinions about the employer and knows that in the event of infringement of his personal rights, the employer may start legal proceedings. It turns out, as declared by young respondents, that they are also the authors of positive entries about employers - Y (20% of responses), Z (16% of responses). The statements of the respondents belonging to the X generation also show (20% of responses) that they post positive entries about the employer on social networks.

It can be concluded here that they probably result from a high level of trust and loyalty towards the company and contribute to building its positive image. Another type of information about the workplace that is shared by generations is the provision of comments under the official entry of the employer. All generations reveal that they do not shy away from comments in this regard - Y (25%), Z (21%), X (18%). The information provided by respondents on social networking sites are recordings of integration events outside the workplace. The highest percentage of responses confirming the sharing of such entries was obtained by generation Y (22% of responses), followed by generation X (16% of responses), the lowest activity was recorded for generation Z (2% of responses). It is important for individuals to be aware that publishing recordings poses a risk of disclosure of company secrets. And this can happen when even seemingly innocent photos may contain confidential information related to the company's activities and do not protect it from competitors.

The responses obtained confirm that social media are also used to post comments on the employer's current activities. Among the surveyed respondents, 38% of people belonging to the Y generation do not shy away from such comments, as do 18% of the representatives of generation X and 10% of the generation Z. It is worth remembering that the online activities of employees do not boil down to exchanging comments that violate the obligation to care for the good name employers. Users of social networking sites should know that the content of the comments does not cause problems related to the employer's exposure to loss of image in the public space.

To determine whether H2 is true, the correlations between the motives for sharing information about employment on social media and belonging to a generation group and type of employment status were investigated. The results presented in Table 3 show that there is a statistically significant correlation between the analyzed variables and that H2 has been confirmed.

Table 3: *Motives for publishing information on employment conditions in social media by representatives of different generations*

Description	X	Y	Z	χ^2	α	H	E	FE	NP	χ^2	α	H
On your own initiative and the need to share with others	5 %	11 %	21 %	122,99	0,05	H1	9%	8%	20 %	35,89	0,05	H1
Observing information on employment conditions in social media	9 %	28 %	2%	105,23	0,05	H1	15 %	10 %	14 %	0,65	0,05	H0

Description	X	Y	Z	χ^2	α	H	E	FE	NP	χ^2	α	H
Inspired by questions posed by other media users	3 %	6%	3%	0,52	0,05	H0	5%	3%	4%	1,81	0,05	H0
Does not share	8 %	2%	2%	74,08	0,05	H1	8%	3%	0%	44,31	0,05	H1

Source: Own study

The analysis of the reasons for sharing information about employment by respondents using the independence test χ2 listed in Table 4 showed that Millennials most often engage in social media activity in terms of sharing information on their own initiative and willing to pass it on to other people (Z - 21% of responses, Y- 11% of responses). They believe that the readiness to pass information about employment to others results from the need to unload their emotions when they encounter some difficulty or obstacle in the performance of their duties. Moreover, their activity in the online media is caused by the desire to communicate irregularities in the workplace to others. Generation X less frequently shows the initiative in terms of sharing information about employment conditions in the workplace (5% of responses). Perhaps this is because they value loyalty to the employer and therefore do not want to create a negative image of the company. The representatives of the Y generation indicate readiness to share information about employment conditions on social networks, when they notice controversial topics that provoke discussion (28% of responses). One of the motives indicated by generation X for the need to share information was the sense of participation in such activities, as a result of the appearance of entries requiring comments (9% of responses). On the other hand, 8% of the representatives of the Y generation engage in sharing information about employment conditions when they were inspired by questions posed by other media users (6% of responses). A negligible percentage of people from other generations (X - 3% of responses; Z - 3% of responses) is driven by this motive of sharing information about employment.

In order to verify H3, correlations were calculated between various situations affecting the negative evaluation of the employer in social media, and the age of the respondents and the type of their employment status. The performed correlation proves the existence of a statistically significant relationship between the analyzed variables. Hypothesis 3 was confirmed. The results are presented in Table 4.

Table 4: *Situations determining the negative assessment of an employer in social media by representatives of different generations*

Description	X	Y	Z	χ^2	α	H	E	FE	NP	χ^2	α	H
Low salary, not in accordance with the contract	13 %	17 %	6%	36,44	0,05	H1	10 %	12 %	14 %	17,16	0,05	H1
Authoritarian superior having a negative impact on the well-being of the employee	3%	10 %	12 %	39,58	0,05	H1	13 %	4%	8%	12,02	0,05	H1
The toxic atmosphere in the company	7%	3%	3%	39,79	0,05	H1	6%	3%	4%	2,43	0,05	H0
Excess work responsibilities that make it difficult to maintain work-life balance	1%	17 %	7%	46,60	0,05	H1	9%	5%	11 %	2,11	0,05	H0

Source: Own study

The χ2 test showed that the situations determining the issuance of a negative employer's opinion in each examined case showed a statistically significant dependence on the age of the respondent. On the other hand, the correlation with the respondent's status was shown by the points concerning low salary and the authoritarian superior. The other variables did not show such a relationship. There are several reasons that determine the activity of users in social media in terms of sharing negative information about the employer. Research shows that low remuneration, inconsistent with the contract, is the main reason why 17% of Gen Y, 13% of Gen X, and 6% of Gen Z will decide to post negative comments about the employer online. According to the survey participants - 12% belonging to generation Z, 10% from generation Y and 3% representing generation X, may make a negative assessment of the employer for being an authoritarian boss who has a negative impact on the well-being of subordinates. Moreover, the atmosphere unfavorable for the fulfillment of professional duties, according to the respondents, may contribute to issuing unflattering comments to the employer (X -7%, Y-3%, Z-3% of responses). It is worth remembering because it is the employer who should react when he notices that there is a bad atmosphere in the company, which makes cooperation between employees difficult.

Another aspect of the professional life of respondents commented on on social networks in which they openly criticize their employer concerns the excess of employee duties that make it difficult to maintain work-life balance (Y - 17%, Z- 7%). This approach to this issue results from the expectations of the young generation towards the employer. It is worth remembering that for an employee of the Millenials generation, work is important, but not the most important thing, what counts for them is work-life balance.

On the other hand, publishing information on the Internet about the performance of duties will not be understood by the employer, and may even work to the employee's disadvantage. Due to his breach of his duty to keep the information to himself, the employer may legally claim reimbursement of the benefits obtained. In order to avoid the above situations leading to a breach of the company's secret, the employee should be informed about the consequences of harmful actions in the confidentiality declaration, which should be an attachment to the employment contract.

5. Discussion

The obtained research results show that representatives of various generations are active in social media in terms of sharing information about the company and the employer. There are several reasons why survey participants join social media to exchange information about the employer. However, the main reasons are: observing information about employment conditions in social media (Y-28% of responses) and the need to share information with other people (Y-11% of responses). Users of social networks post on them various types of entries in which they boast about their professional successes, most often Millennials (Y - 33%, Z - 20%), both employees of a given company (P-32%) and those already in it they do not work (BP - 19%). Disclosing even favorable situations for them may become the cause of problems related to the breach of the company's secret. Often on their social media accounts, representatives of the Y generation (24% of responses) publish photos of important events in the life of the company in which they were employed, as well as its former employees (14%). The results of this study are confirmed by the Weber Shandwick research from 2009, which made people aware of the scale of threats to the company's image that result from the activity of current and former employees in social media. The most frequently mentioned threats include: leakage of confidential and important data to the network; use of private e-mails or other digital messages against the company; unfavorable entries and comments about the company's activities (Weber Shandwick, 2009). The question arises here: Do people who post entries about working conditions wonder that they are not anonymous and that by disclosing confidential information they may contribute to the loss of the company's good image? In order to prevent the appearance of reprehensible employee behavior on social media, the business owner should determine in advance what information sharing activities are acceptable or unacceptable. Hiring an employee should be associated with the need to read him / her and sign a confidentiality clause (Leśniak, 2021).

This research shows that Millennials are willing to be active in social media in terms of exchanging negative opinions about their employers (Y-36%, Z-16%) and former employees of the company (19% of responses). It can be assumed that employees, by posting comments on the web slandering their employer in order to expose his weaknesses in creating working conditions, try to put pressure on him to try to meet their requirements. It is worth remembering that such activities seriously violate the obligation to care for the good of the company. And such a good is precisely the positive image of the company created in the public space, exemplified by social media.

In the context of the above, it is worth quoting at this point the results obtained from IMM research, which indicate the negative feelings expressed by employees in the network towards their superiors. According to the research, 25% of respondents who post entries about the workplace in social media consider their superiors' flashpoint. Of the 1,000 comments made about management, half were negative. The main accusations against them were that "employers do not appreciate, complain forever, are not understanding, they care mainly about profit" (imm.com). IMM research also proves that in Poland each year many thousands of complaints expressing frustration of employees can be found on social networks, mainly due to the poor working atmosphere, unsatisfactory earnings, and poor health impact of work performed. Similar conclusions are drawn from this study that the following factors are the main reasons for giving the employer a negative assessment in social media: low salary (Y-17% of responses), authoritarian superior having a negative impact on the employee's well-being (Z - 12% of responses), excess of duties in work hindering maintaining work-life balance (17% of responses), unpleasant atmosphere in the company (X-7% of responses).

As this research shows, people from the oldest age groups (X- 20%, Y- 20%) and with the status of an employee of the company, satisfied with the terms of employment, feel the need to exchange favorable comments about the employer. The analysis of the research results shows that mainly Millennials (Y - 25% of responses, Z - 21% of responses) and most often people with the status of a company employee (27% of responses) contribute to social media in terms of entering comments under the employer's official post or current comments employer's actions (Y - 38% of responses, P - 31% of responses). Even the use of recordings from integration meetings outside the workplace becomes the share of the Y generation (22% of responses) and people with the status of company employees (19% of responses).

It can be concluded that if people satisfied with the employment conditions see the need to publish positive opinions about the employer, they most clearly perceive the company's activity through the prism of attractive opportunities for professional development. Although their online presence may be dictated by the desire to build a positive image of the employer, they should not disclose details of activities that are within the scope of their professional duties. Improving employees' awareness of the risks related to the disclosure of confidential information will help protect the company from negative consequences that could be incurred. As the experience of Maspex shows, a threat for its owner may be the activity of employees in social media for promotion in favor of the employer. The company "placed infographics that can offend the participants of the Warsaw Uprising. This action led to a boycott of the brand and sparked a lot of debate about provocation in advertising. The author of the infographics was a professional marketing company, however, the approval of the projects flowed from the company's employees. Despite immediate apology from the owner, the information was read within a few hours all social and news sites. As a result, the profile on the site social network Instagram has been removed, and cooperation has also been abandoned with the agency responsible for the publications, and the employees were fined. As part of the half a million zlotys was paid to the Warsaw insurgents ”(Szwajca, Prandzioch, 2018, p. 85).

As labor market experts rightly point out, employees should be made aware of the fact that social networking sites cannot be used to discuss employment conditions. Employees should know that their suggestions for improving the company's activities in creating new solutions for them should be submitted inside the company of which they are an integral part (Paruch and Rogatko, 2021).

6. Conclusions

The aim of the research was to verify the activity of representatives of various generations that they show on social networks in the context of their professional work. The results of the research were used to identify selected aspects of their professional everyday life, prompting reflection on the Internet forum in the areas requiring improvement. As the results of this research show, the activity in the area of sharing information about the employer on Facebook, Instagram and Twitter is related to age. Their users are mainly representatives of Millennials. Facebook is used by the most people from the Y-47% generation, followed by people from the Z-28% generation. Instagram is most often used by people in the Y age group (37%), slightly less often by people in the Z group (23%).

The most numerous group of Twitter users are people from the Y generation (15% of responses) and the Z generation (11% of responses). In the case of the respondent's status, the use of each type of social media surveyed showed a statistically significant dependence on whether the respondent was an employee of the company, its former employee but employed by another employer, or a person currently unemployed. Research shows that people with the status of company employees want to appear on Facebook the most - 38% and 35% of people who are currently unemployed. They attach great importance to presenting their views from the current or previous professional life. On Twitter, people who are currently unemployed - 6% more often share information about their professional life than former employees of the company who found employment with another employer (4%).

This may be because you need to strengthen your self-esteem to gain recognition from other people. Perhaps they want to share information with the community to generate interest in themselves, so that they can be seen as active in their job search according to their expectations.

Among the users of the Instagram social network, there are more people who are currently unemployed (29%) than former employees of the company but still professionally active (23%). Taking into account the type of

entries posted in social media, it should be noted that most often Millennials (Y - 33% of responses, Z - 20% of responses) boast about their successes in their professional life.

Apparently, this means that they are proud of them as they have the opportunity to influence the results achieved by companies. It is worth increasing their awareness that posting entries about professional successes entails the risk of disclosing a company secret. Publishing photos of important events in the life of the company equally becomes the participation of seniors from generation X (15% of responses) and the youngest generation Z (14% of responses). But do they think that they should have the right to use them? If not, they may face official liability for breaching a non-competition agreement. It is worth remembering that the right to post photos from the company's life in public space is only granted to it. It is up to the company to decide whether or not to use them. Millennials (Y- 36% and Z - 16% of responses) as well as people currently unemployed (28% of responses) and former employees of the company employed by another employer (19% of responses) declare their readiness to introduce negative opinions about employers.

Often, losing a job results in users of social networking sites taking up activities in order to post critical statements about the employer on issues related to: autocratic style of team management, low salaries, an atmosphere that makes it difficult to complete tasks and work in a team, excess work duties that make it difficult to maintain work-life balance. It should be noted that if the conducted criticism leads to the humiliation of the employer in the eyes of the public, it exposes him to the loss of trust necessary to build and maintain a positive image, which is a condition for the stable functioning of the company in its environment.

When making decisions about expressing critical remarks towards the employer, the employee should be aware that offensive opinions and unfounded accusations against the employer exceed the limits of the applicable law and lead to the termination of the employment contract. Among the motives for expressing unflattering information about the employer on the forum, the respondents mention the will to share it, resulting from their personal needs (Z - 21% of responses). It is the Millennials from the Y age group (28% of responses) who also lead the way in the exchange of information about working conditions, because they noticed such activity in other users of social networks (15% of responses) and were inspired by questions from other people active in the virtual space (6% of indications).

Taking into account the above considerations, the company's ability to develop a strategy to deal with undesirable activity of employees in social media is of particular importance. The solution in this case may be the introduction of appropriate regulations in the workplace, specifying what behaviors in the field of social media are not accepted by the employer.

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Exploring Social media Knowledge as a Means for fighting Corruption in CEE Countries

Mohammed Ibrahim Gariba [1], Solomon Gyamfi [2] and Vita Jukneviciene[3]
[1]Institute of Economic Sciences, Faculty of Economics and Administration, University of Pardubice, Studentská 84, Pardubice, Czech Republic
[2]Institute of Economic Sciences, Faculty of Economics and Administration, University of Pardubice, Studentská 84, Pardubice, Czech Republic
[3]Institute of Regional Development (Business and Public Management field) Siauliai, Lithuania
Garibaibrahimbabangida@gmail.com
solomon.gyamfi@upce.cz
vita.jukneviciene@sa.vu.lt
[1]https://orcid.org/0000-0002-5358-0155
[2]https://orcid.org/0000-0002-3258-1095
[3]https://orcid.org/0000-0001-5910-3010

Abstract: It is evidently seen that social networks are assessed widely in recent times as a means of sharing knowledge, and more importantly, resist control from influential entities compared to the regular media. Social media fight corruption by making information readily available in the form of analysis, endorsements, and through campaigns and collaboration. For this reason, some researchers are increasingly interested in how knowledge of social networks impacts our society leading to corruption reduction. In this paper, we explore the contribution of the knowledge of social media networks in reducing corruption within CEE countries. Regression analysis is employed to analyze an eighteen-year panel data (from 2002 to 2020), using secondary data from the World Bank, the World Press Freedom Index, and Transparency International of the selected CEE countries. We analyze social media variables such as social media usage, cultural tightness looseness (CTL) as independent variables and used press freedom, political stability index, and GDP per capita as control variables. Also, with corruption as a dependent variable, we used control of corruption index (CCI) and corruption perception index (CPI) to ascertain the social media network effect on corruption reduction. This article contributes to the existing knowledge by discovering the unique role that social media knowledge plays in reducing corruption in CEE countries. The result has shown that both social media usage and CTL significantly affect corruption and its reduction. In addition, it allows us to propose some practical implications for policymakers.

Keywords: social media; Corruption; CEE; Knowledge; Regression Analysis

1. Introduction

Corruption has been the bane in many states of the world. Most affected regions are developing and emerging states whose economies are transitioning from weak institutions and infrastructure to combat corrupt practices of public officials and politicians. Corruption has been defined as an act of using state offices and power for the private gains of a public official (Ahmad, 2012), which culminates in rent-seeking behaviors of public officials and abuse of state resources. Many effects of corruption have been discussed widely among researchers, political, and civil society organizations. The general conclusion is that corruption lowers the growth of the economy while, it leads to disregard for the democratic rule of law. Other effects of corruption include deterioration of economic confidence (lack of investment) and disrespect to state institutions (bureaucratic inefficiencies), which poses a grave challenge to societies in the world.

The significance of social media knowledge in ensuring active participation in decision making and engaging in civic responsibility cannot be underestimated in recent discourse (Shaw et al., 2014). At the same time, culture serves as the social fabric and architect of the behaviors of social actors. In this context, this paper examines whether social media usage and CTL have a potential impact on the level of corruption in CEE countries (Meyer-Sahling and Mikkelsen, 2016). Tang et al. (2019) in their research on the effect of social media usage on the control of corruption and the moderating role of cultural tightness looseness, examine how social media usage reduces corruption in 62 countries, with data covering the period from 2011 to 2015. The analysis finds a positive correlation between the analyzed variables (social media effect on corruption control). The researchers indicate limitation of the study is however that of data unavailability. This research responds to the call for future research to explore further the association between social media usage and CTL on corruption.

Moreover, research exploring the role social media blogs play on reducing corruption in Russia through panel regression analysis found a positive significant relationship. The weakness of this study is the reliance on quarterly data for analysis (Enikolopov, Petrova and Sonin, 2018). By way of filling the gap, the current study employs annual panel dataset of the selected CEE countries. Jha and Saranji (2017), studied the impact of multiway means of communication on corruption by exploring the link between social media represented by Facebook network on corruption in a cross-sectional analysis of 150 countries and found a negative significance. The limitation of the current panel data on social media usage restricts the studies to only cross-sectional analysis. The need to explore more social media variables was highly recommended of which this study employs

As elaborated, most of the studies have concentrated on just social media impact on corruption and most often relied on a single measure for social media using types of social media tools like Facebook network, Twitter, Instagram, to assess social media usage effect on corruption. However, the question of whether the knowledge of such networks (social media usage, CTL) to corruption in a model remains unanswered. Based on this gap, this study seeks to bridge the gap by using composite variables which were calculated from different set of factors based on the survey conducted. This research aim is to explore how social media knowledge and Culture Tightness-Looseness contribute to reducing corruption in CEE countries.

To the best of our knowledge, less to no study explores the link between knowledge of social media and corruption in CEE countries. This study will give policy experts and the EU some implications to support and improve on the reduction of corruption. 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 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 OLS findings and Discussion. In Section 5, we present the conclusions and recommendation.

2. Literature review

2.1 Corruption and its menace

Many factors have been said to influence corruption in many parts of the world. Corrupt practices manifest in predominant acts of giving and receiving bribes (both within the private and public sectors of the economy), government procurement irregularities, and lack of transparency in the decisions of government officials (Šumah, 2018; Tang et al., 2019). Uberti (2018) suggests corruption as mostly determined by the developmental levels of the state. However, corruption may manifest within the institutional, economic, and socio-cultural context of the state as well. Growing empirical literature finds the lack of fiscal prowess of nations, the small size of formal sectors, and the per capita income levels of people in the informal powers within the developing states to contribute to the perceived corruption (see for detail review Luiz and Stewart, 2014; Uberti, 2018). More so, the level and quality of institutions play a major role in corruption perception. Openness and transparency of government officials and adherence to the rule of law within democracies turn to reduce rent seeking, but also the strong engagement of citizens and media in recent studies have proven to minimize corruption perception of the public (Kolstad and Wiig, 2016).

Within the context of the research area of this study, many scholars have attributed corruption perception to be based on the culture, institutional, and political dictates of the communist and post-communist transition state (Mavisakalyan, Otrachshenko, and Popova, 2021; Karklins, 2016). Particularly, the communist state with central planning and regimental social welfare failed in curbing corruption aberrations. In that, elites of the political class use their privilege to *cut corners* and skip the bureaucratic exigencies of getting things done. Whereas many middle-class elites have benefited through corruption reward of the political class for legitimation (Sumich, 2008; Sumich, 2016). The trend has carried on to the post-communist era and the transition states have had perceived corruption among the populace.

Many of the recent empirical research analyze the historical connections vis-à-vis the contemporary factors of how institutions have evolved and shaped in the CEE countries. More so, institutional evolution has been the causative factors of social change and the degree of influence from the historical antecedent. Even so, no consensus can be reached in that regard. Nevertheless, more concentration is placed on the effect of corruption and its causes as well as modern tools to help curb the menace of corruption, which are readily at play. Our

focus is therefore on contributing to the hypothesis of social media network effect on corruption reduction. Many suggestions have been propounded for curbing the menace of corruption. Such of these tools is the e-governance system (Muhammed, 2014; Aerin et al., 2021; Ali et al., 2021) media and technology (Jha and Sarangi, 2017). ICT usage enables information storage, access process and transmit same for the purpose of its usage. Hence, media's role in corruption reduction cannot be taken lightly.

2.2 The fourth estate- the spectacle of social media

Social Media in the wisdom of the pioneers of the early democracy affectionately referred to as the fourth estate provides watchdog role in ensuring the functioning of democratic rule, which was established as an important pillar of government. The idea is to keep citizens informed and provide feedback to government for corrective actions whilst setting forth varying (but factual) opinions to that of an individual in public discourses. In the end, to strengthen the knowledge base of the society. Social media as household name in the media field gained prominence recently about two decades ago (Sajithra and Patil 2013). Social media has evolved from World Wide Web (WWW) era to Blogs and by the advent of supercomputers, networking apps and programs have made it possible (for detailed analysis see Kaplan and Haenlein 2010).

The spectrum of social media applications in recent times makes it impossible to define. However, distinctions can be made about the most prominent ones like Facebook, YouTube, twitter, snapchat and just recently Tik Tok. Social media (social networking, content creators and Blogs) can be categorized based on the social presence and the richness of the content with their functionalities (Kietzmann et al., 2011). These two attributes have great influence on social life of people. Thus, unlike the traditional media, the frequency and directness of social media influence social lives of people. Together with the richness of social media, societal discourses are broken down to the understanding of all people, aiding in easy digestion of policies of government and participation in public discourses as well as people making choices of their own (Suwana, 2020).

In the same way, social media with the element of presence and richness can influence the behaviors of public officials or expose their corrupt activities to the society. Social network sites such as Facebook and content creators' platforms like YouTube enables quick spread of information like organization of civil demonstrations and campaigns against decisions of power. At the same time, governments all over the world have adopted these platforms to propagate government's policy agenda and testing the general feelings of the entire society about plans and project in e-governance system.

2.3 Social media usage and corruption

In this section, we concentrate on the rapidly growing media usage and social media activities of *netizens* (internet users) as a key tool to enable anti-corruption campaigns. Current studies have found convincing evidence of the role social media play to succumb the menace of corruption in society. Through anti-corruption advocacy, netizens can reach out to many citizens within the shortest possible time and engage in collaborative campaigns by offering platforms for people to participate in the discourse of the state. While empowering them to expose and call out rent-seekers, in effect helping to control corruption (Oh et al., 2013; Kane et al., 2014).

Thus, social media brings to light the dark world of corrupt officials in exposé. In a recent study, Tang et al. (2019) measured social media usage effects and corruption reduction moderated by cultural tightness looseness. They observe that cultural tightness looseness moderate social media usage, and corruption negatively. What this means is that cultural fabrics of the society such as weak institutions with malfunctioning media serves as an enabling environment for corrupt officials. However, strong institutions and vibrant media curtails corruption. Perceived corruption of public officials can be influenced by social media usage in an open society with cultural looseness. Thus, the less opened the economy and culture of the people, the less social media usage can influence corruption.

The empirical analysis suggests that high levels of usage of the internet correlate with low levels of corruption. Information was scared and even when available, run through the elites or cadres of the political rulers in the communist regimes. Howard, Agarwal, and Hussain (2011) indicate that information censorship was prevalent within the centrally planned states for political and economic power preservation. More recently, internet and social media usage within the CEE countries have improved significantly providing a great avenue for public debate and exposé of corrupt officials. However, the demand for information resources in the post-communist era has seen remarkable growth amidst the optimism and hope for exchange of ideas and less restrictive diffusion of information, yet many are confused about the use of social media usage.

The denial of the closed society of the then CEE to the information world proved unworkable, but the quick adoption of internet usage tremendously has enabled the people to be engaged in the political and development process of the state. Unlike the censored media, the current external influence of media has served as watchdogs on the fighting of corrupt practices in societies through investigative news and reportage. This encourages collective action of citizens and sense of accountability of political leaders.

Indeed, Social media knowledge has propelled civil society to ensure accountability of the ruling class. Most importantly, the freedom of press in the post-communist era enabled the fight of corruption as evidenced by empirical research of Price (2019). Despite the historical and socio-economic connections within the CEE countries, research at various levels has been scanty on media usage at various levels (Burlacioiu, Boboc and Sava, 2018). The greater attempt by the CEE countries to disentangle themselves from the umbilical cord of communist corruption behaviors is prevalent in the study of Takacs-Haynes and Rašković (2021).

2.4 Cultural tightness-looseness and corruption

The above findings of Takacs-Haynes and Rašković (2021) lead us to the concept of cultural tightness looseness and its role in corruption reduction as a factor in tandem with the media in effectively promoting anti-corruption campaigns. One may be tempted to lump all CEE countries to the same culture. However, there exist cultural variations and the dimension of influence on corruption eradication in society. Conceptual studies have defined cultural tightness looseness as the capacity of the norms of the society in prescribing punishment, which has to do with factors such as the various socioeconomic strata of the society (Li, Gordon, and Gelfand, 2017; Tang et al., 2019).

In their study, cultural tightness looseness was used and found to negatively moderate the effect of social media on corruption fights. Their findings assert that the cultural norms influence behaviors of individuals including those with political power and serves as conduit for proper or corrupt acts. In the current research, we have used cultural tightness, looseness as one of the explanatory variables in determining the reduction of corruption (fight/ perception). Social norms are powerful external forces by which individuals get influenced and act on. These are inexplicable forces external of the individual but controls all actions and inactions of social actors based on the classical sociologists' account. Cultural tightness looseness deals with the pervasiveness and tolerance levels of behavior in society.

Extant research has found cultural tightness to exhibit strong social norms with low tolerance for deviant behaviors. On the other hand, societies with cultural looseness possess weak norms with high tolerance for deviant behaviors (Gelfand et al., 2011; Harrington and Gelfand, 2014). In this way, acts of corruption may be punished differently depending on the cultural spectacle of the observer and the domain of the individual. Tight cultures are intolerant of deviant behavior with higher incarceration of people for deviant acts. Same goes for corruption within political elites and public officials in the tight society. In such societies, social media usage may be used for exposing corruption activities due to the environmental and larger societal collectivism on compacting corruption (Harrington and Gelfand, 2014).

This way, corruption perception would be minimal and public officials will be required or discouraged from engaging in corrupt practices. There is a sense of responsibility to fight corrupt activities of officials as well as the Judiciary within the governance system of the state. On the other hand, the culture with the looseness trait gives leeway and tolerance of pervasive deviant behaviors by societal members. However, as reported by Tang et al. (2019), other empirical findings point to the fact that, in some tight societies, corruption may be tolerated, this makes the findings of the effect of cultural tightness-looseness inconclusive. This suggests that the cultural tightness-looseness relationship with the perceived corruption of the state officials and public employees is not in synch, hence our research seeks to add to the ongoing literature on this field by making cultural tightness-looseness an explanatory variable instead of moderating.

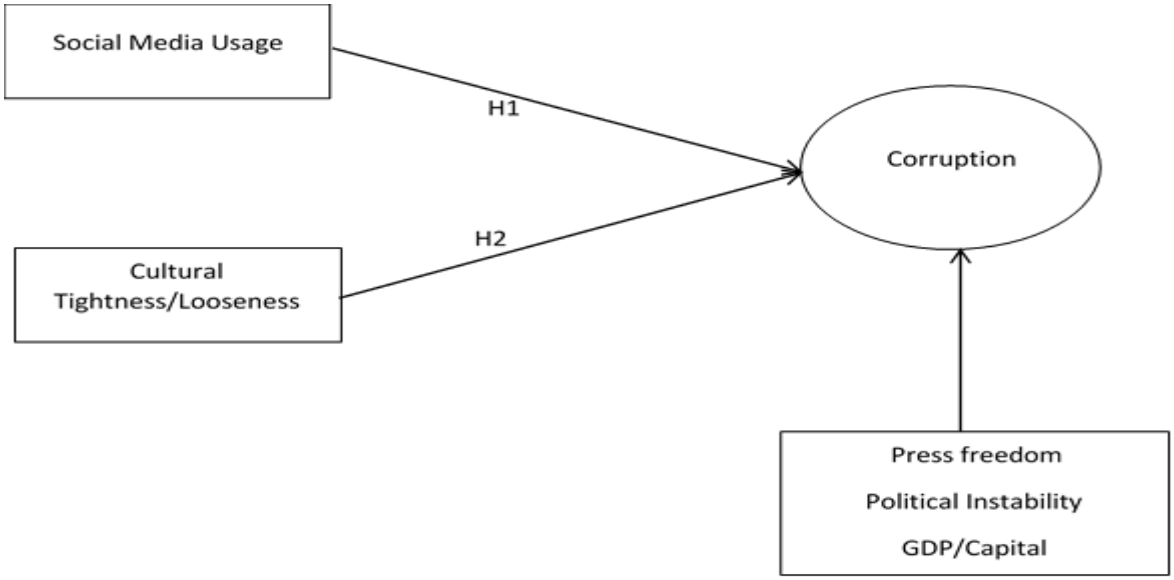


Figure 1: conceptual framework

The above figure shows the conceptual framework of the analysis on how knowledge of social media networks contributes to reducing corruption within CEE countries. Based on the reviewed literature, the following hypotheses have been formulated.

***H_1**: Social media network knowledge significantly affects the perception of corruption and corruption control in the CEE countries.*

***H_2**: Cultural tightness looseness significantly affects the perception of corruption and corruption control among the CEE countries*

3. Data and methodology

3.1 Research Design

The main objective of this research is to ascertain whether knowledge of social media networks and cultural tightness-looseness contribute to reducing corruption within Central and Eastern European countries (Albania, Bulgaria, Czech Republic, Estonia, Hungary, Lithuania, Latvia, Poland, Romania, Slovakia, and Slovenia).

We relied on quantitative research design in conducting this research using the Ordinary Least Squares (OLS) regression modelling (Martinez- Vázquez, Lago-Peñas and Sacchi, 2017) in accordance with Montgomery et al. (2012), the OLS 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 World Bank, Transparency International and Reporters without Borders. The research uses World Bank official website for data collection purpose on GDP per capita, political stability index, Control of corruption index, and social media usage (Jha, and Sarangi, 2017). Transparency International and Reporters without Borders data on the Corruption Perception Index and Press Freedom index were collected for this analysis. For Data regarding the Cultural tightness looseness (CTL). We adopted the data and methodology initiated by Gelfand, Nishii, and Raver (2006). Cultural tightness looseness encapsulates items on a scale of 0 to 10, where the most culturally tight society receives a 0 and the loosest gets 10 assessed by the clarity and number of social norms, the degree of tolerance for norm violations, and overall compliance with social norms in each nation. We used pooled data sets spanning eighteen calendar years, specifically 2002 to 2020, and a sample of 11 CEE countries as is the case of (Krishnan and Lymm, 2016). The sample used for the empirical model specification consisted of all Central and Eastern European member countries except Croatia, the reason being that most of the economies are in transition to the open capitalist market system, and with their historical connections, as well as poor recent performance score from the corruption perception index. The analysis realized 341 numbers of observations. The table below shows the variables used for the empirical, analysis.

Table 1: Descriptive statistics of variables

Variables	Description	Sources
Control of Corruption index (Dependent)	This captures perceptions of the extent to which public power is exercised for private gain, including control of the state by powerful and private institutions in %.	Asongu, (2012)
Corruption perception index (Dependent)	The notion of scores and ranks of countries based on how corrupt the countries public sector is perceived to be by experts and business entities.	Transparency International, (2007)
Explanatory variables		
Social Media Usage	Focuses on how social media services such as Instagram, Facebook, Twitter, LinkedIn, etc. are used by individuals for both personal and professional purposes in a country.	Nam, (2018); Larosiliere, Carter, and Meske, (2017).
Cultural tightness looseness (CTL)	Measures the degree and variance in social norms, the degree of tolerance for norm violations, and overall compliance with social norms in each country	Gelfand et al. (2011); Uz (2015)
control		
Press Freedom	Measured by comparing the level of press freedom enjoyed by journalists and media in countries based on scores and evaluated using five contextual indicators, i.e., political context, legal framework, economic context, sociocultural context, and safety.	Camaj, (2013).
Political Instability	Measures Perceptions of the likelihood of political stability and political motivated violence, including terrorism.	Data.worldbank. org, (2017); Tang et al., (2019).
GDP/Capital	GDP per capita (logarithmic value).	Bai et al., 2020

Source: Author's own adaptation

Mathematically, the OLS 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.

Using the Gretl statistical package, we controlled for corruption using GDP per capita with the assumption that countries with higher GDP per capita growth or wealthy nations should be deemed less corrupt as they are able to afford a better and efficient institution to control corruption (Kolstad, and Wiig, 2009). More so, we also used the level of press freedom and political instability to control for corruption with the notion that countries with greater press freedom and political stability may see a drastic fall of corruption because of the free and independent media and exercise of political rights and freedom (Karnane, and Quinn, 2019).

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 2 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 55% and 51% of the variance is explained in both models based on the R-squared figure.

4. Results and Findings

As hinted above, the accuracies predictive power of our analysis shown in Table 2 are 55% and 51%, 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, 1988). The predictive accuracies show a statistically significant power with the constant variable positive and highly significant.

This study investigates and explores how knowledge of social media networks contributes to reducing corruption within CEE economies. We first analyze empirically the impact of social media knowledge thus social media

usage and cultural looseness tightness against CCI and CPI to ascertain the nature of the relationship and the effect it has on corruption within CEE countries.

The results of the impact of each of the measures of social media knowledge on corruption are shown and presented in Table 2. Model 1 tests the hypothesis that social media knowledge (social media usage) has a significant effect on corruption. The evidence from the results of the analysis supports hypothesis H1 with a highly significant coefficient. Thus, the results show that knowledge of social media usage in the CEE countries has a significant high influence on corruption in models 1 and 2, with both showing an expected negative coefficient. The results prove that when government policies are targeted at increasing the citizens usage of social media networks, through acquisition of advanced technologies and reducing the cost of internet, it is likely to increase the level of advocacy, calls for accountability and transparency. This will have positive effects on the levels of corruption activities leading to reduction of the canker. As can be seen, social media usage influences corruption control and perception in a significant way.

Subsequently, we also tested for model 2, by testing the preposition that knowledge of social media (and cultural tightness, looseness) has a highly significant effect on corruption.

Table 2: Results

Dependent Variables→	*Control of Corruption index* ***(Model 1)***	*Corruption perception index* ***(Model 2)***	***VIF***
Independent Variable/ Control C	*Coefficient*	*Coefficient*	
Constants	*41.33070**** *(3.19974)*	*49.4322**** *(1.95356)*	
Social Media Usage	*−5.18435**** *(1.17654)*	*−5.44495**** *(7.18321)*	*1.133*
Cultural tightness looseness CTL	*0.22253**** *(0.03699)*	*0.13368**** *(0.02258)*	*1.854*
Press Freedom-C	*−0.56238**** *(0.08079)*	*-0.30356**** *(0.04932)*	*1.778*
Political Instability-C	*0.08855*** *(0.04090)*	*−0.07441**** *(0.02497)*	*1.339*
GDP/Capital-C	*0.00072**** *(8.32045)*	*0.00040**** *(5.07993)*	*2.075*
No. of Observation	*341*	*341*	
R-squared	*0.552040*	*0.505410*	
Adjusted R-squared	*0.545354*	*0.498028*	
F-statistics	*82.56703*	*68.46584*	
Prob(F-statistics)	*0.000000*	*0.000000*	
Prob (Homoscedasticity)	*4.87108*	*3.59645*	
Akaike criterion	*2581.179*	*2244.667*	

***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.

The result of the analysis further shows a positive relationship between CTL in all models, which confirms hypothesis H_2 that, cultural tightness looseness significantly affects the perception of corruption and corruption control among the CEE countries.

The relationship suggests that, with a high level of significance at 99% confidence interval, in a too close culture, corruption is likely to increase, and advocacy not be tolerated or non-existent. Unlike the case in model 1, significant improvements in corruption can be attributed to the dictates of CTL. More so, there is a positive correlation between CTL, CCI and CPI, which signals that there is the likelihood of countries with loose cultures to experience an increase in corruption likewise a tendency of a decline in corruption due to free social media advocacy the tight cultures give credence to. To reduce the level of bias in our empirical results, we controlled for corruption using press freedom, political instability, and GDP per capita. 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 and Conclusion

Our study followed enormous rich contemporary research on corruption and social network analysis, which has used the CPI indicators and social media knowledge diffusion (Jha and Sarangi, 2017). Determinants of corruption can be economic and noneconomic. The controls used, such as GDP, helped to control for the cross-economic differences and how the development levels of the different CEE countries influence the corruption perception. Press freedom has been a key determining factor in the fight of corruption. Hence, we controlled for the influence this factor may have on the perception of corruption in the CEE countries. Likewise, political instability is associated with corruption due to the breakdown of the political system, giving way to malfeasance and abuse of the system by the individuals who took down the system. The same can be said for the CEE countries, except that the experience of the breakdown of the Iron Curtain allowed for the powerful middle class and political cadres to amass wealth, which may influence corruption in the CEE.

The significant effect of social media knowledge and corruption perception and control corroborates previous findings like Jha and Sarangi (2017) whose study found a negative correlation between Facebook penetration and corruption. In other research, Tang et al. (2019) concluded that social media usage influences the level of perceived control of corruption. Their analysis also controlled for other factors which were employed in the current analysis, such as GDP per capita, press freedom, and political stability. In a discourse analysis, Frolova et al. (2017) conclude that mass consciousness of people through social networks attributes to the reduction of corrupt behaviors. It is believed and empirically found that people find their civic voices and can engage in civil political discourse using social media, but corruption reduction programs and attitudes are also culturally influenced. Our research has proved that in consonant with the work of Harrington and Gelfand (2014), cultural tightness looseness significantly affects how corruption is perceived and dealt with in terms of controlling the menace.

The current research has contributed to the growing amount of literature in the empirical analysis of social network knowledge and the control of corruption. In the study area, especially, some CEE member states perform worse after the most corrupt states in the CPI indexes, which are released annually. At the same time, we have been able to show that social media knowledge and usage critically help to control corruption. Most significantly, in lieu of Tang et al. (2019), the call to encourage research in CTL. The current study has shown that cultural norms which has to do with the capacity of the norms of the society in prescribing punishment to deviant behaviors have positive and significant effect on the fight and prevention of corruption. Within the CEE countries, social media usage has improved astronomically, however, there exists the lack of nexus between the usage and knowledge of social media tools in combating corruption. We therefore recommend that; more and stricter rules should be instituted coupled with strict monitoring and evaluation of policies directed at combating corruption to ensure fair and equitable distribution of resources to curtail corruption. Improving access to internet and liberalization of media can help solve the menace of corruption in the analyzed countries. Citizens in the analyzed states must use social media in forcing political powerholders to be transparent by ensuring fundamental principles of good governance for decision making.

In conclusion, combatting corrupt practices of public officials and politicians demands a critical innovative tool. The traditional legal regime through the judiciary is unable to curtail the canker as the corrupt nuts can find themselves to use the legal system to perpetrate corrupt activities and for protection against the punishment of the society. The result has shown that both social media usage and CTL significantly affect perceived corruption and its reduction.

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Local ICT Firms' Perspective on Planning Cooperation with city Government for Innovations

Konrad Głębocki
Częstochowa University of Technology, Faculty of Management, Częstochowa, Poland
konrad.glebocki@pcz.pl

Abstract: Local ICT firms can play an important role in creation of innovations which could support a smart city concept realization in a city. The topic of the paper is to present details of local ICT firms' perspective on cooperation with city government for production of innovations important in a smart city concept realization. There is a research gap in up-to-date studies concerning such a topic. Motivation of the author in preparing the paper was to make a step forward to fill this research gap through realizing the article's main objective which was to answer the following question: 'What is the perspective of local ICT firms and what are their expectations in the mentioned cooperation to result in production of innovations useful for the city?' An additional question was 'What is the attitude of local ICT firms towards inviting big international leaders in smart city projects for cooperation in the ICT industry?' Critical research of the paper is first of all of empirical and qualitative nature. A review of the current international literature was of preliminary nature. The review was carried out in respect of a smart sustainable city, ICT innovations and public management, ICT innovations and their sustainability. The study concentrated on the case of the Polish city of Częstochowa. Semi-structured interviews were carried out with managers of six ICT local firms or units located in Częstochowa. The findings of the paper include a set of expectations of local ICT firms useful for city governments in planning cooperation with ICT firms for innovations. In analyzing the perspective of local ICT firms an important element was their attitude towards inviting big international leaders in the ICT industry in smart city for cooperation by the city government. The boundaries of the paper of the above nature limited its scope to the perspective of local ICT firms leaving outside e.g. the analysis of the city government perspective. In the future, the studies should be developed on: creating a comprehensive model of strategic planning of the cooperation between city government and ICT firms for Smart City sustainable innovations.

Keywords: Smart city, city management, ICT innovations, ICT firms, cooperation planning, sustainability

1. Introduction

More and more people live in cities which provokes wider discussion on what strategies the cities should develop not only to retain the current standard of living in cities but to improve it. One important way is to use new ICT technologies and work on innovations and especially sustainable innovations. The concept of "Smart City" seems to be a proper answer to these challenges. Some global companies like IBM or Cisco already are the leaders in development of smart city projects. The problem arises if local ICT firms are doomed to be only subcontractors, or they could bring their own input in creation of smart city innovations. Analysis of possible ways and forms of involving local ICT firms by city government into common work on ICT innovations for smart city realization could be useful for public administration and in particular city government when planning cooperation with private ICT firms for sustainable innovations. The objective of the paper is not only to systematize the aspects of planning such cooperation but also to build a set of recommendations for city government reflecting the expectations of ICT local firms. Taking into account these recommendations by city government could help in better and more effective cooperation between city government and local ICT firms.

The specific topic of the paper is to present local ICT firms' perspective on cooperation with city government for production of innovations important in a smart city concept realization. There is a research gap in up-to-date studies concerning such a topic. Motivation of the author in preparing the paper was to make a step forward to fill this research gap through realizing the article's main objective which was to answer the following question: 'What is the perspective of local ICT firms and what are their expectations in the mentioned cooperation to result in production of innovations useful for the city?' An additional question was 'What is the attitude of local ICT firms towards inviting one or more big international leaders in smart city projects for cooperation in the ICT industry?'

2. Smart Sustainable City

There are many definitions of Smart City. Smart City is a blueprint which is being realized in many cities, some of them with a strategic attitude as e.g. Manchester where two documents strictly related to digitization have been developed: The Greater Manchester Digital Strategy 2018–2020 (published in December 2017) and The Greater Manchester Digital Blueprint (published in February 2020). The first document named five priorities: inclusion, infrastructure, skills and talent, marketing and communications and growth and productivity and the

second one is about empowering people, enabling innovative public services, digitally enabling all businesses and developing and scaling digital business (Zhu, Shen, Ren 2022). Taking into account the broader notion "Smart Sustainable Cities" various definitions could be found. Kondepudi, basing on thorough research and analyzing 130 definitions, formulated the following one: "A smart sustainable city is an innovative city that uses ICTs and other means to improve quality of life, efficiency of urban operation and services, and competitiveness, while ensuring that it meets the needs of present and future generations with respect to economic, social and environmental aspects." (Kondepudi, 2016). This is probably the best definition of the term "Smart Sustainable City" because it captures crucial elements of the essence of a smart city which is sustainable.

3. ICT innovations and public management

For real progress in realization of the city ICT strategy a real challenge is an organizational and cultural issue including human resources especially in respect to lack of motivation and bureaucratic enforcement in a decision-making process. The research in the UK showed that the local authorities are good at utilizing new ICT tools from prominent suppliers. However, there is a lack of innovations because local authorities have no research and development departments responsible for the in-depth analysis of the future needs (Khilji, Roberts 2014).

ICT innovations are needed in cities in many fields: first, in the accounting field (in financial accounting, general accounting of economy-property, analytical accounting in financial or economic version) and second, in a management field (related to: productive resources – modes of purchasing, distributing and engaging various resources, HR in it; performance management with improving processes; needs of beneficiary both external and internal ones). Recent innovations in the ICT sector related to local authorities help in a decision-making process. Among them there are various groups: presentation engines, calculation engines, other engines of analysis (Fontana 2005).

The innovations are being developed in various city life elements which are within the sphere of public management. Up to date research concerns e.g. the factors influencing failures and successes of ICT innovations funded by state in higher education (Wopereis, 2005). Another field of ICT innovations is a city transport comprising tools to be used in e.g.: access to travel information, planning, sharing transport modes, comparing transport modes costs, making payments. In recent years there has been a big growth especially in smartphone applications (Gössling, 2018). In city transportations the catalogue could be even broader as it was indicated in the World Economic Forum Report Expanding Participation and Boosting Growth: The Infrastructure Needs of the Digital Economy e.g.: smart parking, and congestion counteractions. The report classified other fields for ICT innovations in smart city: Energy (smart meter and demand regulation, distributed generation integration, consumption visualization and behavior change), Water and Waste (smart water meters, distribution network control, leak detection, storm and flood management, consumption visualization and behavior change), Social (e-government, remote social infrastructure in health and education, safety and security, social city apps) and Buildings (homes, buildings and energy management systems, smart consumer appliances, peer-to-peer room sharing portals) (Kondepudi, 2016).

Research carried out in different countries brought to light a set of important aspects of the development of the ICT sector, its functioning, and eventually the role of public authorities. Beneath the short review is presented originating from various continents: Europe (the Netherlands, Austria, Poland and Switzerland), Asia (India), Australia/Oceania (New Zealand) and South America (Argentina).

In the Netherlands, part of ICT firms prefer locations outside big cities which are closer to suburban residential locations where their core workers live. However, there is a tendency in the country for spatial specialization in the ICT sector with some specialized activities being still located first of all in big cities (e.g. internet providers or multi-media firms) (Atzema, 2001).

In a sector of economy such as ICT innovation is treated as a key factor deciding the competitiveness of ICT firms. Because the innovation process must be fed with the flow of knowledge, firms rely on internal and external knowledge. In Austria the research showed that in case of a metropolitan region of Vienna ICT firms more often seek to access the external sources of technological knowledge predominantly at a regional level (for the market knowledge they tend to use international sources) in contrast to the case of much less urbanized Salzburg region

where ICT firms relied in both respects (technological and market knowledge) on international sources (Tödtling, Lengauer, Höglinger 2011).

Concentration of ICT firms could lead to clustering being the effect of bottom-up process or city/regional government initiatives. In Poland most clusters initiated by self-government overlap with real bottom-up processes. Public support for already developed ICT clusters (manufacture of computers, electronic and optical products, publishing including software publishing, telecommunications, computer programming, ICT consultancy and information service activities) makes concentration of resources easier in the places with high economic potential (Kowalski, Marcinkowski 2014).

In Switzerland the area of high innovations in the ICT sector is a region of Zürich. One of valuable trends there is existence of many private initiatives of the exchange of knowledge e.g.: Web Monday (Forum for interested in web – new possibilities, new ICT products, new start-ups and new ideas) or Rocket Park (serves typically for the exchange of knowledge between ICT firms) (Collm, Amman 2013).

A smart city concept realization could be started with the establishment of a city company in a form of public-private partnership like in India. In such a company not only representatives of public administration from the central, regional and local level are being represented but ICT consulting firms as well. Further consulting firms together with ICT companies could scrutinize the progress of Smart City concept realization in terms of effectiveness. The central role in the process however is played by Digital Command Center (DCC) as a city unit (Eichenmüller, Münßinger, Glasze 2021).

Not all ICT small firms introduce innovations. Those of firms which do it outperform other small ICT firms in the country in terms of sales growth and profits. Such a thesis had been confirmed in a study in New Zealand (Ng, Hamilton 2015).

In Argentina there are programs of public aid for local ICT firms. The example examined was the case of Cordoba with the program realized in the years 2003-2007. As it was confirmed by the research both direct and indirect effects were positive what has been reflected in terms of sales of the ICT local firms, number of employees' growth, wages and volume of export (Castillo et al. 2014).

4. ICT innovations and their sustainability, big ICT investors

Many ICT innovations related to transport have positive sustainability effects especially when they support growth of interest in sustainable forms of transport. However, ICT innovations could have an adverse effect in terms of sustainability because technological innovations usually enhance the growth of transport demand as a result of competitive travel (Gössling, 2018). Many innovations could diminish air pollution because of limiting a number of operations which will also bring down the costs. A good example is Sharjah, UAE, where Smart Bins and waste containers are fitted with battery powered, wireless sensors to measure the level of filling in real-time. This data is being sent to a cloud server for analysis and display. Collection costs are reduced by 20% as unnecessary clean-up is curbed (Kondepudi, 2016).

In general, sustainable innovations in the globalization era could be developed better if individual employees have developed their cultural intelligence. Employees' cultural intelligence has a significant positive impact on behavior set on creation of sustainable innovation in an organization (Li, Wu, Xiong 2021). In terms of the article's theme, the conclusion is that probably also in local ICT firms the higher cultural intelligence of employees the better the environment for creation of sustainable innovations. The second conclusion is that probably If local ICT firms are to be employed in cooperation with city governments and potentially with a big investor their employees' cultural intelligence is also important for creation of sustainable innovation.

Big ICT international firms (e.g. CISCO, IBM, Accenture) show a tendency to come to the city which would like to be smart when they potentially have a chance of becoming a strategic partner for a city. However at least in European cities that might be quite difficult also because of tendering procedures (Buuse, Kolk 2019). Potential cooperation schemes of local ICT firms-big international ICT firm-city government could be beneficial for local ICT firms. On the other hand, some analysis shows that in the ICT industry local innovativeness of indigenous ICT firms could significantly stimulate and enhance the process of creating innovations in the foreign big international firms as well (Wang, Guo 2017).

5. Methodology

The first review of international literature has been carried out to summarize, synthesize and systematize the arguments which appeared up to date in terms of the topic of the article. Then the case study approach has been used. The case was constituted of six chosen local firms of Częstochowa city. The firms represent various sub sectors of the ICT sector namely: ICT services, programming, ICT applications, software development, ICT equipment sales. Interviewed representatives of firms (Computer Center, Trustnet, Sol-IT, X-Com, Savangard – unit in Częstochowa, Grupa Lew) were owners in four cases and other in two cases: head of Częstochowa unit and member of board. Interviewed firms were SMEs ranging from firms having 20-50 employees, one was micro enterprise with 7 employees, and another was big enterprise with 1300 employees.

On the basis of the literature, a semi-structured interview scheme had been worked out. A semi-structured interview has been carried out in the form of a face-to-face meeting in which there were open-ended questions enhancing discussion with the interviewee. The questions were not sent before the meeting in order to receive more spontaneous answers which best reflect the way of thinking of firms' representatives. The interviews were recorded and then written down. It allowed the researcher not only to ask questions but actively formulate additional questions to develop answers. Thanks to these interviews qualitative data had been collected.

6. Research results

The first question related to the need of preparing a strategy by the city concerning cooperation with ICT firms for innovations. Most of the interviewed firms supported the idea of working out such a strategy. In cases of three firms the enthusiasm was expressed. One was very skeptical pointing out that not disturbing their activity would be enough. The same firm gave an example of public services in supply of Internet which lasted almost a year and finally the firm must have ordered supply of Internet from a private operator (Głębocki K. – Report 2022, p. 1)

The second question was about forms of potential cooperation between the city and ICT local firms. Only one firm which specializes among others in ICT applications allowing payments for public parking places was pro establishment of a common structure. The firm supported the idea of creating a private-public company with the role of an incubator for innovations. For example, if closer cooperation with a city would exist one could work out an application of a map of accessibility of free public parking places based on the connection between park machines and payment applications which would be a much cheaper and easier solution in comparison with installation of sensors or cameras in public parking places. The other ICT firms were skeptical about creating new structure but pointed out various forms of soft cooperation – the firms could realize trainings for officials so that future ordering of services would be easier "talking in the same language", city could be coordinator of closer cooperation between ICT firms and Higher Schools and city could be a coordinator in common sustainable innovations projects management. (Głębocki K. – Report 2022, p. 2)

The next question was on the ICT local firms' perspective when the city would invite a big investor which has a specialized unit in smart city projects. Four of the interviewed firms were against inviting such an investor giving various arguments. The argument most often mentioned was the one of employees – ICT specialists being sucked out of local firms by offering higher levels of wages by such big investors. There was an argument that local ICT firms have wiser employees and better organization but lack bigger capital. Another argument was about global investors not being interested in cooperation with local firms but rather using their own solutions so that local firms could only have potentially the role in implementation of these solutions, not developing new ones. Local firms could develop similar solutions in comparison to the ones offered by big global investors but offering them for much better price. Maybe the medium firm – one of the European leaders could be a good proposal. Two other firms were pro inviting big global investors with the argument of bringing new knowledge. (Głębocki K. – Report 2022, p. 3)

The fields of the biggest possible potential for cooperation with city for creation of innovations mentioned by the firms were the following:

- Health care, waste management, water management, heating of buildings;
- Security of ICT of public services;
- City Smart grid of electricity;
- Development of e-government with extension of cases which a citizen could realize in electronic form, creation of taxpayer portal where a city citizen could pay all payments (taxes and others), development

> of apps for best routes including public transport, park and go zones and the use of public bikes and paid electric scooters. (Głębocki K. – Report 2022, p. 4)

The next question was on the attitude towards exchange of knowledge between ICT local firms for creation of sustainable innovations. All interviewed firms were supportive for such an exchange adding various information and arguments. One firm underlined the possibility of such cooperation but not with their competitors. Local ICT firms exchange to some extent their knowledge already between themselves especially on the owners' level. If such an exchange was organized by the city this would have to be done on the basis of well-constructed rules not to provoke conflicts between local ICT firms. Such a cooperation coordinated by the city should be based on openness and transparency. Sometimes the platform for integration of local firms are sport clubs rather than the city itself. (Głębocki K. – Report 2022, p. 5)

There was also a question about intercultural intelligence of employees – if this helps or not in creation of sustainable innovations. Almost all firms claimed cultural intelligence to be important in the development of sustainable innovations. All firms claimed that they already have experience with employees from other cultures. The ICT sector is the one in which intercultural intelligence is important on a daily basis. (Głębocki K. – Report 2022, p. 5)

The last question was about barriers in cooperation with the city for sustainable innovations. One of the barriers is the lack of interest on the side of the city. Higher schools are the ones which are more interested. Another barrier is ICT systems in cities which are not up to date. City officials are not prepared for such cooperation, having often only vague orientation in what innovations could be developed in terms of sustainability. Often, they decide to continue doing things as they were in the past, being afraid that in case of a failure of a new solution they would be fired and in case of success they will get a relatively small financial bonus. If there are some passionate officials interested in sustainable innovations, they are usually on the lower level of city administration – managers of a medium level and city authorities are not interested very much in these innovations. The Danger is that sometimes cities purchase an innovative system which then is poorly used. Sometimes cities make barriers deciding that only one firm in a big city (Warsaw example was given) will be responsible for parking payments electronic collection, whereas there are in the Polish market 5-7 firms offering such service. Another barrier could be the lack of proper documentation on the side of the city. (Głębocki K. – Report 2022, p. 6).

7. Conclusions

The questions which were formulated in the paper had been answered. The first question was 'What is the perspective of local ICT firms and what are their expectations in the mentioned cooperation to result in production of innovations useful for the city?' and the additional second question was 'What is the attitude of local ICT firms towards inviting one or more big international leaders in smart city projects for cooperation in the ICT industry?' The main conclusions from the research carried out by the author are as follows: according to the firms surveyed a strategy of cooperation between city government and local ICT firms would be useful. Almost all the firms surveyed suggested soft cooperation with a city without any formal new structure but one firm which already is making many projects for cities supported the idea of creating a public-private company. Generally the firms are afraid of the leading global ICT companies being brought to the city. The firms interviewed are prone to exchange their knowledge with other local ICT firms. According to the local ICT firms, the barriers to cooperate with city aiming at innovations, include low engagement of the authorities and poor level of knowledge of city administration employees.

The above results could be set in the form of following recommendations for city government for planning the cooperation with ICT local firms for innovations (comprising also sustainable innovations):

- The strategy of cooperation between city government and ICT local firms for innovations should be worked out;
- The future cooperation could have at least two variants: first variant is soft cooperation without creating any formal structure and second variant (especially for firms already experienced in smart city projects) is a private-public company;
- Not inviting a big global ICT firm or inviting such a firm after wider discussion with local ICT firms and with their acceptance;

- In the strategy of cooperation, especially the following fields should be taken into account: health care, waste management, water management, heating of buildings, security of ICT of public services, city smart grid of electricity, development of e-government with extension of cases which a citizen could realize in electronic form, creation of taxpayer portal, development of apps for transport;
- The strategy should comprise organizing a forum of knowledge exchange for ICT local firms which would be helpful for ICT innovations development;
- In strategic planning of cooperation the engagement of city top management should be secured and promoted as well as improving the level of ICT knowledge of officials should be well planned.
- The above set of recommendations could be useful for public administration and in particular city

government when planning cooperation with private ICT firms for sustainable innovations. The above set does not only systematize the aspects of planning such cooperation but also reflects the expectations of ICT local firms so from practical point of view it could help in better and more effective cooperation between city government and local ICT firms.

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COVID-19 and Safety: A Theoretical Study with Applications

Cátia Godinho[1], John S. Edwards[2] and Eduardo Tomé[3]
[1]GOVCOPP Research Centre Universidade de Aveiro
[2]Operations & Information Management, Aston University, Birmingham, United Kingdom
[3]Universidade Lusófona de Humanidades e Tecnologias, Lisboa, GOVCOPP Research Centre Universidade de Aveiro
catiasofia.campos@gmail.com
j.s.edwards@aston.ac.uk
eduardo.tome@gmail.com

Abstract: COVID-19 put people, organizations and societies under immense stress. That stress was related to fear. Fear meant trust was lost. When trust was lost, business and people were badly damaged, resulting in a massive societal disruption. The Old Normal from before the pandemic was based on presence at work, and the Pandemic Normal during the pandemic has been based on remote work; we believe that after the pandemic a New Normal based on hybrid work will be the dominant one. The three stages, Old Normal, Pandemic Normal and New Normal are all analysed from the perspective of the PPT (People, Processes and Technology) model of knowledge management (Edwards 2011). Underlying the analysis is the concept of safety as it refers to health, and especially *perceptions* of safety. Measures taken to prevent and/or mitigate the effects of COVID-19, such as lockdowns and compulsory wearing of masks, were completely beyond what most people, especially in Europe, Australasia and the Americas, had ever experienced. Assuming that government has a duty to ensure that its citizens feel safe, we look at both the pandemic period and the future in the light of this responsibility. The PPT model is used to consider various aspects of the situation, concentrating on the UK and Portugal as examples. The analysis includes what planning took place beforehand (if any), what preventative measures were put in place and when, how testing and contact tracing was organised and its links to the preventative measures, and the non-clinical aspects of vaccination and treatment. We consider what proved to be effective and what did not – at times a moving target; what lessons were learned during the pandemic; and crucially what lessons have been or should be learned for the future. Using the PPT terminology, the most critical area to get right seems to be the linkages from People to Processes.

Keywords: COVID-19, people, processes, safety, technology

1. Introduction

As 2019 turned into 2020, humanity began to hear about a strange disease which had been spreading in the city of Wuhan in China. It was found to be a virus which spread at high speed mainly because for many people it was asymptomatic. In less than four months most of the world was under lockdown, frontiers were closed, and the world was “at war” (BBC, 2020). What happened after is well known. Firstly, governments tried to ensure a safe environment for their citizens by imposing rules on social distance and the use of masks. Secondly, governments also instituted gigantic programs of economic recovery to ensure that the slowdown would not have lasting effects on the well-being of citizens. Thirdly, world leaders made appeals to social solidarity, asking for compassion in troubled times. Last but not least, scientists battled to find vaccines in record time; by Christmas 2020 a dozen products were available; and afterwards, amid much economic and political wrangling, vaccination started; at the time of writing the virus has taken 6.1 million victims in 471 million cases; 64% of the world population has received at least one dose of a COVID-19 vaccine, 111 billion doses have been administered globally, and 16.69 million are now administered each day. Therefore, nowadays, people are trying to find a middle ground between the pre-COVID-19 way of life in 2019, the “Old Normal” and the lockdown due to COVID-19 way of life in the last two years, the “Pandemic Normal”. It may be that in 2022 a “New Normal” will surface, which will add some elements of the Old Normal (like the possibility of close contact) to some elements of the Pandemic Normal (like more agile processes due to the increased use of technology). We are writing this paper in March 2022; the situation may change by the time you read it.

For now, basic questions remain: should we still use masks, and when? should we relax social distancing? shall we go back into offices, or shall we work from home? will we need booster vaccinations every year? The way societies answer all these questions has wide-ranging implications: first and foremost because humans are “social animals” and social distancing is hard to take for us, individually and as a group.

Underlying the situation is the concept of safety. Humans, be they more or less risk averse, need to feel safe to live normally. Indeed, the Pandemic Normal existed because people needed to change their way of living in

order to feel safe. The feeling of fear led to a loss of trust in the practice of Old Normal actions, and the changes needed to install a new safe environment had drastic consequences, in psychological, social, financial, economic and even political terms. Knowledge is key to that feeling of safety.

This paper analyses COVID-19 in terms of safety and knowledge. What can be said? How? The text is comprised of four more sections. In the next section we review the literature on safety, and introduce the People, Processes, Technology knowledge management model (Edwards, 2011). In section 3 we analyse COVID-19 in Portugal and the UK. In section 4 we discuss our results. In the final section we present our conclusions and offer ideas for further research.

2. Literature review

2.1 Safety and COVID-19

The term safety refers to the protection of individuals, organizations, and assets against external threats and criminal activities. We also use this term when we refer to health. Although the feeling of being safe is an emotional aspect, this feeling can be destabilized by physical threats such as diseases. Since December 2019 the world had to learn how to deal with a new threat, called SARS-CoV2 or COVID-19 (strictly speaking, SARS-CoV2 is the virus and COVID-19 the disease it causes in humans), which became a pandemic.

COVID-19 belongs to the coronavirus family, known since 1960, and causing severe breathing problems. It is a complex virus (Rothan and Byrareddy, 2020, Wilder-Smith, Chiew and Lee, 2020) with high mortality for older people or those with chronic disease (Shi et al., 2020). Some countries already had a pandemic experience with H1N1 influenza, in 2009. About H1N1, Watkins (2020) reminds us that "the resulting UK influenza Pandemic Preparedness Strategy 2011 emphasised the need to maintain the continuity of essential services and continue everyday activities as far as possible". However, this new health challenge was much more dangerous, and the rapid spread of COVID-19 turned it into a very real threat to humanity.

COVID-19 destroyed the meaning of safety, in relation to health. The feeling of being unsafe changes our social life, our day-to-day work and even our mental health. We stop working in our offices, we stop going to school. Many countries imposed strict preventative measures and adopted several safety protocols. Watkins (2020) pointed out that containment could only buy a limited amount of time in SARS-CoV-2, as happened with H1N1. In China, the measures taken to avoid the increase of the virus in other cities were testing and social distancing. But they were taken too late. A globalized world, with large flows of people, become the passport for a highly transmissible virus. We were living in a pandemic. The "lockdown" was the emergency measure adopted for the most part by countries all around the world. Some closed airports, borders and public services. People stopped working in offices and started to work at home. Students stopped going to school. All social life came to a halt. No sports. No parties. Governments told their citizens to stay at home and to avoid all forms of human in-person contact (Dwivedi et al., 2020a). Authors such as Cilhoroz et DeRuisseau (2021) believe that these safety protocols substantially reduced the risk of transmission. They also underlined the importance of universal mask wearing to stop the increase of pandemic case numbers.

The use of technology increased hugely as the only way to continue to work, to study or even to do sports. Dwivedi et al. (2020b) consider "the COVID-19 pandemic has forced many organisations to undergo significant transformation, rethinking key elements of their business processes and use of technology to maintain operations whilst adhering to a changing landscape of guidelines and new procedures". But many health services were not prepared to deal with a pandemic. Health professionals and equipment were insufficient to face this crisis. The healthcare area has to be much more rational with resources targeted at those in most need (Watkins, 2020). Moreover, health workers were at high risk of exposure to the infection (Heliotero et al., 2020), as were firefighters and professionals of civil protection. A Portuguese study about post-traumatic stress in firefighters in COVID-19, recommended they have access to psychological support to reduce trauma symptoms (Guerra, 2020).

The pandemic and the subsequent economic downturn had profound effects on the human psyche health (Zandifar and Badrfam, 2020). Authors such as Roy (2020) remind us of a theory to explain people's behaviour in this crisis. It has the acronym DABDA. This "grief theory" has five stages: denial, anger, bargaining, depression, and acceptance. In fact, many countries (such as Brazil) firstly denied the existence of this threat. Then adopting lockdown as a prevention measure made citizens angry: the loss of freedom and the feeling of being unsafe

contributed to this feeling. After those feelings, we had bargaining, depression, and acceptance. This last one came when citizens accepted vaccination as the solution to recover day-to-day life.

COVID-19 changed the way of living world-wide. The changes happened in work, school and social habits, facilitated by rapid evolution of technology. This legacy is the most positive thing that the world can take from this time. COVID-19 brought severe health consequences for those who were infected, for those whose work is helping them, and for the citizens who became "lonely animals", instead of "social animals".

2.2 Knowledge management: people, processes and technology

Edwards (2011) developed a model on the evolution of knowledge management (KM) (see Figure 1), indicating three phases, the first one guided by technology, the second by people and the third by processes. Crucially the phases produced better results in succession, because in any situation technology, people and processes have to co-exist. Crises (individual, organizational and societal) arise because there is a lack of technology, people or processes, or appropriate links between them. Finally, the solution of any crises requires the combination of technology, people and processes. Since we are analysing the COVID-19 crisis from a KM perspective, we choose the PPT model to explain the current state of affairs.

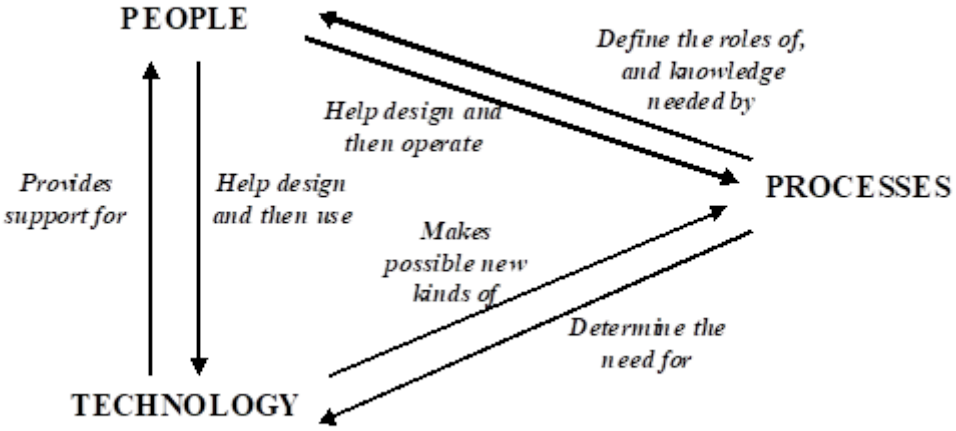


Figure 1: People, Processes and Technology (after Edwards (2011))

Sveiby (2012) used Polanyi's (1962) definition of professional competence as the ability to make correct predictions about future events. He furthermore pointed out that a drastic change in context may render incompetent persons who were previously competent; horse-drawn carriage drivers became incompetent when cars appeared; and more recently the financial crisis happened due to the increase in derivatives and other collateralized debt obligations (CDOs) which fundamentally changed the banking and security markets and made persons who used to be competent in the previous context become incompetent in the new one. CDOs were extensively issued in the 2000s, generating the financial crisis of 2007/8.

This interpretation of competence is relevant for our paper because we are analysing a change in paradigm – namely the difference between the Old Normal (pre-COVID-19) and the Pandemic Normal (during COVID-19). Accordingly, we believe that the COVID-19 crisis also changed the context in which knowledge is managed, in which societies are governed, and in which businesses are formed and value is created. Indeed, one of the major problems of societies and organizations during the pandemic has been how to adapt processes in order to maintain wellbeing, profit and employment levels; and that adaptation was important because owing to the pandemic many workers and organizations faced the prospect of becoming incompetent, when before they had been competent. In consequence the solution for that competency problem has to be found within the PPT triangle defined in Figure 1.

3. The Pandemic Normal in Portugal and the UK

See Figure 2 for an approximate timeline.

3.1 Pandemic planning

Both countries were caught out by the change in paradigm, adopting a model as if it was an influenza pandemic. The UK explicitly regarded influenza as more likely to pose a serious problem than an infectious disease such as a coronavirus, for which the 2017 National Risk Register anticipated the consequences would be "several thousand people experiencing symptoms, potentially leading to up to 100 fatalities" (House of Commons, 2021). The influenza model meant that the plans turned out to be ineffective compared to those of countries (e.g., in Asia) that had taken more lessons from earlier outbreaks of SARS, MERS and Ebola.

3.2 Preventative measures

As with other governments around the world, both countries adopted restrictive measures ("lockdown") to face the huge increase in cases. The UK was relatively slow, as it had been initially believed that the British would not accept a lockdown for a significant period. Only supermarkets and health services continued to operate, although with restrictive timetables. People were forced to work from home, to use masks in streets, and to stay in their home areas. These measures contributed to stopping the increase of numbers and gave hospitals some time to recover patients and beds. "The confinement resulted well in a rapid and substantial reduction in the transmission of the disease." (Health Portuguese Report, 2021, p.35).

A second deadly wave of cases in the winter 2020/21 led to a second lockdown in Portugal and two more in the UK. Ironically, the UK dislike of lockdowns led to too-early relaxation of measures and probably caused the additional lockdown. This philosophy continued to drive UK government thinking, as witness the evident pride in the comment that "On 19 July 2021, the Government removed most restrictions in England … and, in doing so, opened up earlier than many other comparable countries." (UK Government, 2022) and the "Plan B" for the winter of 2021-22, which included compulsory mask wearing, voluntary working from home guidance and the use of COVID negative test certification – but no lockdowns.

Self-isolation caused particular issues in the UK. "…the problem of compliance with isolation instructions remains a challenge. We heard evidence that inadequate financial support was a barrier for some people, and that—until recently—the inability of contacts to be released from isolation if they tested negative contributed to lower compliance." (House of Commons, 2021, p.7) British individualism probably did not help matters. On Hofstede's national cultural dimensions, the UK scores very highly in individualism and low in uncertainty avoidance, whereas Portugal is the opposite (Hofstede Insights, n.d.).

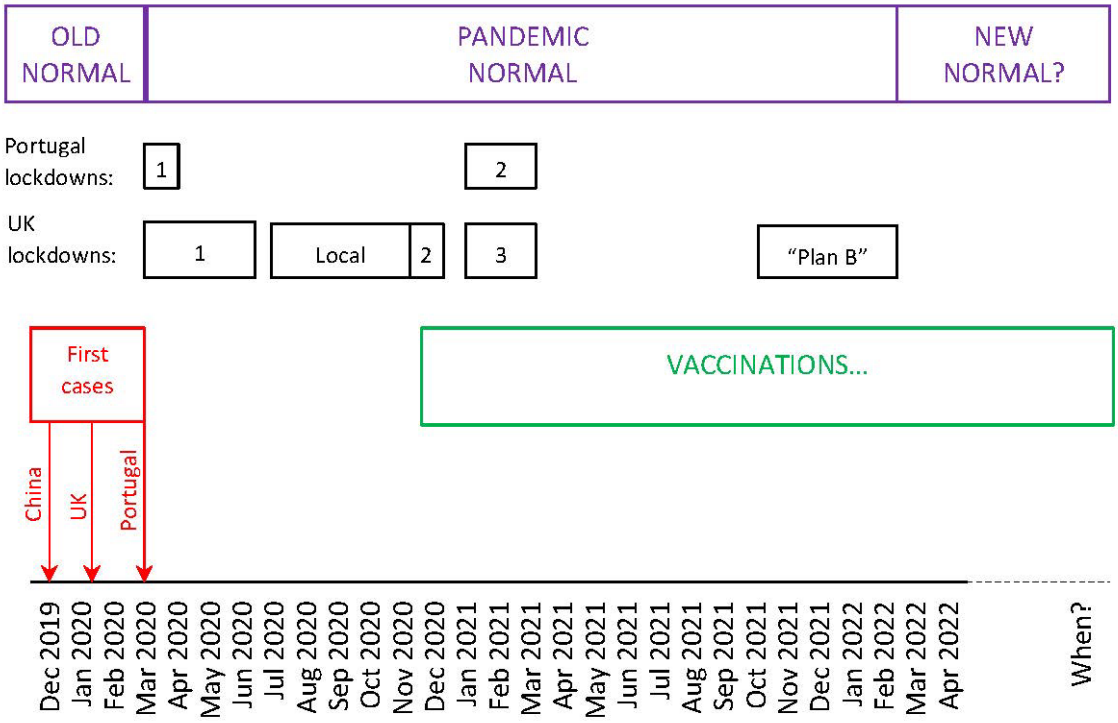


Figure 2: Approximate timeline for the pandemic in Portugal and the UK

3.3 Treatment

The main principle was to separate COVID-19 cases from "clean areas" where no COVID-19 patients received treatment. Portugal installed field hospitals in universities, to help less serious cases and leave hospital beds free for the most serious cases with special care needs. The UK established the so-called "Nightingale" temporary hospitals, although these were never extensively used. There was an excellent response to appeals for former healthcare staff to return to work, but staffing remained the critical issue, with problems of staff burnout under the pressures, as well as the risks to healthcare staff from catching COVID-19 themselves.

This meant that both countries coped well with intensive care provision, but at the expense of treatment for non-COVID conditions. In Portugal, 540,000 hospital visits and 51,000 surgeries were not made in March/April 2020 compared to 2019 (Health Portuguese Report, 2021). Between January and November 2020, 121,000 fewer surgeries were performed. In the UK, attendance for essential non-COVID appointments dropped by between 25 and 75% depending on the condition and the region.

Although post-viral fatigue syndrome has been known since at least the 1980s, medical practitioners have given it low priority, even erroneously treating it as a psychological condition. The severity and extent of "long COVID" were unanticipated, and there are still no approved treatment options, other than rest (Ostojic, 2021). Recent UK estimates are that more than 1 in 50 adults say they have long COVID; 500,000 have had symptoms for more than a year (BBC, 2022).

3.4 Testing and contact tracing

Initially, Portuguese with symptoms associated with COVID-19 had to contact health services by phone to do a PCR test. But when the numbers started to increase, these tests and the antigenic/lateral flow tests started to be sold in pharmacies. Later, testing was used to help life get back to normal. A negative test became an obligatory issue to participate in group events such as weddings, or public events such as film festivals.

In the UK, community testing was stopped early on because of lack of testing capacity. "A country with a world-class expertise in data analysis should not have faced the biggest health crisis in a hundred years with virtually no data to analyse." (House of Commons, 2021, p.6) Eventually this was fixed, extensive lateral flow testing and PCR testing when necessary were provided free of charge, and as in Portugal the "NHS COVID pass" (in an app) was central in a return to something like the Old Normal.

UK contact tracing was initially based on a centralised model led by private sector companies, ignoring the expertise of local Directors of Public Health. The official report admits that it took a year to move to a much more effective strategy that was locally driven with support from the centre.

3.5 Vaccination

This was the major success in both countries. A central part of the UK's response was its role in the rapid development of effective vaccines. Key elements were early investment by government (even before the pandemic) and willingness of the regulatory authorities to allow results of clinical trials to be submitted on a rolling basis. Interestingly, the Vaccine Taskforce was set up outside the remit of the Department of Health and Social Care. British individualism had an adverse effect on take-up rates, as Table 1 shows. Even health and social care workers have not all been vaccinated. In late 2021, the UK government agreed measures to make this compulsory but backed down before the deadline for compliance was reached. More positively, large numbers of volunteers came forward to be trained to administer the vaccines, although in the end general practitioners and community pharmacists did most of the work.

Initially, Portugal also had difficulties in managing the process. But the Portuguese government then gave the responsibility of this process to a task force led by the military who organized everything, to get the majority of the population vaccinated. The communication between authorities and population became clearer and Portuguese people responded to the appeal. The military were extremely efficient. Portugal did not develop its own vaccine, but bought enough EU approved vaccines to guarantee the process. The Portuguese support for the vaccine was reflected in decrease in the number of hospitalizations and deaths by COVID-19 in hospitals, and these facts made Portugal an example to other countries that have lower vaccination rates (Table 1).

Table 1: Vaccination take-up by country (Source: Our World Data ,21 March 2022)

COUNTRIES	TOTAL DOSES ADMINISTERED (per 100 people)	FULLY VACCINATED PEOPLE (Millions)	%FULLY VACCINATED	TOTAL POPULATION (2020) (Millions)
PORTUGAL	225.45	9.42	93	10.31
U.K.	206.12	49.27	72	67.22
N.Z.	212.16	4.28	78	5.08
RUSSIA	111.06	72.39	50	144.1

3.6 Social care

This was the least effective area in both countries. Nursing homes were one of the main focuses of COVID-19, due to the combination of factors such as age, morbidities of nursing home users and the high concentration of people in a limited space. Initially, most of the COVID-19 deaths registered were people aged 80 years or more, users of nursing homes. The pandemic also showed that a measure such as social isolation could bring even more problems to elderly, sick, and alone people. Their social network was not as big as it could be, and old people were not supported in lockdown periods.

The UK made matters even worse with an early 2020 strategy of transferring patients from hospitals to care homes (to free up hospital beds) without rigorous testing. This was an alarming mistake, especially when countries such as Germany had already realised the problems it could cause "This, combined with untested staff bringing infection into homes from the community, led to many thousands of deaths which could have been avoided." (House of Commons, 2021, p.8)

3.7 Organizational life in the Pandemic Normal

A lockdown presents a major challenge to organisations. In both the UK and Portugal, offices, schools and universities rapidly took to the internet, aided by online meeting tools such as Zoom, Teams and Skype. Families used them for social purposes, too. There was a huge increase in remote access to organisational systems. These changes led to temporary shortages of the equipment needed: everything from webcams to personal computers. However, the internet coped with the vast growth in traffic remarkably well. Supermarkets and other companies ramped up their online order and delivery operations by an order of magnitude. Of course, organisations whose services could not be delivered at home did not fare so well, those ranging from hairdressing through pubs and bars to entertainment having to close completely. Sports events took place with no spectators.

In the UK, government services were among the slowest to adapt to working online. Official registration of births and deaths became impossible for months: marriages would also have been impossible to register, but they could not take place anyway because of the restrictions on people meeting. Portugal fared slightly better, with scheduled openings for birth and death registrations (but again there were no marriages to register), and other services moving online.

Public transport services were drastically reduced in frequency as commuting ceased except for essential workers. At the time of writing, many UK services have been reinstated, but by no means all of them, especially buses. The Portuguese situation is again somewhat better.

3.8 Disinvestment in the public health service

The COVID-19 crisis revealed a big problem of disinvestment in public health services. According to the Health Portuguese Report (2021), it is necessary to recover from a huge disinvestment "in technical and technological requalification of public health services"(p. 72, 2021). It is also urgent to recover public health services to respond to non-COVID conditions, as quickly as possible. In the crisis the Portuguese government listened to health specialists before reaching a decision about necessary measures. And this is the main point that the report underlines: the importance of listening to scientific specialists before a decision in the Pandemic Normal.

Funding for the National Health Service has been one of the UK's main political issues for decades: the pandemic changed the debate but did not resolve it. The country's mood during the Pandemic Normal led to the introduction of a 1.25% tax on all employed and self-employed people, specifically to pay for (more/better)

health and social care – but not until 6 April 2022, by which time the country's mood was turning against it. No new normal there, then.

3.9 Validation of the KM model

We consider medical aspects and more general aspects of organisations and society separately, using the PPT lens from Figure 1 to summarise the Pandemic Normal. The knowledge map in Figure 3 shows the more and less successful KM elements.

Taking technology first, KM for new medical technology has generally been highly successful. Effective vaccines were developed. New treatment options were devised. Contact tracing apps had a more mixed outcome: not all of them worked, and there were issues about interoperability of competing systems. More generally, it was a case of a huge increase in the use of technology that already existed, with the internet playing a central role. Thus we see that technology – not always entirely "new" - making possible new kinds of processes has been central to the Pandemic Normal, the main KM issue being learning to use it.

New medical processes were crucial, especially those for the testing and approval of vaccines and treatments, that brought them into widespread use quicker than anyone would have thought possible. UK general practitioners even began offering consultations by phone or video, which had many benefits, particularly for patients with chronic conditions, though some of the UK newspapers campaigned against this from the start and the intensity of this opposition has increased as we head towards the New Normal.

The online meeting and remote access tools brought their own KM process problems. Process changes had to be introduced at speed, often without the chance to carry out any form of pilot study. The digital divide worsened, between those who had the technology and also had somewhere at home to use it, and those who did not. Particularly for online office workers, a new phenomenon appeared – Zoom fatigue: stress resulting from too many online meetings, especially without breaks between them. Many managers were suspicious about how hard people working from home were really working – the managers feared that they themselves were becoming temporarily incompetent – and some organisations instituted more remote monitoring of computer use by their staff as a consequence (Marabelli, Vaast and Li, 2021).

Technology was the tool that humanity turned to in order to try to find some safety while keeping society functioning. Technology was fundamental to enabling people to work remotely; it was also technology that tried to prevent contacts with infected people, most noticeably with the "stayaway" app. Finally, it was a new-found technology, namely the vaccines, that reinstated safety and trust, trust being a central pillar of effective KM. Portugal is very interesting in this regard, because the rate of people with at least one full protocol administered is 93% which created an atmosphere of trust in the country.

People? Well, everyone has been affected in some way. Health and social care staff have borne the brunt of the burden, but it has also fallen on many other groups, including delivery drivers, utilities workers, postal staff, security staff, cleaners and (often unnoticed) IT staff supporting remote working. Few of these have been paid significantly more for their efforts, with the exception (in the UK) of delivery drivers. There is also evidence that the responsibility for schooling and entertaining children at home has fallen disproportionately on women. The UK Office for National Statistics found that women were more likely to be furloughed (laid off from their work), and to spend significantly more time on unpaid household work and childcare (Office for National Statistics, 2021).

There are very clear UK weaknesses (shown in Figure 3) in the people help design and then operate processes link from Figure 1: not involving the relevant people, and a disconnect between the government and the people.

In Portugal most people "ran scared" when the first lockdown was imposed. They felt the need to adjust to a completely different way of life, because they felt unsafe. They had to begin working differently and living differently – couples joked they spent too much time together, student missed friends. Safety concerns turned social life upside down. They also become scared of losing income and jobs – and welcomed all the government policies that supported income (moratoriums and support to wages) and jobs (layoff). After people who were tired of one year of COVID-19 had to endure a second lockdown, there was a massive influx of people to the vaccination centres and the big increase in cases in winter 2021/2022 was tackled with no need for lockdown, comparatively fewer deaths- and more confidence about safety: a clear success for KM.

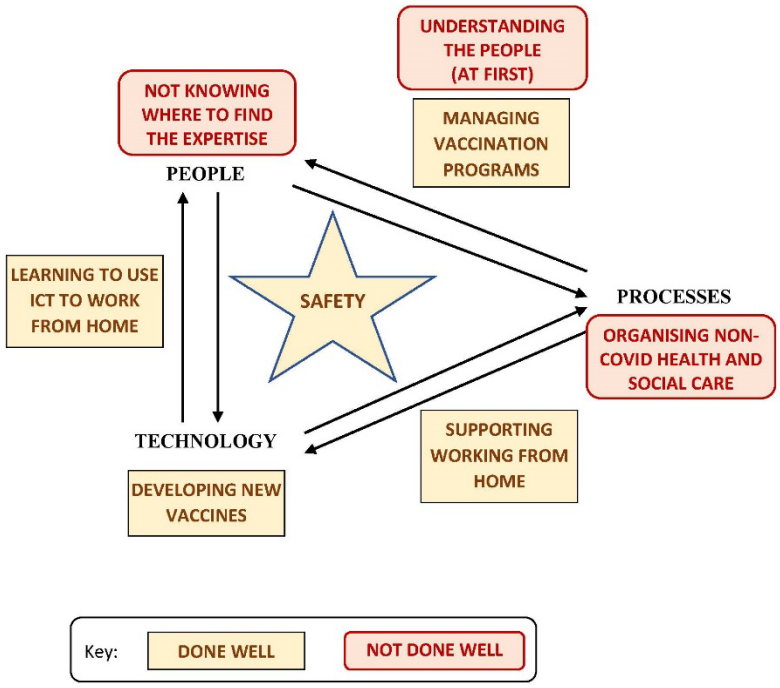


Figure 3: Knowledge map for the Pandemic Normal

Returning to processes, a central feature of any process is the associated measure of performance. The UK government's headline measures of performance in the pandemic have been the number of deaths, and whether or not the National Health Service is being overwhelmed. The first of these has now been outdated by vaccination and improved treatments – not to minimise the effect of even one additional death. For the wider public, complications and long COVID are now surely more significant, so hospitalisations might be a better measure. As for the second, even in the Old Normal the NHS was overwhelmed (to the extent of cancelling routine operations) at some point during most winters in the past decade, so recovering from the strain of the focus on the pandemic will not be easy. As already mentioned, Portugal faces a similar challenge.

Finally, in both countries, people learnt new skills and competences in order to seek safety. That learning was in fact the mastering of new processes. This brings us into the territory of personal KM. That learning also drastically changed the outlook of the working situation of these people – on one hand it become possible for their employers to ask them to work from home, but on the other hand their employment prospects become better because they were able to master more skills and had more competences, leading to what some have called the Great Resignation. And all this was due to safety concerns.

The New Normal will look more like the Old Normal than the Pandemic Normal, but there will be differences. Portugal and the UK now have better plans for dealing with new viruses. The importance of locating expertise has been recognised. The shift online of retail business will not be fully reversed. Six months ago, three quarters of Portuguese companies stated they wanted to implement some form of hybrid work (Puga, 2021) This may have consequences for the whole landscape of city centres. Those who feel less safe will work from home if they can, and may choose to wear masks in crowded places, as many Asians have done for decades.

4. Discussion

The analysis presented in the last section gives some hints for best ways of work for practitioners, in the sense that safety was found to be a major concern regarding Covid-19, and that technology should be aligned and convergent with people and processes in order to generate prosperity. Between the conception and completion of this paper, Portugal had an enormous increase in vaccination numbers, most people with three doses. This made people feel confident to return to normal life. The feeling of being safe had been recovered with vaccination and a huge help from social media information (increasingly important as a KM channel). Social life has become normal again. In the UK, with somewhat lower vaccination percentages, there is now a clear division between the majority of the population, who now feel safe enough to resume lives that are close to the Old

Normal, and a substantial minority (including those most vulnerable) who do not. Indeed in the last months, both in Portugal and the UK, there was an increase in cases, but because a sense of security had been installed, and the right processes were being applied by the right people and with the right technology, activity, in social and economic terms could continue.

5. Conclusions

We have described the Pandemic Normal, using Portugal and the UK as examples, and analysed the situation using the People, Processes and Technology KM lens. Most of the successes have been from technology making possible new kinds of processes, thereby providing support for people. It is striking that the major success in both countries, the vaccination programs that saw technology, processes and people come together, were organized by people from outside the health services sector. The major weaknesses have been in the link that *should* have seen the relevant people helping to design and then operate processes. At the time of writing, we have not fully reached the New Normal. Plans for dealing with future pandemics have been improved. At least one more booster dose of vaccine will be given. Online retail will continue to grow. Whether hybrid working will end up as a small change or a major alteration in the way we work and the structure of our cities needs further study. Finally data must be collected to illustrate the model defined in figure 3.

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Knowledge Sharing and Managing Intellectual Capital in the Times of COVID-19: Evidence from Polish Restaurant Industry

Jagoda Goll and Krzysztof Zięba
Gdansk University of Technology, Gdańsk, Poland
jagoda.goll@pg.edu.pl
kzieba@zie.pg.gda.pl

Abstract: *Purpose*: The aim of this paper is to show how restaurants in Poland managed their intellectual capital (IC) in the COVID-19 crisis and how knowledge sharing (KS) helped them to survive in those dynamically changing conditions. Methodology: The study is based on qualitative research – semi-structured interviews with a few restaurant owners and managers responsible for the business operations during the first year of COVID-19 pandemic. *Findings*: Research results show that one of the key factors in the restaurant survival is their IC. Proper management of this capital allowed businesses to adjust to this unprecedented situation. Dynamic and intense KS between restaurants' owners, managers and employees fastened the process of adjustment and provided new kind of services necessary to successfully operate in the new reality. *Research limitations*: The paper takes into consideration only selected restaurants in the Pomeranian region in Poland. Hence, the results cannot be generalized. *Practical implications*: The paper shows how restaurants' managers and owners used KS and IC management in order to adapt their business operations to the COVID-19 reality. That can be inspiring for entrepreneurs and help them fully utilize IC of their employees and coworkers, as well as discover the benefits of KS practices. The study also shows the idea of supportive restaurant community and its important role in KS. It also shows arising coopetition between businesses in order to survive violent changes in the socio-economic environment. *Originality/value*: The paper focuses on dealing with the COVID-19 problems in the restaurant industry from the KS and IC perspective. So far, there are few studies of this kind that take the catering sector as the main subject of the research. Findings can be helpful and valuable not only for academics, but also for entrepreneurs and managers that seek knowledge and solutions they can use in order to grow and develop their organizations in the turbulent environment.

Keywords: COVID-19, intellectual capital, knowledge sharing, SME's, hospitality industry, restaurants

1. Introduction

The COVID-19 pandemic affected the whole economy since the very beginning. Lockdowns were provided suddenly which forced many businesses to stop their activity overnight. One of the most affected sectors is the hospitality industry which bases its operations mostly on tourism and people's daily needs for entertainment (Dube *et al.*, 2020). Suddenly restaurants and hotels were considered as dangerous, threatening with contagion. Their basic operations (sit-down services and accommodation) were forbidden by governments, and customers were scared of the new disease. That combination resulted in a rapid and huge decrease in demand and in consequence a drastic drop of revenues for the hospitality industry globally (Buffington *et al.*, 2020; Gursoy and Chi, 2020; Kim *et al.*, 2020; Yang *et al.*, 2020; Madeira *et al.*, 2021).

Restaurants were forced to rearrange their operations, find new ways of providing food services and manage to deal with disappearing demand for particular jobs (bartenders and waiters). Additionally, restaurant businesses are usually micro/small enterprises without any specifically formulated strategy and they operate on day-to-day basis. Restaurant owners and managers had to learn quickly and find innovative solutions not only to keep their employees' jobs but also to simply survive in the market.

Problems and challenges that emerged globally created the environment full of unknowns. Entrepreneurs sought for answers how to deal with occurring problems and what tools or solutions may be used to overcome them. Intellectual capital (IC) started to be seen as an important and helpful asset (Hamilton, 2020). It was shown that the survival of the manufacturing business during the crises strongly depends on the IC (Al-Omoush *et al.,* 2022). Another factor considered to be crucial is knowledge sharing (KS). Its impact on organizational performance (Ahmed *et al.*, 2020) and on innovation (Montani and Staglianò, 2021; Pellegrini *et al.* 2022) during COVID-19 crisis was investigated. The obtained results show the positive relation between KS and both organizational performance and innovation. Hence, KS and IC seem to be crucial in the survival of businesses during the COVID-19 crisis. Therefore, this paper is focused on what was the role of KS and managing IC in the survival of Polish restaurants during the pandemic. Using a small sample of Polish restaurants and taking the perspective of restaurants' owners and managers, we present how IC and its potential was used to deal with new, unpredictable problems and how KS helped in adjusting business activities to new conditions.

2. Literature Review

2.1 Knowledge sharing

KS is already well-known phenomenon in the field of Knowledge Management (Boer, 2005; Zheng, 2017). It may be defined as "the exchange of knowledge between and among individuals, and within and among teams, organizational units, and organization" (Schwartz, 2006).

KS requires a willingness to share experiences and know-how with other people to empower the knowledge of the whole team and organization. It is linked with trust among people who take a part in this process (Bolisani and Bratianu, 2018). That indicates the need of comfortable environment in which people seek to gain knowledge and develop themselves, improve their skills and achieve personal and organizational goals. Propensity to trust may be even considered as the precursor for KS behavior among employees. (Ogunmokun *et al.*, 2020). Considering the whole hospitality industry, KS positively affects service innovation performance and new service development (Monica Hu *et al.*, 2009).

Taking into account the COVID-19 pandemic, we can find indications of the positive impact of KS on the organization performance (Ahmed *et al.*, 2020) and that employees engaged in KS are more innovative, even facing the stress caused by the pandemic (Montani and Staglianò, 2021). However, those recent studies refer to the public and private universities and to technology-based firms. Hence, it remains unknown to what extent the positive relation between KS and organizational performance or innovation can be found in the hospitality sector.

2.2 Intellectual capital

The term of IC was coined to explain the difference between market value and accounting value of the firm. Not all assets are tangible, visible and easy to represent in the financial statement so the market value is often higher than accounting value of the company. IC can be considered as a concept, system, collection of assets, process or strategy (Molthar and Indarti, 2021). Thinking of IC as the collection of assets, it can be defined as knowledge that can be converted into value (Edvinsson and Sullivan, 1996).

There are two major approaches to IC. It can consist of two components: human resources and intellectual assets (Edvinsson and Sullivan, 1996), or three components: human capital (HC), structural capital (SC) and relational capital (RC) (Andreeva and Garanina, 2016). Human resources in the first approach reflect human capital in the second one. Structural and relational capital in the second approach can be considered as the components of intellectual assets from the first one. For the purpose of this study, we focus on the IC as perceived by Andreeva and Garanina. It allows us to compare our results and conclusions to those obtained by Leon, who focused on the strategies of restaurants during COVID-19 pandemic with regard to IC (2021).

HC is the knowledge, experience, skills, relationships and capabilities of employees. Usually, the knowledge possessed by employees is tacit, especially considering the restaurant sector. That means it is uncodified, difficult to copy, visible in the way employees do things. Tacit knowledge, according to its definition, is rather impossible to measure. Employee's knowledge can be also explicit – in the form of certifications, codified in instructions of how to do things. That kind of employees' knowledge is more common in corporations, law, financial, technology firms (Andreeva and Garanina, 2016).

SC refers to company's intellectual property. An example of SC may be: patents, copyrights, procedures, databases, routines. It is the knowledge possessed by the company that is somehow codified. In the restaurant it can be the recipe, dress code, logotype, the website, learned schemes (Andreeva and Garanina, 2016).

RC represents relationships that company has with its customers, suppliers, competitors and other stakeholders. It can be the trust, loyalty built between the firm and its clients. It is very important especially in the catering sector where competitiveness is very high (Andreeva and Garanina, 2016).

More and more firms realize the significant role of IC as the source of value and profitability (Edvinsson and Sullivan, 1996; Harrison and Sullivan, 2000). Studies also investigate the actual impact of each component of IC on organization performance (Andreeva and Garanina, 2016). There are indications of usefulness of evaluating IC (Engström *et al.,* 2003) and evidence of positive relation between IC and return on assets in the hospitality and tourism sector (Costa, *et al.,* 2020). Additionally, IC positively affects innovation capability (Molthar and

Indarti, 2021). However, we have found only one paper about the influence of IC on restaurants' reaction to the COVID-19 crisis (Leon, 2021). It is based on secondary data from Tripadvisor and suggests that while trying to adapt to new market conditions, management concentrated on RC and SC, whereas HC was rather neglected.

2.3 Knowledge sharing and managing intellectual capital – joining concepts

Both KS and IC are strictly related to the knowledge that the company possesses. However, possession is not enough to benefit from it. The knowledge should be properly used to increase profits and improve performance. One way of using the possessed knowledge is sharing it – among employees (internally) or with other stakeholders (externally). A lot of studies investigating what affects company's performance take both KS and IC into account (Wang *et al.*, 2016; Allameh, 2018). There are indications that these two concepts are strictly related (Attar, *et al.*, 2019; Oliveira *et al.*, 2020). KS is an example of managing IC. In the construction industry IC is positively related to innovation performance and promotes it through KS (Li *et al.*, 2019). There is also the evidence that KS is strictly related to firm performance and strengthens IC. The relationship between these two concepts is positive (Wang *et al.*, 2014). However, little is known about how COVID-19 pandemic influenced the above-mentioned relations in hospitality sector.

3. Methodology

Most of the above-mentioned literature regarding IC and KS in COVID-19 pandemic bases its results on quantitative data. Only Pellegrini et al. (2022) decided for qualitative research, more specifically case studies. However, this study concerns telemedicine company. Hence, we decided that qualitative method of research may bring new and valuable insight into restaurant businesses during the pandemic. IC is intangible asset and measuring it is extremely difficult and may bring contrasting or not adequate results, depending on the chosen method of measurement of each IC component. Qualitative research enabled us to find intellectual capital possessed by restaurants directly and in which forms it appears in this kind of business and how it is valued by those who are responsible for managing it. Following the guidelines of Creswell (2009) we have decided to use semi-structured interviews with convenience sampling. The interviewees were managers and owners of restaurants in Tricity (Pomeranian region in Poland). Such method enabled gaining information about how each restaurant individually got affected by the COVID-19 pandemic and how it tried to cope with emerging problems and challenges. Through the interviews it was possible to get perspectives and experiences of managers and owners (Hammarberg *et al.*, 2016) on how restaurants manage their IC and use KS trying to survive the COVID-19 crisis.

Table 1: Research sample.

Restaurants	Type	Interviewee
A, B	Fine-dining	Manager
C, D	Fine-dining	Owner
E, F	With specific cuisine	Owner
G	With specific cuisine	Manager
H	"Home kitchen"	Owner
I	"Home kitchen"	Manager
J	Based on regional products	Manager
K	Canteen	Co-owner
L	Canteen	Brand manager

Interviews were conducted with 12 owners and managers. The sample consists of 5 types of restaurants:

- Fine-dining
- With specific cuisine (e.g. vegan, Thai)
- "Home kitchen" – restaurants serving typical Polish dishes with informal service
- Based on regional products (mainly fish)
- Canteen – entertainment venues (organizing vernissages, DJ sets etc.) serving popular dishes like pizza or burgers but in the idea of slow-food.

In the sample there is no typical fast-food restaurant because they are usually familiar with food delivery as their products are adjusted to takeaway. The aim of this study was to investigate the situation of businesses for which the pandemic meant major change in activity.

Our aim was to find the answer to the research question: *What was the role of IC and KS in the survival of Polish restaurants in the COVID-19 pandemic?*

The interview included the following questions:
What were the key problems during the pandemic?
What were the most valuable resources they had and how they were used?
How employees participated in the process of adjusting to new reality?
How did they learn to operate in dynamically changing environment?

Inspired by some studies (Kim *et al*., 2021; Leon, 2021; Bratianu, Bejinaru, 2021) and the research gap presented in the literature review and following the suggestions of Gursoy and Chi (2020) to generate new insight and knowledge regarding the hospitality industry, we decided to formulate 4 interview questions as presented above. Questions Q1 and Q4 are inspired by the publication by Kim, Kim and Wang (2021), as it also refers to strategies used by restaurant businesses during pandemic. Some indications in this respect can be found in the study by Bratianu and Bejinaru, in which the COVID-19 pandemic is said to induce a switch from deliberate to emergent knowledge strategies with restaurants as an example (Bratianu, Bejinaru, 2021). However, it was a comparative analysis of these two types of strategies and the paper did not provide any specific examples of how restaurants in fact operated and managed their business during the pandemic. Furthermore, apart from the study by Leon (2021) focused on IC, there are no papers addressing problems mentioned in Q2 and Q3 with regard to hospitality sector.

4. Results and Findings

To gather the most relevant information all interviews were transcribed. The most relevant results and findings are presented in relation to the main questions of the interviews.

4.1 Key problems faced during the pandemic

The majority or interviewees mentioned uncertainty about the future and financial instability as the main problem during the pandemic. Restrictions and regulations concerning hospitality sector were changing dynamically forcing businesses to adjust the way of operating overnight. With decreased income came increased expenses for delivery boxes, cleansing products, gloves and masks (which were difficult to get from suppliers at that time). What is more, all managers and owners mentioned that their main goal was to keep the staff unchanged. The owner of restaurant D said: "*The biggest stress I had concerned my people. I really suffered from it, walking and thinking about it constantly. I prepared piles of papers for different scenarios: one with dismissals, one with reduction of working hours, one with unpaid leaves. I didn't know if I would be able to pay them and keep them with me."*

To reduce costs all restaurants decided to negotiate both with the owners of the premises to reduce the fees or postpone the payments and with suppliers to arrange new agreements for alcohol or other products. It is the direct use of RC – relations built with stakeholders during the time of providing the business. The owner of restaurant E said with emotion: "*We are surrounded by so wonderful and supporting people. The owner of the premises [we cooperated for many, many years] agreed to decrease our renting cost to the lowest possible level. She decided to resign from their own benefit from renting. She was sure that we will survive and will not let her down [deceive her]. […] It was worth to cooperate with all people honestly and fair for all these years*". Only in case of restaurant D and H it was not possible to settle more convenient conditions of renting so both restaurants decided to find a new place. In these cases, the new location was found thanks to the relations with other entrepreneurs that used their own contacts. Not only the use of RC is visible here, but also KS between entrepreneurs with regard to real estate market, which can be even interpreted as the evidence for the coopetition in times of pandemic.

4.2 The most valuable resources and the way they were used

As the most valuable resources restaurants perceived staff and brand, only restaurant L did not mention employees. Skills and experience of employees, being a part of HC, proved to be important and useful during the crisis. The owner of restaurant E claimed: "*Mostly thanks to our team this restaurant survived, we worked together for so many years… […] They trusted us and wanted to help us to survive as they could*". Brand (SC), built by the quality and the type of served food was reported as an extremely powerful tool that prevented restaurants from disappearing from customers' minds.

The majority of restaurants focused much more on the social media through improving the quality of photos of the food and increased frequency of posting. The owner of restaurant H declared: "*We took care of it as never before! Well, before we even didn't have to take care of it. But since we were closed, we needed to reach our customers somehow. And that was the only way*". The goal was to maintain contact with clients and to remind them that restaurant still existed and appreciated every order. "*We added personal note with the graphics from our employees in the packages with food for every customer with our thanks to them and showing them how grateful we are for their help"* – said the owner of restaurant K. Nearly all restaurants (apart from D and F) used their HC for being in constant and fruitful contact with customers, using own employees' skills, instead of outsourcing marketing activities.

Restaurant G and E relied very much on its brand, hoping that the specificity of their cuisine would allow them to survive. One of the respondents (G) claimed: "*We have very strong brand for which we worked for a long time. We simply thought that our cuisine will defend itself. We based on this brand and did what we used to do as good as always*". Thanks to the strength of their SC, customers ordered food very often, in case of restaurant G it was even necessary to invest in extra phone numbers to pick up orders and to develop agreements with delivery services.

Restaurant I during the time of lockdown focused on developing skills of their employees by providing many courses and trainings. Restaurants K and J mentioned giving non-interest loans or donations for employees whose income decreased significantly during the lockdown because of decreased number of working hours and lack of tip. Elasticity and versatility of employees enabled restaurants D, H, J and I to renovate the local – painting the walls, renovating furniture. All restaurants needed to rearrange their space because after the lockdown there was a need to maintain the proper distance between customers. That also was the task for employees.

HC in the form of skills and experience of workers was used to find and introduce innovative products and services. The restaurant K organized special meeting with the whole staff and asked them: *"What can you do best? How can we use it here from now on [in order to survive]?".* Some examples of new solutions are: pastries in restaurant K, jars with dishes in restaurant J, boxes with food to share with the necessary promotion (graphics, brochures, website) to reach customers in restaurant B, marinated meat for barbecue in restaurant C. In restaurant F "surprise package" (box with half-ready products for one week) was provided and in restaurant H the whole staff was involved in creating new menu for the new location. In Restaurant E high skills of one of the waiters allowed him to take care of their social media promotion.

4.3 Employees' participation in the adjustment process

Employees, representing HC, were considered as the most valuable resource for the restaurants during pandemic. In nearly all of the interviewed restaurants they were deeply engaged in decision making during the pandemic. The only exception was the restaurant L (which is a part of big restaurant chain). In this case all decisions were made by top management. This top-down approach which neglected the value of employees resulted in quitting the job by most of the staff. After reopening this restaurant suffered many problems connected with the deficit of well-trained staff. According to the interviewee, restaurant L is in operation only due to big financial reserves and the fact that during the second lockdown the owners decided to cooperate with delivery services.

In other restaurants employees were extremely engaged in efforts to enable the business survival during the pandemic. Employees showed high flexibility regarding their positions. Most of restaurants mentioned switching the duties between the staff, e.g. waiter or bartender became a driver or cook. The owner of restaurant F said: "*They [employees] were so elastic and understanding [regarding their duties]… They wanted to stay here, with us. They worked when it was very cold and worked longer and harder [when it was necessary]".*

It also happened that the whole staff was engaged in the process of renovation (D, H, J, I). *The owner of restaurant D said: "Everyone came back to work with us [after the time of closing the restaurant during hard lockdown] and helped us with everything! They painted walls, helped with moving things [furnitures, cattlery]. They didn't complain, they didn't try to avoid this hard physical work*". Waiters and bartenders took the responsibility of marketing on social media (B, E, H, J). In order to find out the needs of customers, employees of restaurant J provided the research among their families and friends that brought guidelines for cooks on what menu can attract more customers. Such employees' engagement proves the importance and power of HC for the restaurant business during the pandemic.

4.4 Operating in dynamically changing environment

Most of restaurants described the process of learning to operate in dynamically changing environments as "learning by doing". After making decision restaurants observed and evaluated the effects of it. Restaurant K mentioned making many mistakes and experiencing dissatisfaction of customers until their dishes in jars achieved proper quality. Restaurant J tried to provide many different dishes that were supposed to suit the taste of customers and only few of them turned out to be good choices. All restaurants after reopening had to rearrange their space and it took them some time to coordinate the service with new layout of tables and new duties that occurred – disinfecting tables regularly, making service with gloves and masks, controlling whether guests are respecting the rules, etc. Manager of restaurant J described this period as: "*It was like you have to suddenly use the language which you haven't spoken for many years. You know that you can speak this language but it takes some time until you are once again fluent in it*."

However, the trial-and-error method was not the only way of learning. KS behaviors between the staff and managers/owners was another one. The majority of respondents stated that all employees were invited to share their ideas and knowledge to find new solutions in order to cope with emerging changes caused by the pandemic. There is also a case of KS with external stakeholders as a part of learning process resulting in shortened time needed for adjustment to new conditions: the owner of restaurant D participated in international conferences for women in gastronomy on which each entrepreneur shared their experiences and conclusions. Moreover, she exchanged knowledge with owners of restaurants in various cities of Poland. She admitted that this KS experience was very motivating, inspirational and gave her a lot of power to cope with the crisis. The owners of restaurant K claim they depended on KS between restaurant owners from the same area. They exchanged the information about what system of delivery is the most sufficient, which government restrictions are obligatory and which are optional, what can be done to assure more working hours for employees. The owner of restaurant F mentioned the special competition for entrepreneurs organized by Pomeranian Development Agency Co. During this competition entrepreneurs presented their own ideas on how to cope with the pandemic and exchanged these ideas between each other. A very interesting case regarding the process of KS was presented by the owner of restaurant H. There is a big Polish community of restaurant owners and managers in the form of private Facebook group. The owner of H admitted that thanks to this group she was able to fasten the process of applying for financial aid from the government, she got a lot of advices regarding food delivery and she received recommendations for visual presentation of dishes for the restaurant website. Entrepreneurs from the same area even helped each other in promotion – they shared links of each other's restaurants and invited people to support all local restaurants during the crisis. This is the example of KS on a really big scale and actions taken by the members of this community are clearly an example of coopetition (Gnyawali and Ryan Charleton, 2018).

5. Discussion

Implications from the obtained results are quite universal. It turned out that the type of restaurant does not matter with regard to managing IC or KS during COVID-19 pandemic. Our data shows that all the components of IC were useful during the time pandemic crisis. HC in the form of skills and experience of employees played the crucial role from the perspective of managers and owners. Thanks to HC restaurants were able to quickly find and provide innovative solutions and products which were necessary to operate in dynamically changing environment. Moreover, the process of adjusting the operations to new conditions was easier. Such findings contrast with the conclusion of Leon whose research suggested that managers and owners were mostly focused on RC and SC while HC was neglected (2021). Our findings not only show the usefulness, potential and relevance of HC, but also prove that managers and owners appreciate HC as the most important resource during the crisis.

Using relations with stakeholders (RC) and basing on the restaurants' brand (SC) proved to be helpful in the aspect of financial problems and demand for services. Long-term collaboration with suppliers or premises' owners resulted in successful negotiations on reducing costs. Managing RC by focusing on marketing and communication with customers resulted in sustaining demand on the necessary level. However, these actions were only possible thanks to the engagement of employees and their readiness to take new responsibilities. The success of maintaining the relations with customers was the result of building and maintaining strong brand before the pandemic. The only disparity in findings regarding types of restaurants concerns fine-dining restaurants and restaurants with specific cuisine with regard to the SC. These restaurants depended on SC to the higher extent than other types of restaurants, mainly in order to attract customers. The reason for that may

be the fact that such restaurants serve dishes that are somehow unique, not so easily available on the market and rather difficult to prepare at home.

However, it is evident that all components of IC are interdependent and each component had a crucial role in the survival of restaurants. Similar conclusions concerning the importance of all IC components are found in the paper by Alnassafi on the role of IC in crisis management in private universities (Alnassafi, 2022). Additional support comes from the research by Al-Omoush *et al*. (2022).

A lot of innovative solutions provided by restaurants during the crisis came from employees. Therefore, we claim that contrary to Molthar and Indarti (2021) not that only RC and SC, but also HC plays pivotal role in innovation capability. According to our results, the idea of innovation occurred thanks to HC, while RC and SC were the helpful tools to adapt it. Many restaurants encouraged employees to participate in finding solutions to deal with pandemic, to share their knowledge and skills in front of the whole staff. We can see the creation of open and supportive environment with a lot of trust towards employees, enabling KS behaviors. These restaurants in fact provided innovations proposed by employees. That may indicate KS behaviors induce employee innovation as suggested by Montani and Stagilanò (2021) and Hu *et al.* (2009).

In our research KS appeared also on higher level – between restaurants' owners and managers. Thanks to this, restaurants were able to learn on each other's mistakes, find answers from people facing the same challenges, inspire and motivate each other, as well as fasten the process of adjustment to new conditions. Interviewees that participated in KS process between competitors did not mention any negative outcomes of it as suggested by Crick and Crick (2020), but rather described it as a very helpful and powerful tool.

6. Conclusions

In this paper we presented the pivotal role of IC in the survival of restaurants during COVID-19 pandemic. In contrast to other studies, our results show the importance and potential not only of IC in general, but also of its component – HC – in the time of crisis. It can be useful insight for restaurants' managers owners that may rethink the value and potential of their HC and how relevant it is for the business success. Findings also indicate that employees (HC), given the trust and support and encouraged to KS behavior, turn out to provide many innovative solutions which are especially needed during crisis. In this study we showed that as the result of the COVID-19 pandemic KS evolved to another level and associated competitors that relied on each other's knowledge and experiences during crisis. It is food for thought for all entrepreneurs and it may encourage openness for coopetition when environment and market is changing dynamically.

This study has several limitations. The sample consists only of 12 restaurants located in the small region of Poland and they are not representative for the whole industry. The obtained results cannot be generalized and may not be relevant as interviewed restaurants operate in the limited environment and according to local regulations. Moreover, the study was based on qualitative research and answers of interviewees are very subjective, so the results should be treated with caution, especially because of limited triangulation.

This paper offers many implications for further research. Studies concerning the role and impact of IC on business performance during such extraordinary crises like COVID-19 pandemic are scarce. Many studies on IC use quantitative methods and we believe using qualitative research may offer a deeper understanding of IC phenomenon and its role. Finally, the area of KS between competitors in the hospitality sector creates space for further investigation. This sector is a very competitive market so creating KS community is quite unique in this case. Making research in the context of KS among restaurants could offer very surprising and inspiring results.

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I Share, we Share? A Mixed-Method Analysis of Helping behaviors, HRM Practices and Knowledge Sharing Behavior

Tiago Gonçalves[1], Carla Curado[1] and Natalia Martsenyuk[2]
[1] ADVANCE/CSG - ISEG, Universidade de Lisboa, Lisboa, Portugal
[2] ISEG, Universidade de Lisboa, Portugal
tiago.goncalves@aln.iseg.ulisboa.pt
ccurado@iseg.ulisboa.pt
nataliamartsenyuk@hotmail.com

Abstract: Knowledge sharing represents a key process to create value in organizational environments that reflects a complex interplay of individual and organizational level factors. Driven and heavily reliant on individuals' willingness to share with others, effective knowledge sharing behavior is fostered through organizational characteristics that can promote prosocial behaviors, such as structured Human Resources Management Practices (HRMP). Nevertheless, knowledge sharing represents an extra-role voluntary behavior that depends on individual intention to engage in altruistic behavior to help others. While several studies assess the mediation role of such helping behaviors (HB) between organizational conditions that can foster knowledge sharing, few studies explore the complex combination between HRMP and individual HB leading to knowledge sharing in organizations. Similarly, there is a lack of empirical evidence on how HRMP and HB can contribute to the absence of knowledge sharing. This study addresses such gaps by examining the impact of HRMP and altruistic HB as conditions leading to knowledge sharing in the service industry (n=130) using a mixed-methods approach. We follow a quantitative design, using a partial-least squares (PLS) analysis to explore the relationship between HRMP, HB and knowledge sharing. Then, we follow a qualitative design, using a fuzzy-set qualitative comparative approach (fsQCA) to identify complex configurations between HRMP, HB, age and education contributing to the presence and absence of knowledge sharing. Our quantitative findings find a positive relationship between both HRMP and HB leading to knowledge sharing behavior (KSB). Our qualitative findings present four alternative ways leading to knowledge sharing and corroborate the quantitative analysis. Additionally, qualitative results show four different configurations leading to the absence of knowledge sharing. We offer insight of the convergence of results, providing managerial approaches that can be used to promote KSB. Similarly, we recommend best practices to counter an absence of KSB given our methodological options and preventive practices inside the scope of Human Resources Management (HRM).

Keywords: Knowledge Sharing Behavior, Human Resources Management Practices, Helping Behaviors, Mixed-methods

1. Introduction

Knowledge sharing is still an individual process whose optimization requires psychological and behavioral knowledge, although it is extensively studied in the context of perceived managerial practices that can promote it at the organizational level (Obrenovic et al., 2020). Previous studies support the argument of knowledge sharing as a prosocial extra-role social behavior when considering the crucial interaction between social interactions, organizational support, and altruistic behavioral traits (Suwanti, 2019). Nevertheless, and while empirical and conceptual efforts have been conducted to expand individual psychological complexity of knowledge sharing (Obrenovic et al., 2020), the combined influence between individual altruistic predispositions and organizational practices affecting knowledge sharing remains scarce in the literature. Similarly, evidence shows that HRMP are related to KSB (Dodohk, 2020).

However, little is known about HRMP directly leading to knowledge given social capital complexities (Singh et al., 2021). Such scarcity presents a research gap. Our work aims to provide theoretical and practical contributions to knowledge management literature by exploring and integrated combination of individual altruistic helping behaviors and HRMP related to KSB.

We use a theoretical rationale supported by the theory of planned behavior (Ajzen, 1991) and the social exchange principles (Blau, 1968) to explore the relationship between existing HRMP and HB leading to KSB in service organizations. The articulation between both theories comes from a cost-benefit rationale to justify willingness to share knowledge (Zhao and Detlor, 2021). As an intangible organizational resource, knowledge can be perceived as a form of power, acting as social currency (Chen et al., 2019). By extension, besides reputation, sharing knowledge can also contribute to positive reputation and status (Zhao and Detlor, 2021). Such influences shape individual and group attitudes that act as cognitive weights contributing to knowledge sharing behavior (Ho et al., 2009) – underpinning the principles behind the theory of reasoned action (Ajzen,

1991). Given their usefulness to understand the impact of different motivations on behavior, we use both theories, considering their thorough use in knowledge management literature (Zhao and Detlor, 2021; Ho et al. 2009). We follow a mixed-methods approach that permits a refined level of analysis allowing to understand both the configurations leading to the presence, but also those leading to the absence of knowledge sharing. Additionally, and following the identified emergence of understanding individual differences in knowledge sharing (Obrenovic et al., 2020), we analyze complex non-linear effects, connecting HB and HRMP with demographic characteristics of organizational members to expand on theoretical and practical findings.

Our work is structured in several sections. First, we present the literature review leading to the research hypotheses and research propositions. Then, we expand on the adoption of the SmartPLS and fsQCA methodologies as techniques supporting the research choices. The empirical results will be presented, concluding with theoretical and practical implications of our work, discussing current limitations and future work.

2. Literature Review

2.1 Human Resources Management Practices and Knowledge Sharing Behavior

HRMP encompass managerial strategies aimed at maximizing employee performance, being structured around organizational objectives (Johnson and Szamosi, 2018). Developing on the social exchange theory (Blau, 1968) HRMP that directly affect the structural dimension of the organization's social capital promote KSB (Cabrera and Cabrera, 2005). Evidence shows that HRMP focused on the organization's social capital – such as work design, staffing, training and development, performance management, reward management and culture (Cabrera and Cabrera, 2005; Kremer, Villamor and Aguinis, 2019) – can foster interdependencies that increase the number of interactions and knowledge flows (Kremer, Villamor and Aguinis, 2019). Research also addresses the importance of knowledge-oriented HRMP in mediating KSBs through the facilitation of social networking activities (Singh et al., 2021). However, little is known about the complex interactions between HRMP and individual characteristics shifting the malleable nature of social capital towards the promotion of knowledge sharing activities (Singh et al., 2021). We argue that the existence of both soft HR and hard HRMP promote KSB (Cabrera and Cabrera, 2005; Kremer, Villamor and Aguinis, 2019), considering the organizational reliance on HRMP that can achieve knowledge mobilization through changes in the organizational social capital (Dodokh, 2020; Singh et al., 2021). Therefore, we propose that:
H1: HRMP have a positive relationship with KSB.

2.2 Knowledge Sharing as an extra-voluntary helping behavior

HB comprise voluntary gestures of support and help towards others that prevent or take place as a response to work related problems (Podsakoff et al., 2000). By extension, HB define one of the multiple facets of Organizational Citizenship Behaviors (OCB) (Sawyer et al., 2022). OCBs encompass individual and discretionary behaviors that promote and support organizational performance through altruistic motivations (Bateman and Organ, 1983). According to Organ (1988), OCBs include those that are beyond formal job requirements, driven by civic virtue, courtesy and sportsmanship, that contribute to the organizational function and not explicitly rewarded. Expanding on this idea, Dekas et al. (2013) suggest that HB portrays the altruistic and courtesy behavioral outcomes that prevent work-related problems. Examples of HB include filling in for a colleague on their day-off, providing career advice or even provide support in problem solving tasks (Dekas et al., 2013).

In the context of knowledge management literature, KSB can be defined as extra-role voluntary behavior, not always mandatory in organizations (Cabrera and Cabrera, 2005; Choi, Kim and Yun, 2019), with previous conceptual works even proposing KSB as a subdimension of OCB (Dekas et al., 2013). Conversely, knowledge sharing is often driven by motivational mechanisms that permit the engagement of such behaviors (Ajzen, 1991) when social exchanges are perceived and reciprocated (Choi et al., 2019). Drawing parallels between KSB and HB, evidence suggests that knowledge sharing can pose as a prosocial behavior, being stimulated by internationalized norms, with perspective-taking playing a vital part in the decision to share others (Obrenovic et al., 2020). However, while recognized as a prosocial behavior, there is still scarce empirical and conceptual work bridging knowledge sharing and prosocial, extra-role altruistic behavior (Thomas and Gupta, 2021). Considering the discussed similarities between HB and KSB, we propose that:
H2: HB has a positive relationship with KSB.

Evidence suggests that the growing body of work surrounding KSB addresses a juxtaposed relationship with individual, collective, and organizational characteristics (Ahmad and Karim, 2019). However, individual differences and psychological predispositions to engage in such behavior still posit a need to expand our knowledge behind knowledge sharing related phenomena (Obrenovic et al., 2020). Following such rationale, we argue that individual level and organizational level factors of influence are also complexly connected to demographic information leading to knowledge sharing: namely age and education (cf. Kianto et al., 2019). The complex interplay between conditions presents conflicting evidence, suggesting multiple pathways that can contribute to knowledge sharing. Lastly, and considering managerial consequences and the lack of empirical research addressing the discussed antecedent's contribution to the absence of knowledge sharing, we propose that:

P1: There are alternative configurations between age, education, HRMP and HB leading to the presence of KSB.
P2: There are alternative configurations between age, education, HRMP and HB leading to the absence of KSB.

Figure 1 presents the research model.

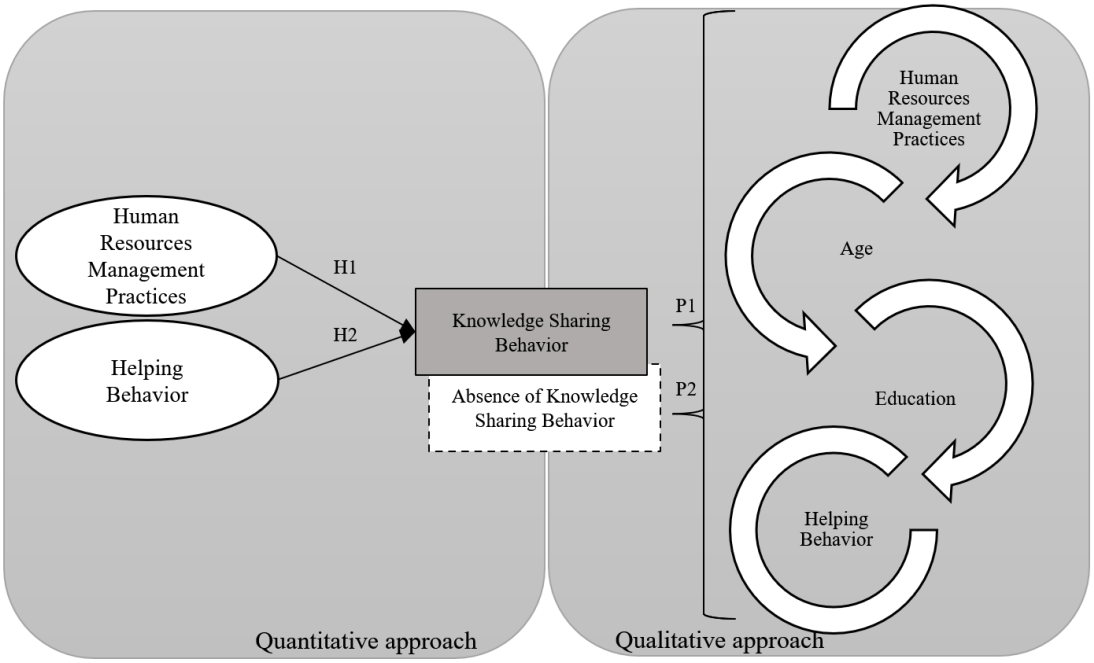


Figure 1: Research Model

3. Methods

3.1 Mixed-methods approach

This study follows a mixed-methods approach, using survey data to perform quantitative and qualitative analyses of KSB. Such research methodology allows for corroboration of results between techniques, allowing a flexible strategy of integration of results (Venkatesh et al., 2013). We use a PLS analysis to explore the relationship between HRMP and HB with KSB. We then use an fsQCA technique to identify complex configurations as proposed by the research propositions. The research design allows for triangulation of results, bridging academic and practical contributions as a result (Pindek et al., 2019).

3.2 Sample

The data comes from an online survey using QualtricsXM®, sent to a database including the 6500 top services sector companies operating in Portugal. We conducted several ex-ante measures to reduce common-method variance threats found in cross-sectional instruments (Reio Jr., 2010). Measures used come from different sources, previously validated and used. Anonymity and confidentiality were ensured. Items were counterbalanced and randomized. Clear instructions were provided to respondents, subject to consent. We then conducted a pretest of the adapted measures to Portuguese, following a back translate methodology. Following cleanup procedures, the final sample comprises 130 responses.

3.3 Measures

We use previously validated scales from different sources in the literature to address the studied constructs and further reduce common-method variance (Reio Jr., 2010). The scale for HB comes from the HB dimension of the OCB scale (Dekas et al., 2013). HB measures individual perceptions of selfless discretionary behaviors aimed at helping others under the perceived principle of increased social cost over benefit (Dekas et al., 2013; Organ, 1988). HRMP scale comes from Shape and Rednan (2010). HRMP measures the individual perception of existing hard HR and soft HRMP inside an organization (Shape and Rednan, 2010). KSB scale comes from Curado (2018). KSB measures the self-perceived engagement in knowledge sharing activities, considering both tacit and explicit knowledge sharing alike. All the measures were adapted, following a five-point Likert scale system (1 – Completely disagree to 5 – Completely Agree). Table 1 reports the descriptive statistics of the sample.

Table 1: Descriptive statistics

Demographics (n=130)	**Category**	***f***	**%**
Age (in years)	18-25	15	11.6
	26-33	21	16.3
	34-41	30	23.3
	42-49	27	20.9
	50-57	24	18.6
	58-65	9	7.0
	More than 66 years of age	3	2.3
Education	Secundary Education	13	10.1
	Professional Education	9	7.0
	Licenciate degree	61	47.3
	Master	41	31.8
	PhD	1	0.8
	Other	4	3.1

3.4 Quantitative analysis

We follow a quantitative approach through a PLS analysis. PLS is a method of structural equation model suitable to small sized samples (Chin, 1998). All the used measures were previously validated in different settings of research. However, given the diversity of service companies in the sample, we conducted an exploratory factory analysis to further assess the validity of the constructs. Initial assessment of Pearson's r and scatterplot among variables supports evidence of linearity (Watkins, 2018). The sample follows a normal distribution for all variables ($p < 0.001$). Bartlett's sphericity ($p < 0.001$) and the Keiser-Meyer-Olin statistic (>0.8) suggest data appropriateness to conduct the EFA procedures (Hair et al., 2016). The estimation model follows a least-squares estimation method through the principal component analysis using a varimax rotation. Then, we calculate the empirical estimation of the number of factors to extract. We follow a minimum average partials (MAP) analysis to counter the weaknesses of decisions based on eigenvalues alone (Watkins, 2018). MAP computes a matrix of partial correlations after the extraction of each component. Then, the partial off-diagonal correlation is calculated from the extracted previous matrix for each component (Velicer, 1976). The final solutions for the original and corrected MAP analysis propose the extraction of the 3 factors (HRMP, HB and KSB), further corroborating the Construct Validity of the measures.

3.4.1 Measurement Model

Following the EFA analysis, we assess construct reliability given the literature cutoff values. The obtained values were within the recommended range (Hair et al., 2019b). The analysis of variation extracted (AVE) and CR allows the convergent validity of the constructs. Similarly, all constructs present values above recommended cutoff thresholds for AVE (>0.4) and CR (>0.8) (Hair et al., 2019a; 2019b). HRMP shows the lowest value for AVE (0.44). Nevertheless, literature suggests that values higher than 0.4 are acceptable if combined with a high CR (>0.8) (Hair et al., 2019b) (HRMP ($\alpha = 0.883$; CR = 0.902; AVE = 0.440), HB ($\alpha = 0.920$; CR = 0.937; AVE = 0.713) and KSB ($\alpha = 0.874$; CR = 0.914; AVE = 0.728)). All outer loadings are above 0.7, or above 0.4 when combined with a CR higher than 0.7 (Hair et al., 2019a). Outer loadings for HRMP present an item with a lower loading (HRMP8 = 0.410). However, deletion of the item would decrease the reliability of the scale. The remaining HRMP items loadings ranged from 0.520 to 0.780. Outer loadings for KS ranged from 0.764 to 0.913 Outer loadings for OCB ranged from 0.811 to 0.892. All outer loadings are higher than the cross loadings for all the indicators for all the measures. Variance inflation factors show values below the recommended value (<5) for all the items. The heterotrait-monotrait ratio of correlations (HTMT) ranged from 0.359 to 0.509, being below the recommended threshold (0.85 for conceptually different constructs) (Hair et al., 2019b).

3.4.2 Quantitative results

We analyzed the significance of the relationships in the structural model using the SmartPLS® bootstrapping algorithm. Then, we conducted a blindfold analysis to predict the accuracy of the path model. Results show a value between low to medium accuracy (R^2 =0.300; Q^2 = 0.230; p<0.001) (Hair et al., 2019b). Regarding the hypotheses tests, results show that awareness and presence of HRMP positively impacts KSB outcomes (β=0.318; t =4.163; p <0.001). Thus, hypothesis 1 is supported. Similarly, extra voluntary HB positively impact KSB (β=0.318; t =4.163; p <0.001). Therefore, hypothesis 2 is also supported. Table 2 presents the quantitative results.

Table 2: Quantitative results

Paths	Coefficient	t value	*p*	Hypothesis result
HRMP→KSB	0.318	4.163	<0.001	Supported
HB→KSB	0.358	4.909	<0.001	Supported

3.5 Qualitative analysis

After the quantitative analysis, we conducted a qualitative approach to explore our propositions on configurational complexity leading to the presence and absence of knowledge sharing. FsQCA is a context application technique that explores configurational pathways of complex conditions contributing to the studied outcomes (Pappas and Woodside, 2021). Created to expand on traditional empirical analysis that use symmetrical statistical approaches, fsQCA an objective technique that relies on statistically informed configurational approaches using complex theory (Kumar et al., 2022). As a technique following Boolean principles, fsQCA allows for the combination of sets of variables whose non-linear synergy is of interest in the study of complex outcomes, such as behaviors and behavioral intentions (Fiss, 2011). Furthermore, fsQCA offers a holistic approach, exploring diversity (under a variety of conditions) and pathways leading to both the presence and absence of a desired outcome (Fiss, 2011). Given the detailed analysis possibilities of the fsQCA technique, the combined qualitative treatment of quantitative data supports mixed-methods research (Pappas and Woodside, 2021). Thus, the empirical quantitative nature is expanded with qualitative inductive reasoning for an increase richness of results (Ragin, 2008). FsQCA is a suitable technique to study knowledge sharing given knowledge sharing multidisciplinary complexities (Santos et al., 2022; Santos, Oliveira and Curado, 2021; Oyemomi et al., 2019). Similarly, fsQCA usage has exponentially increased in Management research (Kumar et al., 2022), Entrepreneurship (Kraus et al., 2018), Marketing and Information Systems (Pappas and Woodside, 2021). Considering such rationale, we follow a fsQCA technique to explore how HRMP and HB, in combination with demographic characteristics of the sample (Kianto et al., 2019), interact leading to the presence and absence of knowledge sharing.

3.5.1 Calibration

We used a direct method for calibration that requires the transformation of variable values into membership scores (Ragin, 2008) for HB, HRMP, age, education and KSB. Membership scores follow three anchors calculated from the average of conditions, ranging from 0, 0.5, and 1. The three anchors express full non-membership (0), full membership (1), and maximum ambiguity conditions calibrated according to the transformation midpoint (0.5). Table 3 expands the descriptive statistics of the sample, with the inclusion of the calibration cuts used.

Table 3. Descriptive statistics and calibration of conditions and outcome

Conditions and outcome	*Descriptive statistics*	*Calibration cuts*
Knowledge Sharing Behavior (KSB)	μ = 4.21; σ = 0.77; min = 1; max = 5	(5; 4.3; 3.9)*
Human Resources Management Practices (HRMP)	μ = 2.93; σ = 0.89; min = 1; max = 4.75	(3.95; 2.85; 1.8)*
Helping Behaviors (HB)	μ = 3.77; σ = 0.76; min = 1.4; max = 5	(4.9; 3.9; 2.9)*
Age (in years)	≤ 25 =11.5%	≤ 25 = 0
	≥ 26 and ≤ 33 = 16.2%	≥ 26 and ≤ 33 = 0.2
	≥ 34 and ≤ 41 = 23.1%	≥ 34 and ≤ 41 = 0.4
	≥ 42 and ≤ 49 = 20.8%	≥ 42 and ≤ 49 = 0.6
	≥ 50 and ≤ 57 = 18.5%	≥ 50 and ≤ 57 = 0.8
	≥ 58 = 9.9%	≥ 58 = 1
Education (university degree)	Not graduated = 16.9%	Not graduated = 0
	Graduated = 46.9%	Graduated = 0.5
	Postgraduated = 36.2%	Postgraduated = 1

* Calibration cuts (0.95; 0.50; 0.05).
μ = average; σ = standard deviation; min = minimum value; max = maximum value

3.5.2 Necessity and Sufficiency analysis

The fsQCA permits the assessment of complex non-linear relationships by assessing each single case and indicating necessary and sufficient conditions leading to the outcomes (Rihoux and Ragin, 2009). This comparative analysis of cases follows two analyses. The necessity analysis addresses necessary conditions for the outcome when the outcome is present in the subset of the condition, or set of conditions (Ragin, 2008). Results show that there are no necessary conditions to KS. That is, KSB can be present even in circumstance where HRMP, KS, education or age are not. We then conduct the sufficiency analysis via the generation of a truth table that provides configurational solutions for the studied conditions. After the inspection of both the intermediate and parsimonious solutions, we identify core conditions and peripheral conditions leading to the outcome (Ragin, 2006). Core conditions are conditions leading to the outcomes present in both the parsimonious and intermediate solutions, whereas peripheral conditions are conditions that are only present in the intermediate solution. The absence of a condition or outcome is represented by "~" (Ragin, 2008) ahead of its label.

3.6 Qualitative Results

Following the inspection of the truth tables, we identified the configurational pathways leading to both the presence and absence of knowledge sharing. Results show raw coverage and consistency values respecting the recommended threshold (Ragin, 2006; Woodside and Zhang, 2013). Table 4 reports the intermediate solution leading to the presence of knowledge sharing. Table 5 reports the intermediate solution leading to the absence of knowledge sharing. Black circles (●) indicate the presence of a condition in the configuration contributing to the outcome. Voided circles (○) indicate the absence of a condition in the configuration contribution to the outcome. Blank spaces indicate that the condition is not relevant for the configuration. Larger circles indicate a core condition. Smaller circles indicate a peripheral condition.

Table 4: Complex configurations for the presence of Knowledge Sharing Behavior (KSB)

KSB = f(edu, age, HB, HRMP)							
Configuration	**Conditions**				**Coverage**		**Consistency**
	education	**age**	**HB**	**HRMP**	**Raw**	**Unique**	
1	●		●	●	0.456136	0.456136	0.767212

Overall Solution coverage: 0.456136; Overall Solution consistency: 0.767212

Table 5: Complex configurations for the absence of Knowledge Sharing Behavior (~KSB)

~KSB = f(fedu, age, HB, HRMP)							
Configurations	**Conditions**				**Coverage**		**Consistency**
	education	**age**	**HB**	**HRMP**	**Raw**	**Unique**	
1	○			○	0.405205	0.056777	0.839661
2				○	0.459550	0.038842	0.813349
3	●	○	○		0.421668	0.091710	0.795093
4	○	●	○		0.345353	0.033438	0.834206

Overall Solution coverage: 0.705153; Overall Solution consistency: 0.756989

Results show the existence of a single condition leading to the presence of KSB (Configuration 1). Education, HB and HRMP are core conditions in the configuration, yet, age is not relevant to the presence of knowledge sharing. Organizational members with higher education, who engage in altruistic behaviors and are aware of HRMP inside the organization share knowledge with others, regardless of their age.

Regarding the absence of KS, results show that there are four configurations leading to the absence of KS. Education condition's presence and absence are peripheral conditions, whereas the age condition's presence and absence, the lack of HB and absence of HRMP are core conditions. Results show that organizational members with lower levels of education that perceive an absence of HRMP in the organization do not share knowledge, regardless of their age and degree of engagement in helping others (Configuration 1). Similarly, the absence of perceived HRMP by organizational members contributes – by itself – to the absence of knowledge sharing, regardless of their age, education and engagement to help others (Configuration 2). Results also show that HRMP is an irrelevant condition contributing to the absence of KSB behavior in when considering young and

more educated organizational members that are not engaged in helping others (Configuration 3). Configuration 4 regards older and less educated organizational members that do not engage in HB.

4. Discussion and Conclusions

Our findings underpin and expand on previous research emphasizing the importance of perceived organizational support through organizational practices and promotion of cooperation. Lin and Hsiao (2014) propose that employees that are more prone to engage in organizational citizenship behavior are more likely to share knowledge. Similarly, our findings corroborate the important role of HRMP in knowledge sharing practices, since HRMP stimulate the organization's social capital (Dodokh, 2020; Singh et al., 2021). Qualitative findings expand the quantitative findings by exploring complex non-linear configurations leading to the presence and absence of knowledge sharing.

Qualitative results show that there is a single configuration leading to knowledge sharing (Table 4. Configuration 1), which is consistent with the results from the hypotheses testing. Our findings reveal that older altruistic employees and the existence of HRMP generate KSB. Such evidence is consistent with the importance of individual altruistic predisposition to share knowledge with others (Obrenovic et al., 2020) paired with the promotion of HRM initiatives (Singh et al., 2020). Our findings suggest the importance of having HRMP among altruistic individuals with higher education. We propose that the promotion of self-efficacy through the pursuit of university degrees should be encouraged in service organizations.

By contrast, there are four configurations leading to the absence of knowledge sharing. Thus, achieving knowledge sharing is rare. It seems it is a more complicated organizational endeavor, prone to inflexible circumstances where managerial strategies concerning peer support and the existence of both hard and soft HRMP need to be ensured. On the other hand, the absence of knowledge sharing is more common to achieve. Such results endorse previous literature arguments who discuss the complexity behind organizational frameworks to the successful implementation of knowledge management tools (Agrawal and Mukti, 2020).

There are evident negative consequences of not having HRMP (Table 5. Configurations 1 and 2) or not having HB (Table 5. Configurations 3 and 4); in such cases there is no KSB. Results show contrasting evidence of circumstances between age and education when organizational members do not engage in helping others, regardless of existing HRMP (Table 5. Configurations 3 and 4). Such results corroborate previous findings highlighting the importance of the demographic interplay in individual characteristics leading to knowledge sharing (Fasbender and Gerpott, 2021; Ohja, 2005). One configuration shows that there are circumstances where only the absence of HRMP is necessary to prevent KSB (Table 5. Configuration 2). Following on contrasting demographic circumstances, results reveal such argument through the irrelevance of HRMP in cases where HB is absent (Table 5. Configurations 3 and 4). We argue that attention must be given not only to the *existence* but also to the *usage* of HRMP (Singh et al., 2021).

Fasbender and Gerpott (2021) suggest that age discrimination is indirectly related to an intention to limit knowledge sharing. While older individuals with higher perceptions of self-efficacy are more likely to share knowledge with their younger counterparts, ageist HRMP can negatively moderate the self-efficacy of older organizational members, leading to reduced knowledge sharing. Similarly, our findings corroborate this view as per circumstances found where age (and education) contributes in different ways to the absence of knowledge sharing. Younger employees with higher education and with an absence of HB are found in circumstances leading to the absence of knowledge sharing (Table 5. Configuration 3). Older employees with a lower level of education and with an absence of HB also don´t share their knowledge (Table 5. Configuration 4). Advising caution, we posit that older, less educated organizational members might be exposed to HRMP that favor younger workers (Boehm and Dwertmann, 2015). Therefore, we advise the promotion of HRMP that can support knowledge sharing (Dodokh, 2020), and fight ageism (Fasbender and Gerpott, 2021).

Our work provides several theoretical and practical contributions. We use a mixed-methods approach to achieve triangulation and complementarity between quantitative and qualitative methodologies. Findings in Table 4 are in line with hypotheses testing results (supporting triangulation), whereas Table 5 offers configurations to the absence of KSB (providing complementarity). Inherent complexities related to KSB allowed for a richness of results that would not be possible to achieve using a quantitative methodology alone. Our work also addresses several research gaps. First, we expand on the identified psychological complexities behind KSB and altruistic

behavior (measured by HB). We also address an identified research gap related to the complex interaction of HRMP and social capital characteristics (education, age, HB) by devising a research strategy that accommodated such requirements.

Regarding the practical implications of our work, we provide insight of both configurations leading to the presence and absence of knowledge sharing. Thus, this work conclusions provide guidelines and directions to undertake in the shape of organizational practices to potentiate KSB. Similarly, our findings hint *what not to do* to counter KSB absence. We may advise managers to promote a communication culture in their organizations, promoting the self-efficacy of employees through self-actualization and training. Similarly, we posit that fostering prosocial behavior policies, paired with robust HRMP is vital to the maximization of KSB between members. We also advise caution when considering team configurations based on age and education in situations where organizational culture is characterized by low communication, high competition, and lack of perceived altruistic behavior among peers.

5. Limitations and future work

This works presents limitations. We use a combination of PLS and fsQCA techniques to provide a theoretical and practical contribution grounded on a detailed, in-depth analysis of knowledge sharing phenomena in service organizations. However, our research design also follows a cross-sectional time horizon, therefore limiting causality. The reduced sample size (n=130) focused on a specific geographical scope (Portugal) presents possible researching bias, requiring further replication of findings in more diversified environments. Notwithstanding, our work provides a managerial blueprint that can be pursued to maximize knowledge flows in service organizations. We recommend future research to include further hybrid conditions that articulate organizational practices and individual conditions: namely team characteristics, configurations, and the role of leadership as contributors to the presence and absence of knowledge sharing. Given research limitations, we would also like to suggest future research to pursue a longitudinal time horizon to better understand the evolution of internal and external influences interacting with knowledge sharing. Lastly, we also recommend the inclusion of diversified knowledge, as described by knowledge management ontology: namely through the exploration of differences between tacit and explicit knowledge sharing alike.

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The Perceived Effect of Intellectual Capital on the Performance of a Higher Education Institution: A Case Study

Adriana Gradim[1], Elaine Neris[2], José Vale[3] and Florinda Matos[4]
[1]University of Aveiro – DEGEIT University of Aveiro, Portugal
[2]Federal Institute of Education, Science and Technology of Mato Grosso - Campus Juina Brazil
[3]CEOS.PP - Centre for Organisational and Social Studies of P. Porto, Porto Accounting and Business School, Polytechnic Institute of Porto
[4]DINÂMIA'CET-IUL - Centre for Socioeconomic Change and Territorial Studies, Iscte - University Institute of Lisbon, Lisboa, Portugal
adrianacoutinho@ua.pt
elaine.neris@ifmt.edu.br
josevale@iscap.ipp.pt
Florinda.Matos@iscte-iul.pt

Abstract: During an increasingly competitive environment, where digital technologies play a crucial role, organisations began to seek competitive advantages in their intangible resources to survive. Therefore, organisations' intellectual capital (IC) is considered an essential source of competitive advantages. Higher Education Institutions (HEI) have also recognised the relevance of this phenomenon since these organisations use their IC to produce knowledge. In response to the call to analyse IC in practice, which includes emerging countries, this paper's goal is twofold. On the one hand, it aims to assess the perceptions of a Brazilian HEI's internal stakeholders regarding the relative importance of each IC dimension. On the other hand, it intends to understand how IC influences the performance of these organisations. Additionally, it intends to comprehend how internal stakeholders perceive and might measure performance. A case study was conducted at the Brazilian Federal Institute of Education, Science and Technology of Mato Grosso. The findings suggest that the three traditional IC dimensions are equally important to create competitive advantages, although there is no unanimity regarding which is the most important. They also show that IC influences, through several means, the performance of the HEI, although there was a focus on individual performance and also on negative issues, something which may, potentially, be caused by some lack of knowledge regarding the IC concept. Another finding is the lack of awareness regarding the importance of digital technologies in improving IC. Finally, an overlap between IC and performance indicators has been noticed. This study contributes to developing awareness about the relevance of intellectual capital in HEIs pertaining to emerging countries and its importance in improving their performance.

Keywords: Intellectual capital, performance, higher education, case study, stakeholders, digital technologies

1. Introduction

Currently, economic prosperity is deeply related to knowledge-based competitiveness, where "knowledge-based" resources play a crucial role in the development of the "modern organisation" (Guthrie, 2001; Shehzad et al., 2014). Knowledge sharing practices, knowledge development, networks that produce a good image, and information systems that support quality decision-making are critical success factors for a company (Chatterji and Kiran, 2017). Also, organisations are entering a digital transformation. This digital transformation and the development of digital tools mechanisms may help organisations sustain competitive advantage since the future is digital and the traditional management mechanisms are less appropriate for organisations to grow (Al Hakim et al., 2020). Hence, this study focuses on the concept of Intellectual Capital (IC), which has seen its popularity increase significantly in the last three decades. Different theories, such as the resource-based theory, the learning organisation theory, the information processing theory or the human capital theory, suggest that IC has the potential to create value and increase a company's performance (Shehzad et al., 2014). Although there is no unanimity regarding its definition, IC is traditionally categorised into three dimensions: human capital, structural capital and relational capital (Lee, 2010). Furthermore, organisational value creation depends on the interaction between these IC dimensions. The greater the interaction, the greater the ability to create value (Cabrita and Vaz, 2006).

This paper addresses IC in a specific context: the education sector in an emerging country: Brazil. Education is a crucial pillar in any economy, and its role in a country's success is indisputable (Chatterji and Kiran, 2017). However, on the one hand, the quality of education depends highly on the organisation's resources (namely

intangibles) to create IC. On the other hand, if the organisation does not have the proper resources to create IC, it will negatively impact its performance, namely regarding organisational innovations and competitiveness (Tjahjadi, 2022). Therefore, in this paper, IC is defined as a "dynamic system of intangible elements whose effective management is essential to enhance value creation in universities" (Ramírez et al., 2013, p. 27).

Higher education institutions (HEIs) can be considered providers of knowledge, innovation facilitators, promoters of entrepreneurial talent, economic and civic leaders, and especially knowledge pioneers (Bejinaru, 2017). These institutions play a key role in developing a knowledge-oriented society, using intangible resources as input to produce knowledge (Shehzad et al., 2014). Therefore, IC is one of the most important strategic resources for improving organisational performance (Tjahjadi, 2022).

However, research on the interrelationship between IC and performance is still scarce in the context of HEIs pertaining to emerging countries, something which is missing in the literature, and can allow cross-country analyses. Assessing this interrelationship in such institutions is highly important since the better the management of their internal resources (namely intangible ones), the better their performance will be (Tjahjadi, 2022). Also, managers tend to assess performance based on financial indicators, something which has been considered insufficient (see Zuñiga-Collazos et al., 2020). Therefore, the general goal of this paper is to analyse the perceptions of an HEI's internal stakeholders on the importance of IC and understand how IC influences an HEI's performance. Additionally, the paper aims to comprehend how internal stakeholders perceive and might measure performance, by exploring their opinions.

Regarding the paper's main goal, the following research questions were formulated:

Q1) How do an HEI's internal stakeholders perceive each IC dimension?

Q2) How IC influences the performance of an HEI?

An in-depth case study was carried out at the Federal Institute of Education, Science and Technology of Mato Grosso (Campus Juína) to answer these questions.

The remainder of the paper is structured as follows:The second section is devoted to the review of relevant literature. Next, the adopted methodology is described. In the fourth section, the results are presented and discussed. Finally, in section 5, some concluding remarks are made, and cues for future research are offered.

2. Literature review

2.1 Intellectual capital in higher education institutions

Higher education institutions (HEI) are increasingly immersed in a transformation process provoked by a need to become more flexible, transparent, competitive and comparable. These institutions are an important source of intangible resources, and, thus, they need to properly manage these resources and recognise the value of IC (Ramírez and Gordillo, 2014). Over the years, it has been debated the need for human resources to develop human digital capital skills as a way to organisations secure competitive advantage. Hence, it is necessary to elaborate mechanisms, which should be created through digital tools, to help efficiently manage knowledge and IC (Di Vaio et al., 2020).

Hence, to create value, it is essential for HEIs to identify IC measures, as well as to effectively manage and report it (Córcoles et al., 2013). HEIs can develop models (based on financial and non-financial indicators) specially designed to identify and provide information about their strategies, objectives, visions, activities and main intangible resources (Ramírez et al., 2017). Consequently, it becomes possible for HEIs to know the skills that most contribute to their performance, improve resource allocation, enhance synergies, and reach their goals. IC can be recognised as a fundamental strategic factor in facing competitive challenges (Ramírez et al., 2017).

Over the past three decades, several definitions of IC have emerged (see Dumay, 2016). In this paper, IC is considered a dynamic system composed of intangible resources, of which effective management is essential to create value for HEIs (Ramírez et al., 2013). This paper also adopts the traditional taxonomy applied in IC research, which considers IC composed of three dimensions: Human Capital (HC), Structural Capital (SC) and Relational Capital (RC). In the case of HEIs, human capital refers to the intangible value inherent to individuals' competencies, which, in short, encompasses the expertise, knowledge and experiences of researchers,

professors, technicians, and students (Secundo et al., 2015). Structural capital refers to the intangible resources pertaining to the institution. It includes, among others, databases, intellectual property, research projects, the research infrastructure, research and education processes, governance principles and the university culture (Secundo et al., 2015). Finally, relational capital encompasses HEIs' internal and external relations, such as contacts with public and private partners, their position and image in networks, their academic prestige, the partnerships with the business sector and regional governments, their links with the civil society, collaborations with research centres, networks and alliances, or their attractiveness as a place to study and work (Secundo et al., 2015). From another perspective, and in the context of the present digital economy, the digital transformation is a holistic concept that requires a change in all the organisation's processes by knowing which technologies are relevant and how they can improve the business and the value created to all stakeholders (Gabryelczyk, 2020). Therefore, IC dimensions should incorporate new technological and digital innovations. For example, employees need to acquire new digital skills (i.e. develop HC) (Gabryelczyk, 2020).

Regarding the relative importance of the IC dimensions, there is no unanimity. Ramírez et al. (2013) argue that HEIs' stakeholders generally consider RC the most important dimension, followed by HC and, finally, SC. However, Ramírez and Gordillo (2014) suggest a different order, stressing the importance of HC, followed by SC and then RC. Barbosa et al.'s (2016) study show another perspective, i.e., that the three dimensions have the same level of importance, according to the perception of different stakeholders.

IC is an evolving phenomenon (Martín de Castro et al., 2011). Therefore, different phases can be distinguished in terms of their investigation. IC research is currently expanding its vision and is thus heading into its fifth phase (Bisogno et al., 2018), which is concerned with how higher education institutions, as stakeholders in a broader ecosystem, can help solve social problems (Secundo et al., 2018). Therefore, measuring and monitoring HEIs' IC is a crucial task which can positively impact society (Pedro, 2020).

2.2 Intellectual Capital and Performance in Higher Education Organisations

Two main reasons justify performance measurement in HEIs: to help improve education quality and help HEIs meet the demands of their stakeholders (Chen et al., 2009). For a long time, effectiveness and efficiency were the most used standards to measure organisational performance. However, HEIs' performance has a multidimensional nature. Its evaluation requires appropriate indicators and methods to measure different dimensions (Cricelli, 2018). These indicators should allow the control and measure of education's quality, provide information to policymakers, and allow references for managing and allocating educational resources (Chen et al., 2009). Thus, it becomes crucial for HEIs to know their stakeholders' opinions about their goals and the performance indicators to be used.

Considering that knowledge is both an input and output for HEIs and that their most valuable resources encompass professors, researchers, staff, students, their relationships or their routines, it is possible to claim that their performance is directly associated with IC (Ramírezet al., 2017; Bratianu and Orzea, 2013). In recent years, literature has considered IC a "strategic variable in achieving adequate performance in the universities" (Iacoviello, 2019, p. 2). Several initiatives and models have been developed, namely since 2004. Leitner (2004) gave a significant contribution by developing a framework with the following reasoning: IC development is a consequence of the established political goals and the HEI's goals. This framework distinguishes six performance processes which impact the HEIs' stakeholders. Other initiatives were also conducted, namely in Spanish Universities. It can be stressed the IC Program (ICP) project in Madrid, the Observatory of the European University (OEU) at the Autonomous University of Madrid, or the Knowledge Management Project at the University of the Basque Country (Ramírezet al., 2017). Córcoles et al. (2013) also developed a model to identify the most common intangibles present in HEIs. Thus, this paper adopts a concept of organisational performance, which considers the combined results between individual, team and program performance (Lusthaus et al., 2002). Accordingly, an HEI must have its performance measured by the ability of its academic staff to transfer their competencies and, consequently, a graduate must have his success measured by his ability to "develop" their own competencies (Sultanova et al., 2018). This means that performance management and IC reporting (through different indicators) overlap to some extent (Leitner, 2004). In fact, Ramírez and Gordillo (2014) proposed a model based in the traditional IC taxonomy, which can be adopted to measure HEIs' performance. They used the following intangible elements: academic and professional qualifications of staff; teaching capacities and competencies; mobility of teachers and researchers; scientific productivity; management quality; effort in innovation; intellectual property; graduate employability; student satisfaction; efficiency of graduate teaching; relations with the business world; collaboration with other universities; and university's image.

Over the past few years, some authors have endeavoured to research the relationship between IC and performance in HEIs since "intellectual capital can improve HEIs' performance because of their ability to transfer knowledge" (Tjahjadi, 2022, p.3). For example, Mumtaz and Abbas' (2014) study showed a significant effect of IC on the performance of Pakistainese private HEIs, stressing the importance of HC. Alain (2015) assessed the effectiveness of IC and academic performance and its relationship in HEIs pertaining to the Kingdom of Saudi Arabia. The study suggested a positive and significant relationship between IC (and all its dimensions, namely HC) and academic performance. Barbosa et al.'s (2016) study addressed the perceived importance of each dimension of IC and its contribution to HEIs' performance. Their findings suggest that HC, SC and RC influence performance in an interconnected way. Also, Chatterji and Kiran (2017) explored the organisational and relational capital and their effects on northern India HEIs' performance, providing useful insights to policymakers. The results suggest that HEIs need to interact closely with government institutions and private industries to improve their relational capital. Anggraini et al. (2016) assessed the effect of IC and its dimensions (human, structural and relational capitals) on the performance of 8 public HEIs in Indonesia. They found a significant relationship between IC (and its dimensions) and HEIs' performance, with relational capital having the strongest influence.

In resume, HEIs should manage their IC as a whole (Pedro et al., 2022). However, according to Pedro et al. (2022, p.255), HEIs "should also pay greater attention to how HC may represent the dimension with the greatest room for improvement". Moreover, they also consider that stakeholders keep a good perception of the positive and significant relationship between an HEI' IC and its performance. These various examples show that although IC must be considered as a whole variable that can influence performance, different dimensions can have stronger or weaker influences.

3. Methodology

In this study, an exploratory in-depth single-case study was conducted to analyse the perception of the internal stakeholders of an HEI specific Campus (Campus Juína) about the importance of IC and its dimensions, as well as its effect on performance. According to Yin (2017), adopting the case study method is ideal for analysing contemporary phenomena in their specific context. Campus Juína is located in the Amazon biome and pertains to the Federal Institute of Education, Science and Technology of Mato Grosso (IFMT), which encompasses 19 campuses. According to IFMT's registries, 841 students were enrolled in Campus Juína, of which 332 attended a higher education course and 32 a post-graduation one. Furthermore, its staff comprises 44 administrative technicians, 50 permanent professors, and 12 contract professors.

Data were collected through semi-structured interviews, complemented with document analysis and direct observation. The semi-structured interviews used open questions and were preceded by the following steps: 1) development of an interview guide which was composed of eight questions, aiming to assess the interviewees' opinion towards the IC concept and the relative importance of each IC dimension, to know how the internal stakeholders perceive organisational performance, and to assess how IC influences performance. The guide also included an additional question where was asked the interviewees to name some indicators that they consider important for assessing the Campus performance; 2) scheduling the interviews (by e-mail or in-person), and 3) collecting the signature on the free and informed consent form for the audio recording of the interview to be authorised.

Between the 3rd of July and the 17th of August 2018, 25 face-to-face interviews were conducted: 10 with middle and higher-level administrative technicians, 9 with professors, 3 with coordinators of higher education courses, and 3 with students representing higher education courses. The interviews had an average duration of 40 minutes. The study's theme and objective were explained at the beginning of the interviews. Since most interviewees did not fully comprehend IC, this concept was also briefly explained. All interviews were audio-recorded. Then, they were fully transcribed. During the interviews, notes were also taken. Direct observation of the context was also carried out, that is, of the Campus itself. Finally, to characterise the HEI, documents were analysed, specifically the current Institutional Development Plan (PDI 2014 – 2018) and the Law for the Creation of Federal Institutes. It was still necessary to use electronic correspondence to access additional information, such as the number of students enrolled during the research period and the number of effective servers (technicians and professors). Finally, the data was subject to content analysis and a codification process.

4. Results and discussion

Regarding the first research question (how an HEI's stakeholders perceive the relative importance of IC dimensions), it is important to stress that most interviewees were not aware of the concept. That is why a brief explanation of the concept was provided. Nevertheless, opinions were divided. About half of the interviewees considered that the IC dimensions are equally important, which is in line with Barbosa et al. (2016), who consider that HEI's stakeholders tend to perceive all IC dimensions to have the same importance level.

However, the other half stressed the importance of HC and RC. For example, in line with authors such as Ramírez and Gordillo (2014), who stress the role of HC in HEIs, INT14 suggested that: "[first], you need the human capital (…) so that you can apply [new] knowledge in your institution (…), and that knowledge you will [develop the organisation]. This interviewee considered that relationships result from human and structural capital development. INT17 also stressed the importance of HC, claiming that "it is very important when the personnel is committed. Consequently, teaching can be effective even if it occurs under a tree. Structural capital only would be important to maintain the basic rules". In INT 7 words, "if I do not have a good relationship with the students, it is no use". Conversely, other interviewees consider relational capital the most important IC dimension, which is in line with Ramírez et al.'s (2013) study. For example, INT3 considers that "some assistant technicians enter the organisation without knowing it. Therefore, relationships with others can foster better knowledge of the organisation. According to this interviewee, some people have knowledge but cannot potentiate it, while others with fewer skills can do much better due to the relationships they create". These findings show that some interviewees only perceive relationships as internal ones, such as the ones between teachers and students or other internal actors, something which is not in line with Secundo et al. (2015), who stress the importance of both internal and external relationships. Only a few interviewees highlighted both internal and external relationships. INT18 had a particular opinion: "I think relationships have a higher impact. For example, it is complicated to fix human relationships, whether internal or external. It [can] take years; it depends on the person".

Furthermore, almost all interviewees considered that the IC dimensions complement each other and should be addressed in a balanced way. Such fact is in line with Pedro et al. (2022), who argue that IC should be viewed as a whole. As INT15 puts it: "[all IC dimensions] must be intertwined and intrinsic; otherwise, [it] does not work. They must be in harmony". INT19 considers that "good relationships, the company's culture and peoples' skills and knowledge (…) are factors that complement each other (…). Together, they can improve the institution as a whole". This interaction was illustrated both positively and negatively. For example, according to INT3 "[an employee] went on a process mapping course. This fact had a structural impact because now [we can] map our processes". This example illustrates how HC is related to SC. However, negative effects can also be verified, as mentioned by INT4: "A PhD thinks he is so superior to others, that he does not treat people with respect here, affecting the students [and] the colleagues". The stakeholders' perceptions are in line with Barbosa (2016) and Bratianu and Orzea (2013), who argue that there must be an interaction between the dimensions of IC. However, not always value is created.

Finally, and surprisingly, no interviewee tackled the importance of new technologies and digital processes to improve the HEI's IC.

Regarding the second research question (how IC influences the performance of an HEI), all respondents considered that IC influences the overall performance of Campus Juína. For example, INT19 considered that "if [the institution] has people with skills, with good knowledge, an organisational culture shared by everyone, and good relationship between the members, then there is a better chance of having a good performance". However, according to INT5: "performance is about results, and to have results, you must have goals (…). So, I think [IC] is (…) a crucial factor in achieving performance, both positively and negatively". These illustrations are in line with Mumtaz and Abbas (2014), Alain (2015), Barbosa et al. (2016) or Chatterji and Kiran (2017), which suggest that IC affects HEIs' performance, both positively and negatively.

In fact, several interviewees focused on the negative side of performance. INT14 illustrated such an effect, claiming that "the relationship between teacher and student can affect the institution's performance. (…) From the moment you have friction, for example, which happens in higher education courses, some classes can be affected (...). This [can] cause demotivation, which [can lead to the] dropping out of several students due to the fact of not having a good relationship with the teacher". INT7 also considers that "sometimes we are not

effective in the structural part. For example, I participated in a committee focused on student retention and success. We spent a long time studying, researching and discussing, and we did a project with improvement actions. [However, this project] stopped. We start something and do not finish it". These illustrations show that performance can be addressed not only at the institutional level but also at an individual one, as conceptualised by Lusthaus et al. (2002).

Also, the findings suggest that each IC dimension can impact organisational performance. For example, according to INT7, RC has the greatest effect on performance among the three IC dimensions. As he claimed, "I have a good relationship with a company (…), and recently we have been able to send them some interns, we have been able to do research there, have field classes and now, finally, we have received donations from them. All of this came from that relationship. [Inversely] we see several problems of teachers with relational problems with the class, and [consequently] students have low performance because they do not have a good relationship with the teacher". These findings are in line with Anggraini et al. (2016). They suggest that the IC has a significant influence on the global performance of HEIs and emphasises that relational capital contributes with a strong influence compared to human capital and structural capital. Hence, contrary to Pedro et al's (2022) claim that HC may be the dimension with more potential for improvement, in some cases, RC and SC should also be stressed.

Other perceptions were still found, highlighting human capital as the one with the greatest effect. For example, according to INT9, "if a teacher arrives in my classroom who is just graduating and has no experience in the classroom or is not prepared to teach a class, I think this will influence his students' performance (...). So, I believe that if he does not have a certain experience, he will not be able to transmit the knowledge in a way that the students can understand, and this will affect the students' performance". Once again, there is a focus on performance at an individual level (see Lusthaus et al., 2002). Also, the interviewees did not address the importance of new digital tools or new digital human skills to improve performance.

Finally, to comprehend how the HEI's internal stakeholders might measure performance, some examples of indicators were provided by them. Then, these performance indicators were divided into different dimensions, specifically: technicians; teachers; higher education courses; research; services; and financial. The results show that most proposed indicators have a non-financial nature, in line with Ramírez and Gordillo (2014). Also, according to Leitner's (2004) conclusions, the results show an overlap between IC and performance indicators, which is exemplified in Table 1.

Table 1: Educational Performance Indicators

Educational Performance Indicators		
Indicators for evaluating technicians' performance	**Indicators for evaluating teachers' performance**	**Indicators for evaluating the performance of higher education courses**
Student satisfaction with attendance	Participation in events and projects	Student satisfaction with the course
Participation in extension activities	Number of papers produced	Number of graduates employed in the area
Punctuality	Number of participations in commissions	Number of surveys related to the course
Participation in training, capacity building, congresses or lectures	Student satisfaction toward the teacher	Students' interest during the courses
Quantity of tasks performed	Number of supervisions	Teachers' qualifications
Assiduity	Punctuality	Number of graduates employed in the area
Relationship with colleagues	Teacher-student relationship	Withdrawal rate
Relationship with supervisors	Participation in training, capacity building, congresses or lectures	Professional qualification
Initiative capability	Elaboration of summaries	Number of practical classes
Assistance quality	Participation in events	Campus Assessment
Compliance with the assistance schedule	Publication of papers	Investment spent by number of graduating students
Number of people who attended the library	Relationship between teachers and coordinators	Number of teachers hired

Educational Performance Indicators		
Indicators for evaluating technicians' performance	**Indicators for evaluating teachers' performance**	**Indicators for evaluating the performance of higher education courses**
Books layout	Workload compliance	Ratio between the number of students entering the courses and the number of students leaving the courses
Receptivity in the service	Average of students	Number of vacancies filled
Speed of service	Degree level	Monitoring of graduates during a given period
Control of the diaries	Absenteeism rate	Number of scholarships for assistance and permanence
Relationship with the public	Availability for student attendance.	Students' scientific production
Relationship with other sectors	Publication of books	Infrastructure of higher education courses/appropriate lighting/technological resources
Teachers' satisfaction regarding the technical assistance	Active methodologies in classes	Number of visits to the library/laboratories
Fulfilment of tasks	Compliance with the work plan	Participation in scientific events
Compliance with deadlines in the delivery of documents	Quantity of practical classes	Approval rate of students in the subjects specific to their area of study
Capacity of initiative	Compliance with the syllabus	Biannual evaluation to evaluate the students' performance
Participation in projects within the institution		Students' satisfaction with the course teachers
Respect for hierarchy		Relationship of the courses with the community
Sector organisation		Number of students who came from other cities
Number of participations in commissions		Average individual and class grades during the course
		Final exam prepared by the course coordinators

5. Concluding remarks

This study aims to assess the perceptions of the internal stakeholders of an HEI, regarding the relative importance of each IC dimension, as well as to comprehend the effect of IC on its performance. It is possible to conclude that the HEI's internal stakeholders consider that all IC dimensions are important, should be approached in an interconnected way and can influence the institution's performance. However, there was no unanimity regarding which IC dimension was considered the most important. Although most of the interviewees considered that all IC dimensions are equally important, the remainder stressed the role of RC and HC. Also, most stakeholders focused on the internal relationships, something which suggests that they were not totally aware of the IC concept, even after a brief explanation.

Regarding the stakeholders' perception concerning the effect of IC on performance, there was no consensus on the dimension considered most important in this aspect. However, all dimensions may have the potential for improvement. Furthermore, the paper suggests that although performance can be conceptualised according to different levels, most interviewees addressed it at the individual level, with a particular focus on students and teachers. A negative view of performance was often highlighted, something which may be explained by the context: a specific HEI in an emerging country.

Finally, when asked to suggest performance indicators perceived as ideal for evaluating the HEI, most interviewees suggested non-financial indicators. Also, it was possible to observe some overlapping between performance and IC indicators. Also, and surprisingly, the interviewees did not address the theme of new technologies and digitalisation. In fact, implementing such indicators through IT systems could help increase HEI's performance. It could help achieve a continual improvement of the organisation through automatic tools, thus developing HC and SC. Also, through social media, the communication of results to the stakeholders could increase RC.

This paper provides important contributions. In the specific case of HEIs in emerging countries, stakeholders may have limited knowledge about IC. However, they can provide some illustrations after a brief explanation, despite a tendency to focus on individuals. Also, although they have a close perception of IC, they tend to have different

opinions regarding the relative importance of each dimension. Furthermore, when the context is problematic, they tend to focus on the negative aspects of IC and performance. Finally, assessing the effect of IC on performance is not easy since IC and performance indicators may overlap. In practical terms, this study contributes to raising awareness about the importance of measuring and managing IC, instigating HEIs and their managers to define how they will guide their investments in IC to maximise their performance.

Finally, it should be noted that this study is not free from limitations. First, since a single case study was carried out, results can only be generalised theoretically. Second, the concept of performance was approached in a broader way. Third, further research should address the effect of IC on performance on other HEIs, namely comparing the ones pertaining to developed economies with those pertaining to emergent economies. Also, future studies should take an individual perspective of how people's performance can impact HEI's performance. Lastly, future studies should address this theme from a sustainable point of view, namely addressing social, environmental and economic types of performance.

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Smart Development Principles of Knowledge Ecosystem in an Industrial Cluster

Kristina Grumadaitė, Giedrius Jucevičius and Sonata Staniulienė
Vytautas Magnus University, Kaunas, Lithuania
giedrius.jucevicius@vdu.lt
kristina.grumadaite@vdu.lt
sonata.staniuliene@vdu.lt

Abstract: This paper presents and analyses the principles to develop a knowledge ecosystem in the case of an industrial cluster – "a geographical concentration of interconnected companies, specialized suppliers, service providers, companies in related industries and associated institutions (trade / industry associations, universities, educational institutions) that compete but also cooperate" (Porter, 1990). In the scientific literature, knowledge ecosystem is relatively recent and less explored concept, which is mostly defined as a network of geographically co-located actors, primarily centred around a local university or another research organisation for knowledge search and creation (Almpanopoulou, 2019; Clarisse et al., 2014). Because industrial clusters are putting an emphasis on product commercialisation and creating value (business or innovation ecosystem), the development of knowledge ecosystem more or less reflects a quite fragmental point of view – it is sometimes understood simply as having an university or a research institute among the cluster members and organising particular training seminars, while cluster members may remain individualistic and passive regarding mutual knowledge sharing and creation (Jucevičius, Grumadaitė, Jucevičienė and Čeičytė, 2019). However, in this paper knowledge ecosystem is understood as a precondition of innovation and business ecosystem in order to deal with complex and wicked problems (Andersson and Törnberg, 2019). In addition, smart development is explored expanding digitalisation boundaries, while understanding a social system through the dimensions of agility, network-based, sustainability, learning, innovativeness (Jucevičius and Jucevičienė, 2017).

Keywords: knowledge ecosystem, smart development, industrial clusters, development principles

1. Introduction

The scarcity of knowledge and competence is defined as one of tensions that encourages the enterprises to join various cooperation forms, including industrial clusters (Jucevičius, Grumadaitė, Jucevičienė and Čeičytė, 2019). Scientific literature emphasises that the most successful are those systems, which reflect the concept of self-organisation based biological *ecosystems* that are deeply embedded into a particular context and thus are able to adapt to every changing conditions (Filotas et al, 2014; Messier et al, 2015). Accordingly, following this concept of ecosystem, management literature analyses the essence of business ecosystem, industrial ecosystem and related ones (Adner, Oxley and Silverman, 2013; den Hartigh and Tol, 2008; Lu, Rong, You and Shi, 2014; Moore, 2006; Valkokari, 2015). *Knowledge ecosystem* as a concept gains more and more attention with a theoretical and practical need to focus on knowledge enhancing activities, such as knowledge sharing and knowledge development (Öberg and Lundberg, 2022).

The importance of knowledge sharing and knowledge adaptation became extremely important during COVID-19 pandemic times, when business enterprises have required innovative solutions and the creation of new order, and sense making (Rubin and de Vries, 2020; Uhl-Bien, 2021). These solutions are related not only to the adaptation of novelties of Information and Communication Technologies, which is often understood as a smart quality in the scientific literature, but also with various so called "soft" aspects that require to adapt different approaches and perspectives. According to Jucevičius and Grumadaitė (2014), smart development of an ecosystem is about "stimulating its relations and interactions in non-linear and non-hierarchical ways", facilitating the self-organisation and emergence of the system out of multiple interactions. Jucevičius and Jucevičienė (2017) also emphasised that smartness of a social system includes eight dimensions, while digitality is only one of them together with agility, network-based, sustainability, learning, innovativeness, intelligence and knowledge-driven. Thus, in the paper this expanded concept of smartness is adapted while answering the formulated *research question*: what are the principles behind the development of knowledge ecosystem through the lenses of smartness?

This research question has risen out of theoretical and practical realisation that despite the importance of knowledge, knowledge sharing and acquisition of different knowledge forms is still challenging. The trials of

developing knowledge ecosystem may be very fragmental without taking into account the importance of the connections and relationships among the elements.

Accordingly, *the aim* of this paper is as follows: to define and to analyse smart principles of knowledge ecosystem development.

The first part of the paper reveals the concept of knowledge ecosystem, its processes and structural parts through the lenses of smartness. The second part represents the context of industrial clusters in Lithuania regarding knowledge ecosystem development. Finally, the third part presents development principles of knowledge ecosystem.

2. Knowledge ecosystem essence: structure and processes through the lenses of smartness

As any *complex adaptive system*, a knowledge ecosystem is a network of interactions based on competition, cooperation, coordination, communication and compliance (Anderson, 1999; Di Paolo and De Jaegher, 2012; Laihonen, 2006). These interactions are maintained by a variety of agents with different functions and roles without a centralised control from outside – thus, knowledge ecosystems are self-organising (Anderson 1999; Brenner and Mühlig, 2013; Laihonen, 2006). Knowledge ecosystem is following common values, simple rules and standards of behaviour (Dashwood, 2014; Edgren and Barnard, 2012; Gunningham and Rees, 1997; Mason, 2007). In the complexity theory these rules, values, standards and models are defined as attractors, which allow the ecosystem to return back to the equilibrium (Boal and Schultz, 2007).

Because of variety of interactions and compliance to common values and behaviour standards a new order is continuously created and knowledge ecosystem keeps developing. Thus, these parameters can be considered as *primary parameters*. It can be stated that because of these primary parameters being in place, knowledge ecosystem acquires *the secondary parameters*, such as identity, adaptation, coevolution, non-linearity, viability, trust and responsible behaviour.

One should emphasise that knowledge ecosystem has a clear sense of *identity*—values, traditions, competencies, culture, and core beliefs—and every action is self-directed, so there are no reactive or uncertain actions (Mason 2007). Due to all the mentioned characteristics, the system is *dynamic* and *vital* (Plowman et al, 2007).

Following behavioural norms and values helps a knowledge ecosystem to exhibit *responsible behaviour* in interactions both within the system and with the external environment (Anderson and Russell, 2011; Dashwood, 2014).

Because knowledge ecosystem as any complex adaptive system is open, new order emerges in reactive and proactive ways through *endogenous*, or within-the-system, *coevolution* and *exogenous coevolution* that occurs when a system interacts with its environment (Mitleton-Kelly, 2003), thus increasing the *adaptation*. Due to the constant adaptation sudden and unexpected transitions to a radically different form of order may happen (Parsons 2007). It can be explained through the concept of *non-linearity*, or sensitive dependence on internal conditions (Prigogine and Stengers, 1984). This means that being in a network leads to the interdependence of network actors, and then even a single action can affect the fate of the entire system. In order to maintain systemic development, a mutual assistance shall take place - sharing best practices, providing assistance to actors who lack some capabilities. Thus, one of the main indicators of self-organising complex adaptive system is a high level of trust (Carapiet and Harris 2007).

In the knowledge ecosystem, the dynamism of previously mentioned aspects can be analysed through the lenses of knowledge management processes. In this paper, these processes include:

- knowledge generation;
- knowledge sharing;
- knowledge capture or storage in human memories, organisational processes, artefacts and digital systems;
- knowledge utilisation (Zaim, Muhammed and Tarim, 2019).

These processes reflect and are influenced by the primary and secondary parameters. Through the lenses of complexity theory, knowledge sharing is of a vital importance because without interactions self-organisation, which is the central feature of complex adaptive systems, is non-existent (Laihonen, 2006).

Taking into account the parameters of knowledge ecosystem as a complex adaptive system, smartness is understood as a broader concept that an application of digital technologies - smart social system is "a system of communications, when people are ready for their interactions in the environment of their social system but according to the need (especially – to get information and other resources), and are also open to other environments; they are able to envisage the features critical for their environment or their system, to which they quickly and inventively react by adjusting to this environment with adequate decisions as well as using it to attain the goals of their system" (Juceviciene and Jucevicius, 2017). While analysing the dimensions of smart social system, Jucevicius and Liugailaite-Radzvickiene (2013) defined the following dimensions of smartness: *intelligence* or capabilities to compare itself with other social systems and to take particular actions in order to reach the goals; *learning*; *agility* or the ability to respond quickly to the changing circumstances; *networking*; *sustainability*; *knowledge driven*; *innovativeness* and *digitality*. These dimensions reflect previously defined primary and secondary parameters of complex adaptive systems, for example, such as a networking vs. a network of different actors; responsible behaviour, which can be connected to sustainable approach and activities; adaptation, which is also highly connected to intelligence and agility. Thus, by combining the approaches of complexity and smartness of social systems, one should conclude that *knowledge ecosystem is a network of interacting and competing actors, which interact inside the system and with the external environment, by following simple rules of responsible and sustainable behaviour, standards and values, including trust, in order to maintain digital and other types knowledge management processes of knowledge generation, knowledge sharing, knowledge storage and knowledge utilization, which lead to knowledge creation to increase the system's co-evolution, adaptation and innovativeness.*

3. The context of knowledge ecosystem development: case analysis of industrial clusters in Lithuania

The research that was carried out in Lithuania, whose business enterprises still deal with the challenges of cooperation and trust. It included nine industrial clusters that formed naturally on a purpose to cooperate and create innovative products: Cinema cluster, Game industry cluster, Tourism cluster, Machinery cluster, ICT cluster, Wellness cluster, Cluster of medical innovations, Photo electronics cluster and Laser cluster. A multiple case research strategy was adapted (Yin, 2014). The main source of primary data was 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 processes, primary and secondary parameters, as it was mentioned in a previous part of this paper, including knowledge management processes. In overall, the research was based on the four following tasks:

- to identify the actors who initiate and ensure relationships, enabling the formation of self-organising industrial system;
- to reveal the interactions and relationships that allow self-organising industrial system to be viable, adaptive, co-evolving, characterised by learning, trust, and responsible behaviour;
- to reveal the resources necessary for the formation of self-organising industrial system;
- to identify the values and behaviour patterns that support self-organisation and cooperation.

This paper represents the research results, which are directly related to the development of knowledge ecosystem. Based on it, cluster coordinators were asked the following questions: What are relationships with science and educational institutions? How are learning processes *to acquire knowledge* ensured in the cluster? How are communication and collaboration processes *to share knowledge* ensured in the cluster? Is there a scarcity of enthusiasm? If so, how it is solved? Are there competing enterprises in the cluster? If so, what solutions are applied? Are your cluster members more inclined to act individually? How it is being solved?

The amount and variety of questions varied from interview to interview, depending on the previous answers.

Research results have revealed that the cooperation among cluster members and science and educational institutions have intensified after entering the cluster: *"until now, until the formation of that cluster, they did not communicate much with universities"* (Wellness cluster). This cooperation is important because "The enterprise does not have competence and knowledge" (Game industry cluster) and „lacks project expertise in

certain parts" (Cinema cluster). Thus, as Tourism cluster stated, *"we are always trying to make sure that there is no shortage of science institutions to advise us, because we really recognize that we are not soldiers, if we are in the field alone, we need help, we need academic help"*. Accordingly, science and higher education institutions provide specific knowledge in order to solve issues. The involvement of science and education institutions is significant in developing new projects and implementing scientific research. In such a case, cluster cooperation with universities and other higher educational institutions may include various administrative matters and universities' priority setting to participate in a particular project or not. For example, the coordinator of Cinema cluster stated that "After the secondary projects started, such as building robots and so on, we called the university, but...". One should emphasise that the scheme to attract European Union funding for cluster development formally requires the participation of science and educational institutions. However, it doesn't mean that such relations between cluster and higher education institutions are always formal and artificial – the clusters developed various ways to involve current and new science and education institutions in order to reach cluster goals.

In some cases, these institutions are not only from Lithuania, but from other countries as well. For example, the coordinator of Cluster of medical innovations emphasised the relations between cluster and scientific research institute in Switzerland. High quality international science relationships are formed in the case of high technology industrial clusters too.

Cooperation with educational and science institutions works as a tool to create new study programs and specialisations at the higher education and vocational institutions and thus to reduce the shortage of specialists: *„There is a big shortage of specialists, they need to be trained, so naturally the required specialties were born in universities, such as the Lithuanian Academy of Music and Theatre"* (Cinema cluster). New programs at Lithuanian universities and universities of applied sciences were initiated by Tourism and Game industry cluster too. The latter cluster also shared knowledge about gaming industry to youth through the cluster magazine.

One should emphasise that cluster enterprises in a cluster develop an R&D infrastructure (for example, Game industry cluster, Wellness cluster, Cluster of medical innovations). Industrial clusters also create training systems in order to maintain knowledge acquisition by cluster members. As Game industry cluster coordinator stated, they also created a unique multilayer training system at the cluster level: *"we have know-how, which is transformed into individual training projects with certain training topics; employees are studying according to them and receive certificates".*

The most common activity to acquire new knowledge is various seminars and training, attended by cluster members. The popular topics are management and leadership (Cinema cluster), marketing, communication psychology, hospitality and foreign languages (Tourism cluster). Wellness cluster mentioned training and seminars on business models, knowledge sharing and personal development. As the coordinator of the latter cluster states, *„enterprises like various seminars, trainings in which they are happy to participate, so maybe some trainings will be more interesting for them, and they will participate and contribute."* Thus, training may work as a tool to increase the activity of members in a cluster.

Training also helps to create social networks: *"Enterprise employees acquire new skills, communicate at the same time, find common connections through communication, work on social capital, which then turns into business contacts and business services or some kind of joint projects between several enterprises"* (Game industry cluster).

It is also emphasised that acquiring knowledge should be continuous: "you have to chew it every day from different angles, with different tastes" (Cinema cluster). As it was emphasised by the Cinema cluster coordinator, *"you can only learn from other teachers who do that work, i.e., by working together with them"*.
The coordinator of Tourism cluster also emphasised visiting of cluster members' enterprises in order to learn about their realia: "*we look at their services, where they made some updates"*. Cluster members also visit other clusters, as in the case of a Tourism cluster.
One could conclude that mutual learning about themselves and each other, enhancing trust and creating new ideas, in analysed clusters happens because of the following activities:

- frequent regular company meetings;
- communication in an informal environment;
- project activities;

- participation in publicity events;
- participation in joint training.

However, research results still revealed many challenges, which restrict information and knowledge sharing among the cluster members, such as difficulties in mutual agreement, individualism, competition, and continuous passiveness. Individualism is especially vivid in clusters that represent creative industries. For example, the coordinator of Cinema cluster mentioned the phenomenon of "lonely stars", who are used to have very strict opinions and don't hear the others: "the more personalities, the harder it is to manage everything". Individualism also is related to competition, when "it is not yet possible to distinguish that <...> in the cluster there are one set of rules and outside the cluster there are other rules" (ICT cluster).

However, the biggest challenge to overcome in the most of Lithuanian clusters is the passiveness of a particular amount of cluster members, which are in the list of a cluster only theoretically. Although a temporal passiveness of any cluster member is a normal phenomenon, continuous passiveness is a negative phenomenon in the perspective of knowledge ecosystem development. Often this passiveness is a result of inadequate expectations towards cluster and the attitude of seeking an individual benefit without sharing: "they tend to pursue benefits rather than performance" (Game industry cluster). If this attitude is spreading among the cluster members, the development of knowledge ecosystem is getting restricted because no interactions are happening. In order to increase the development processes, cluster coordinators defined various principles regarding ecosystem development, and those principles reflect the smartness dimension, presented in the previous parts of this paper.

4. Smart principles of knowledge ecosystem development through the perspective of Lithuanian industrial clusters

Jucevičius (2014), while analysing the development of a smart social system, defined the following development principles:

- non-standard approach to development opportunities;
- creation of an ecosystem favourable to creativity, entrepreneurship and innovation;
- formation of community culture.

Research analysis revealed that every research cluster was formed in its unique way: they adapted strategy of experimentation, external agency strategy or strategy of ad hoc colleagues-professionals. While continuing with their activities, strategy of active coordination, coordinated self-organisation or self-organisation was implemented with its individual expressions. These strategies aren't going to be detailed further in this paper but they are mentioned to confirm the different perspectives towards development that fit the particular reality the most.

Research results revealed that the cluster members and clusters themselves become more innovative – they create more innovative products; thus, they are able to commercialise new knowledge. Clusters became competence centres: "cluster now is a certain base, with some history and with know-how, how to do and develop projects of a similar profile" (Cinema cluster).

Much attention in the clusters is given to the development of community culture. First of all, it is important to emphasise that *the members of cluster individually should develop their positive attitude towards a cluster and activities there*. Individual characteristics in order to contribute more into cluster processes can be defined as follows: enthusiasm; belief in a cluster; working for the benefits of the cluster/ ability to contribute to the cluster's activities; openness; complementing each other; consulting and helping each other; teamworking; confidence; ability to take benefits of the cluster and long-term orientation.

It is a "consistent, steady, hard work to fulfil the commitments and goals", making the contribution to the development of the cluster and its processes: "You have to give. You must bring. You must contribute" (coordinator of Cluster of medical innovations). Many of the characteristics are directed outwards - cooperation, negotiation, openness, etc., and this clearly contrasts with individualism. As the coordinator of ICT cluster stated, "everything depends on the person - if there is an interested person in the enterprise, who believes in the idea, and for whom that cooperation, communication is acceptable, everything goes normally".

Personal efforts to participate in the development of a cluster also depend on a long-term orientation, i.e., realising that a cluster is a long-term phenomenon, where the results and the benefits can emerge only in the long-term period. In turn, "focusing on short-term goals" contributes to non-participation in cluster activities. Although training programs and systems are important to cluster members, it must result in continuous knowledge sharing, creation and adaptation - the members themselves must mature, taking new initiatives themselves and thus setting an example for each other, coordinating various processes among themselves. *Research results revealed that the cluster members who show their personal example of knowledge sharing are of great importance.*

The other principles are as follows:

- setting boundaries between cooperation and competition;
- developing a healthy attitude to competition;
- defining a clear vision, mission, values and goals in the cluster at the beginning of the activities;
- specialisation and differentiation in order to be unique and decrease competition;
- developing of a new joint (innovative) product;
- discussing each issue;
- dialogue;
- frequent regular and positive communication;
- following common principles of consensus and transparency;
- mediating in cooperation processes;
- explaining the importance of cooperation;
- defining realistic expectations that naturally respond to modern business needs;
- explaining meaningfulness of the cluster activities;
- highlighting the benefit of being in a cluster;
- inspiring optimism;
- involvement in working groups reflecting various areas of cluster activity;
- creating projects;
- applying idea generation methods.

A healthy attitude to competition means that everyone can find their niche: "there will be enough room under the sun for everyone" (Cluster of medical innovations). In addition, according to the interview with a representative of Laser cluster, "competition is running together" to achieve a common goal, when the runners - business enterprises – possess different capabilities. Thus, *it is very important for cluster enterprises to define common goals and achieve them* – for example, as the coordinator of the Medical innovation cluster stated: "let's conduct a scientific research together!" A common goal is also a development of a new joint product. This means creating something that no other cluster enterprise has competed / is competing for, and *each enterprise occupies a certain niche in the product development process* based on the competencies it has. In this way, cluster members "trust the cluster more, because they do not need to reveal their competitive advantages" (Wellness cluster). It is also important to emphasise that enterprises belonging to clusters often develop their *specialisation and apply a differentiation strategy*. Consequently, even if they do not participate in the development of innovative products of the cluster, they do not experience significant difficulties due to competition.

In general, setting a clear vision, mission and goals is a significant tool to decrease conflicts and disappointment later. As the coordinator of Machinery cluster stated, "everyone identified that activity, the goal", and "there are no major disputes, discussions, antagonisms". Meanwhile, when dealing with various common matters in the cluster, it is important to always *discuss each issue* and follow "both the principles of consensus and transparency" (Machinery cluster). It should not be forgotten that a better mutual agreement depends on knowing each other more and spending time together. Cluster coordinators emphasised the importance of regular frequent communication. In addition, "positive communication is needed" (Cinema cluster). The source of positive communication is informal communication, which allows individuals to learn more about each other and gain trust.

Game industry cluster coordinator said that difficulties in cooperation are more related to "ignorance" or "lack of training", thus, the following solutions can be distinguished, such as *mediation in cooperation processes* and

clarification of the importance of cooperation, which can also take place in practice - through the organisation of joint events. One of the main *values* that should be embedded into cluster activities, is *unity* (Cinema cluster).

Common reasons for continued distraction from cluster activities include inadequate expectations of the cluster, expecting benefits without putting effort in it, and not seeing the meaning of the cluster. (for example, Cinema cluster, Tourism cluster, Machinery cluster; Cluster of medical innovations): “in theory, everyone imagines that it’s very cool, that everything is very easy to do”, that “if we become members of the cluster, that’s all - <…> someone will help earn money”, etc. Seeking benefits with a limited amount or no efforts can be also characteristic of scientific institutions as members of the cluster. The coordinators of both creative industry clusters talk about this: “they usually seek benefits, not activities”.

Disappointment with the cluster increases even more in the face of difficulties, and then a phenomenon is observed where “some came very active and enthusiastic at first, but now they are less active and maybe no longer enthusiastic”. Thus, *realistic expectations must be defined in the cluster*: it is important to understand that “the cluster cannot move mountains”. Research results reveal that the meaning of the cluster is to benefit from the activities through the sharing of mutual burdens. The benefit can be seen through the meaningfulness and purposefulness of the activities carried out in the cluster: “if we organise an event, we know why we are organising it, for what purpose, what lecturers, what benefit”. When activities are meaningful and useful, cluster members experience a variety of positive emotions, including joy and pride, and this has a significant impact on enthusiasm, without which "there is no point - you can't do anything you're told."

In some cases, however, it is necessary to *highlight the benefits of the cluster and inspire optimism*. The members of the cluster are encouraged to be proactive and get involved in activities, whether they are business enterprises or scientific institutions. Enterprises can be included in working groups to solve various cluster issues, projects are created, trainings are organised. The most ideal case, when the cluster members themselves set goals, generate their own relevant ideas, and seek their own solutions. This corresponds to the essence of a complex adaptive system - initiatives must come from below and not be imposed.

5. Concluding remarks

Knowledge ecosystem is, in a broad sense, is a self-organising network of actors, interacting on the ground of simple rules and common values and behaviour models with a purpose to maintain knowledge management processes in order to create new knowledge. When adapting the expanded concept of smartness, the development of knowledge ecosystem has a strong emphasis on relationships in the system and with an external environment and is oriented to system’s adaptation, sustainability, innovativeness, learning, agility.

A multiple case study of nine industrial clusters in Lithuania revealed the aspects of knowledge ecosystem development. All the clusters developed relationships with science and higher educational institutions for developing projects and R&D, creating new study programs and specialisations in order to deal with the scarcity of specialists. Clusters also developed their R&D infrastructure and training systems for cluster members in order to nurture their technological and soft skills.

One should emphasise that clusters make efforts in adapting a non-standard approach to development opportunities, creating conditions for creativity and innovation and forming a community culture. However, clusters still experience the challenges of competition, passiveness or disagreement, which hinder knowledge sharing and new knowledge creation as a final result. In some cases, various seminars, provided by a cluster, become an attractive activity to be in the cluster, even without getting involved in further activities. Thus, smart development principles

Thus, smart principles to encourage the development of relationships and knowledge ecosystem accordingly are related to the development of specialisation and differentiation, defining clear mission, vision, values (such as values of unity, cooperation, transparency) and goals, defining realistic expectations, highlighting the importance and benefits of cooperation and being in the cluster.

However, the research has some limitations. First of all, it provides a glimpse into overall processes in clusters from the cluster coordinator perspective but doesn’t analyse the perspective of cluster members. Thus, further

research may concentrate on the analysis of the relationships between different cluster members in order to analyse knowledge management processes and implementation of smart development principles in more detail.

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Knowledge Management Models Supporting Causal Analysis in Project Design Creation

Tadeusz A. Grzeszczyk
Warsaw University of Technology, Faculty of Management, Poland
tadeusz.grzeszczyk@pw.edu.pl

Abstract: Correct implementation of the processes of building causal analysis frameworks is one of the critical elements to ensure success in the proper preparation of project designs. These frameworks are the foundations on which the provisions of the theory of change are based, and logic models illustrating causal links between input resources, activities, outputs, results (outcomes) and impacts, as well as identified problems related to the needs of stakeholders and their proposed solutions. The proper run of causal analyzes requires collecting and using significant resources of explicit and tacit knowledge related to the conducted community mapping, stakeholder analyzes (their needs and expectations), priorities of financing organizations, feasibility studies, and strategic analyzes of internal and external factors. Adequate support for managing this type of knowledge is essential to ensure the possibility of appropriate improvement of the planning, monitoring, and evaluation systems of projects and programs. One of the potentially available directions for developing research in supporting the management of valuable knowledge in the processes of causal analysis in project design creation may be solutions applying the extensive achievements of ICT systems modeling. The study discussed in this paper was carried out to find answers to the following research question: what is the possibility of using selected knowledge management models to support practical causal analysis that is beneficial in project design preparation? The primary purpose of this paper was to develop and pre-examine knowledge management and logic models in terms of their usefulness in the implementation of project design creation processes. Theoretical considerations related to the proposed models were supplemented with the offered possibilities of their implementation and the development of further research on the potential of improving designing systems, in particular when taking into account explicit and tacit knowledge valuable in the correct implementation of stakeholder expectations management processes for the success of projects and programs.

Keywords: knowledge management models, causal analysis frameworks, logic models, project design, ICT systems modeling

1. Introduction

Causal analysis is one of the essential elements of planning development projects and building their results chains, causal mechanisms in the theory of change, logic models for monitoring and evaluation systems that can be useful not only for ordinary linear models, but also for modern circular business models (Mattos *et al.*, 2022). This analysis is based on causal and relational hypotheses that support learning and storing knowledge about planned causal linkages identified between an intervention and the expected changes, results, outcomes and impacts. This knowledge is of an explicit and tacit nature and requires implementing effective management mechanisms related to its identification, collection, sharing, learning processes, and generating new knowledge. The related difficulties result from the multifaceted nature of this knowledge, the source of which may be analyzes of the needs and expectations of stakeholders, mapping processes of local and regional communities, project sponsors' expectations, comprehensive research results related to conducting feasibility studies, and strategic analyzes taking into account internal and external factors. Overcoming the difficulties and challenges associated with managing this type of knowledge creates an appropriate basis for ensuring the possibility of adequately improving the planning, monitoring, and evaluation systems of projects and programs.

The key solution applied when building monitoring and evaluation systems is the Logical Framework Approach (LFA), which can effectively support the collection of useful multifaceted knowledge already at the project design creation stage. The basis for the initiation and proper implementation of these systems is causal analysis, which can be successfully carried out with the use of LFA-based models. Carrying out causal analysis within this type of models can effectively support the collection of the necessary knowledge resources and lay the foundations for risk management already during project planning. Properly enriched LFAs can be used not only to gather knowledge necessary for risk management, but also to improve aspects related to sustainability (Rodríguez-Rivero and Ortiz-Marcos, 2022). Better and in-depth knowledge of the identified existing major problems and potential solutions also facilitates building causal logic models. They describe simplified and linear causal relationships and can clearly reflect and explain the logical relationships between the essential elements of the analyzed projects, e.g., related to the current difficult situation and diagnosed problems occurring in specific local areas and regions. These dependencies include inputs (resources involved), planned and then implemented activities, outputs, as well as multidimensional outcomes and impact. The process of building logic models usually requires the following steps: initial structuring of the evaluation process; data collection; analysis of the

project environment, problems, goals, and strategies for achieving them; saving the analysis results in a graphic or table form; building project design as well as using logic models for monitoring and evaluation (Newcomer *et al.*, 2015).

Information and knowledge resources play an essential role in all the steps involved in building causal logic models. Experts can carry out the preliminary structuring of the evaluation process using knowledge resources resulting from the conducted SWOT analysis, concept mapping, etc. In the next stage of collecting the necessary data, information and knowledge, it is possible to rely on primary data and knowledge (e.g. interviews or observations) or secondary sources (e.g. existing documents or multimedia digital repositories). Additional important information and knowledge resources can be gathered as a result of identification, analysis, and consultation with stakeholders who may differently influence the project implementation and be classified in different ways. Stakeholders can be defined as: primary or secondary, internal (involved in the project implementation) or external (being positive or negative), positively or negatively affecting the achievement of the assumed goals. Research proves that it is worth looking for new methods and tools enabling decision analysis of project success factors and analyzes of stakeholders, who may play important positive and negative roles, and also, e.g., effectively influence decision-making processes related to the management of investment projects (Belay *et al.*, 2022).

The dynamic development of modern ICT and AI solutions is an excellent opportunity to use the existing achievements in these fields to support knowledge management useful for causal analysis in project design creation. Therefore, the following inspiring research question arises: what is the possibility of using selected knowledge management models to support practical causal analysis that is beneficial in project design preparation? This question defines a scientifically interesting research problem, the solution of which will be facilitated after formulating the goal, which is to develop and pre-examine knowledge management and logic models in terms of their usefulness in the implementation of project design creation processes.

Theoretical considerations related to the implementation of this goal are also accompanied by practical comments, in particular regarding the implementation of the proposed IT solutions and the possible development of further research on the possibilities of improving solutions, mainly in terms of more practical consideration of explicit and tacit knowledge reflecting the expectations of the project and program stakeholders. This paper attempts to demonstrate that the proposed knowledge management models are well suited to support the causal analysis in project design creation processes that underpin the building of logic models for various projects and programs. The presented research results may be interesting in terms of improving planning, monitoring and evaluation systems of various types of projects.

2. Knowledge Management in Causal Logic Models

Causal analysis in project design creation is primarily related to logic models, which in a simplified and linear way reflect the more complicated dependencies that occur in a complex reality. They mainly concern the specificity of interventions and the assessment of their impact in a way suitable for monitoring and evaluation systems of projects or large socio-economic programs. The lack of properly performed causal analyzes and the appropriate logic models built on this basis may result in the inability to collect knowledge useful in discovering and exploring the success factors of the projects and programs assessed. It also reduces the possibility of conducting synthetic analyzes, preparing practical evaluation reports, which contain examples of good practices that may be beneficial when applying long-term outcomes of completed projects, as well as during the planning and implementation of subsequent programs. Logic models are particularly valuable during the implementation of intervention planning processes because they provide effective solutions for capturing evidence identified before starting the implementation of planned solutions. The lack of use of logic models is particularly manifested in the form of difficulties with conceptual clarity, replicability, scalability of interventions and opportunities resulting from learning from failure (Hanson and Jones, 2017).

Causal logic models can effectively support knowledge management during the practical application of the program theory-driven evaluation concept. The joint use of logic models and theory of change enables the appropriate inclusion of various groups of stakeholders during the creation of design of project and program, their implementation, and taking into account the systemic environmental impact (Meyer *et al.*, 2021). However, using the theory of change could provide a clearer picture compared to the logic model, which is usually closer to reality but more challenging to put into practice in the planning processes of building project designs. For this

reason, in the practice of monitoring and evaluation, causal logic models play a fundamental role as they enable adequate support of analysis processes aimed at conducting stakeholder analyzes, identifying existing problems and their desired solutions, improving communication with stakeholders in terms of communicating the essence of planned projects and programs, clear descriptions of logical structures of planned activities and their effects, as well as building effective monitoring and evaluation systems.

Causal analysis used in logic models is based on studies of the environment and context of projects and programs, and concerns the analysis of the relationship between identified vital needs and problems occurring in local areas and regions. Thanks to this research, it is possible not only to identify the reasons for the occurrence of these problems but also to define solutions necessary for project implementation, which would meet the needs resulting, e.g., from analyzes applying the theory of change. Logic models are often used together with an extensive set of various approaches, methods, and tools such as SWOT analysis, stakeholder analysis, community mapping, feasibility studies, problem/objective trees, strategy selection, solution tree analysis, and others (Grzeszczyk, 2018; Zhang and Liu, 2020).

The application values of logic models result from the tabular and graphic images of the causal sequences, which are clear and understandable for practitioners. In the case of public finance projects, tabular presentations in the form of Logframe (Logical Framework Matrix - LFM) have been popularized, which are used as part of the more general Logical Framework Approach (LFA). Interesting research was conducted related to building knowledge management logic models, which can, e.g., be used to support the work of health professionals and to properly use the effects of implemented projects in healthcare systems (Ohkubo *et al.*, 2015).

The LFA is often applied in parallel with the well-known Project Cycle Management (PCM) methodology, which is based on the assumption that, although the projects are unique in nature, it is possible to distinguish repetitive stages having a similar form - even within very different projects. This assumption allows conducting analyzes taking advantage of the cyclical nature of projects and define repetitive stages that can be separately assessed during the planning and implementation of unique projects. Transparent and easily digestible images of current and forecast relationships (obtained thanks to tabular logic models) facilitate building effective project management systems as well as their monitoring and multifaceted evaluation.

When constructing tabular representations of causal sequences, a systems approach is used to define assumptions as well as causal and relational hypotheses that are very valuable in project planning and structuring evaluation processes. These hypotheses are verified in the course of project implementation and learning about the fundamental relationships of activities leading to the required results and impact of the projects.

Proper and readable mappings of causal logics in simple logic models make it possible to consider multiple causalities and contingent dependencies that do not differ much from the multidimensional theoretical models constructed using the sophisticated theory of change, which enables explaining complex reality using a large number of factors. Causal logic models are also a reasonable basis for applying practically useful tools supporting the planning and implementation of even large and intricate projects. These types of tools include, e.g., very popular evaluation matrices, which are a solution valued by practitioners, supporting the analysis of the theory of complex interventions, creating project and program designs, as well as a clear presentation of multilevel dependencies and results chains, ranging from identified problems and needs to planned project outcomes and impacts. The use of these tools is based on the experience and knowledge of experts and requires the management of this knowledge and the collection of additional resources from project and program stakeholders. Introducing appropriate knowledge management systems enables the creation of clear images of causal relationships and logic of projects and programs.

Effective knowledge management supporting the proper mapping of causal logic should be carried out in a holistic and multilevel manner, i.e., covering organizations, projects, and development programs. In addition to explicit knowledge, it is also necessary to consider tacit knowledge resources that can be captured in project evaluation processes (Grzeszczyk, 2020). Significant difficulties in collecting and using this sort of knowledge arise from the fact that these types of resources are usually widely dispersed among stakeholders as well as team members and users who occur in different subjective contexts and environments related to various processes, programs, and portfolio projects strategically important for organizations (Payne *et al.*, 2019).

A holistic approach to building knowledge management models related to project management takes into account multidimensional analysis based on human resources, ICT, and the specificity of the organization, and should also incorporate the following three levels of analysis: about projects and programs (containing the characteristics of performance monitoring indicators and outcomes, organizational structures and effects of skills management), in projects (including the use of repositories, discussion results, the use of IT systems supporting decision-making) and from projects (best practices and lessons learned) (Damm and Schindler, 2002).

Complex and dynamic dependencies often occurring in causal analysis frameworks require the use of adequate ICT instruments supporting knowledge management. In accordance with the holistic view, it is necessary to ensure the proper implementation of multilevel processes of collecting and applying knowledge about causal dependencies using constantly developed methods and techniques resulting from the latest achievements in various scientific disciplines.

3. ICT Support for Knowledge Management in Causal Analysis

The interdisciplinary nature of issues related to ICT-based knowledge management systems should be considered when studying the possibilities of improving causal analysis in project design creation processes. Such valuable systems include, e.g., mind mapping, On-Line Analytical Processing (OLAP) and On-Line Transaction Processing (OLTP) technologies, data mining, data warehouse and knowledge repositories, knowledge-based decision support systems, project simulation based on AI, Business Intelligence, knowledge-based systems and expert systems. Solutions using Case-Based Reasoning (CBR), Natural Language Processing (NLP) systems, rule-based systems, and deep learning may also be useful.

Potentially valuable machine learning methods use deep learning, namely various types of neural networks that can be the basis for building universal data processing systems with significant computational capabilities. Their disadvantage is usually a long learning process before they can be practically applied. Spatial knowledge is unreadable to experts because it depends on the type of network, its structure, and the weight values associated with the connections between neurons. From this point of view, expert systems and systems using knowledge bases are friendlier. They have the positive feature of using symbolic knowledge representation and learning through the use of adaptation and self-improvement from examples based on empirical data. Such examples can be of a subjective and qualitative nature that is difficult to process automatically with other methods.

Systems applying knowledge bases enable automatic data processing, knowledge discovery and building its structured representation based on patterns that are difficult or impossible to discover as a result of manual data inspection. One of the more popular methods of this kind is based on association rules representing logic relations with the corresponding items appearing in an antecedent and a consequent. A significant number of association rules mining algorithms and their newer modifications have been developed so far (Diaz *et al.*, 2021). Many rules can be generated in computational processes, and it is necessary to leave only the ones that are interesting and strong. A strong rule is characterized by the values of support and confidence values greater than the adopted minimum values (Rui *et al.*, 2022).

Association rules are well suited for supporting causal analysis in project design creation because their use is based on the simple form of the conditional statement: 'If antecedent then consequent'. This implication enables relatively simple modeling of causes and expected solutions. Following the basic understanding of the conditional statement, if the antecedent is considered true, then the consequent can also be regarded as true. Such statements may be of many types and applicable to different situations. For association rules and the application analyzed in this paper, causal implications are of the highest importance, where the causal relationships between antecedents and consequents are primarily considered. An additional important feature of this type of conditional statement is taking into account mainly the relationships that are discovered based on empirical data that result from people's behavior and the stakeholders' attitudes towards the analyzed projects.

The association rules method belongs to a set of popular data mining methods for implementing rule-based machine learning systems, in which knowledge bases are built using rules that are a readable form of the results of knowledge discovery processes. In particular, these rules are applied to uncover non-trivial, meaningful, and practically useful correlations and associations between variables in large empirical datasets. A typical example of the application of association rules is market basket analysis to study the purchasing habits of customers

(Hamzehi and Hosseini, 2022). In addition, many other instances are known, such as e.g. cyber security issues, intrusion detection systems (Zhang *et al.*, 2022), Web usage mining (Husin *et al.*, 2022) or analysis of data from social media - discovering virality patterns in Twitter (Saquete *et al.*, 2022). Causal analyzes carried out with the use of association rules may constitute a significant supplement to the qualitative analyzes carried out including and consulting stakeholders of planned projects and programs, involving particular experts, project implementers and potential beneficiaries.

Association rules have many present and potential future applications as they form the basis of many statistical data processing and mining systems. In the case of simple analyzes, the processes of generating a symbolic knowledge representation using little complex a-priori algorithms do not require the definition and use of many parameters. Usually, it is enough to focus on the minimum support (which determines the number of frequent item sets) and the minimum confidence (which supports the assessment of the reliability and the probability of existence of rules in the analyzed empirical datasets). In addition, the following less significant parameters can be considered: the minimum correlation, the maximum item set size in body / head and maximum item set size in head.

Considering these significant achievements in new computing, ICT technologies and association rules based approaches, it is worth mentioning the possibilities of using such approaches to build knowledge management models supporting causal analysis in project design creation. These models may be helpful in the context of problems related to the multifaceted nature and the many dimensions of the causal analyzes performed. Additional problems are the dynamically growing resources of information and knowledge related to the planning and implementation of contemporary projects and programs, as well as the frequently occurring ambiguity, imprecise and uncertain data, which are the basis for building knowledge resources related to making important decisions. The research carried out using a selected model supporting causal analysis in project design creation is an attempt to deal with these problems.

4. Methodology and Results

The research process was performed in two phases. First, preliminary research was carried out on the analysis of the literature on the subject, analyzes of the possibilities provided by the available logic models in graphical and tabular versions, as well as the diagnosis of possible cognitive technologies and AI. Based on the results of these preliminary studies and analyzes, a research question was formulated (given in the Introduction section) regarding the possibility of finding and using selected knowledge management models to support practical causal analysis that is beneficial in project design preparation. The goal was also specified, which was to develop and pre-examine knowledge management and logic models in terms of their usefulness in implementing project design creation processes. Such a goal became an inspiration for selecting research methods, conducting planned theoretical research, and building a model of knowledge management that can effectively support causal analysis in project design creation.

It was decided to use the following research methods and techniques: literature research, observation of evaluation processes, document analysis, and statistical computational experiments. Before the simulations and computational experiments were carried out, programming documents and draft versions of documents from panels of experts who evaluated public projects were analyzed. First, the documents presenting the principles of carrying out and the results of the project evaluation processes were investigated. Computer modeling and calculations were also run using the a-priori algorithm for mining association rules available in TIBCO Statistica 13.3 software.

The scope of considerations and analyzes was limited to the causal analysis stage, which is usually the first stage in the planning and project design creation processes. It is also the most challenging stage because it requires building a stable and reliable basis for the next stages of constructing correct logic models. This stage of analysis and calculations is related to the logical course of reasoning and the formulation of hypotheses regarding the forecasted positive tactical and strategic changes expected as a result of the implementation of a given project. These expected changes (resulting from the delivered desired project products) can be verified using the hypotheses formulated during the planning and building of the project design. Statistical computational experiments were based on association rules models, which can support knowledge management, as they enable discovering frequent patterns and knowledge in empirical datasets, examining relationships between variables, and studying causal structures as well as correlations and associations.

The primary justification for the use of this type of model is its universality and usefulness in analyzing data from various sources, i.e. only empirical data collected specifically for carrying out these analyses are not required. Therefore, data collected through interviews with stakeholders and residents of the local area where the development project will be implemented can be used. However, one can also rely on data collected for other needs and related to, e.g., previously implemented projects, surveys, etc. Such features were obtained because data exploration and unsupervised learning processes were implemented based on an algorithm for discovering patterns from unlabelled data.

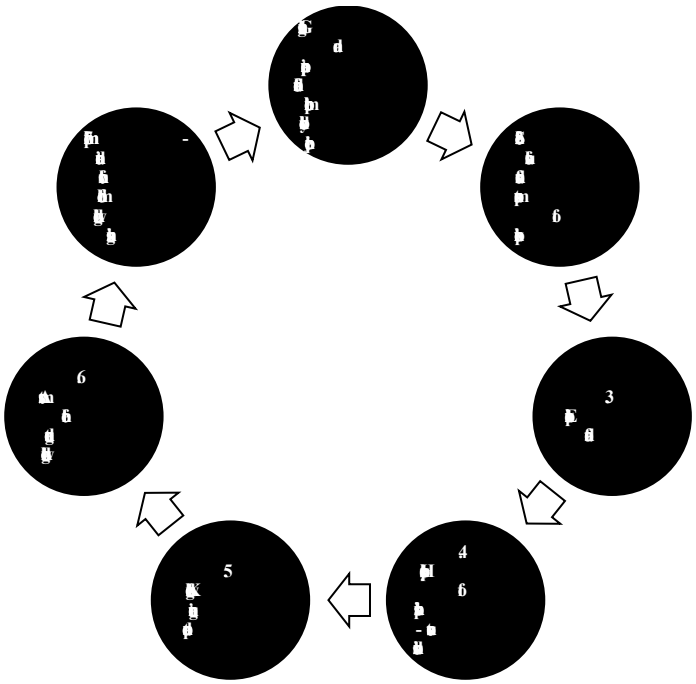


Figure 1: Knowledge Management in Causal Analysis Frameworks (source: own study)

The following seven stages of knowledge management in causal analysis frameworks were adopted (Figure 1). As part of the first stage of gathering and preparation of data on the problem, research data was collected, but most of all, already existing data from secondary sources were gathered. As a rule, data from various sources require standardization and appropriate preparation. In the next stage, the selection of causal factors and parameters of exploration were made. Causal factors were the variables taken into account during the next stage of data exploration. The essential parameters of exploration considered during the analysis were the minimum support and the minimum confidence. In the next stage concerning hypotheses of relationships, dependencies related to causal analysis were taken into account and examined within logic models in project design creation.

As previously mentioned, the algorithm in the selected software was used for the calculations; and knowledge generation and capture were performed with its application. A very important stage in the research process concerned assessment of the generated knowledge, because the obtained results were often not beneficial. For this reason, the cyclical nature of the calculations and analyzes was assumed. The individual stages were repeated many times until the results that could be considered satisfactory from a practical point of view were obtained. Only after achieving a positive assessment of the generated knowledge (in the form of appropriate association rules), it was possible to gather complete results from the last stage of implementation and use of the model for knowledge sharing.

Solving the problem of knowledge management support in causal logic models in the form of a system-based approach ensures considerable flexibility and scalability of the proposed solution. It is also the basis for potentially available implementation and further development options.

5. Conclusions

Logic models play a crucial role in the development of project design and the design of monitoring and evaluation systems for projects and programs. These processes can and should be supported with the use of new ICT. Their

bolder introduction is justified because they can be the basis for implementing solutions constituting significant support for experts involved in modeling causal relationships regarding projects and programs. The literature analysis shows there is relatively much research on machine learning methods, but still too few proposals related to project management support. It is worth noting significant achievements related to, e.g., modern methods of AI and knowledge engineering, which can be observed in connection with research in the field of computer science concerning knowledge-based systems. In project management area and the social sciences, there is a rationale for research into ICT applications, as it leads to new solutions in the fields referred to.

The research's primary goal (concerning the development and initial study on knowledge management and logic models in terms of their usefulness in implementing project design creation processes) was achieved. In addition to theoretical considerations, the results of preliminary empirical research related to the use of association rules were also presented, which proved their usefulness because of their form facilitating the study of causal relationship hypotheses describing potentially possible interventions and their results stemming from the implementation of the designed projects and programs.

The conducted research shows that the developed knowledge management model, which can support causal analysis in project design creation, has significant practical values and can be an essential supplement to the existing solutions based on logical models used in monitoring and evaluation systems for various projects. The application of the system approach creates good opportunities for the use of interdisciplinary achievements related to the development of ICT tools. The general form of the model and the reliance on the system approach allow for a relatively simple expansion and further improvement of the currently proposed model. Further advances in cognitive sciences and AI could lead to the emergence of other valuable solutions to enhance the model's capabilities.

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The New Normal Worklife: Lessons from the Pandemic

Hanne Haave, Ole Jørgen Ranglund and Tone Vold
The Inland Norway University of Applied Sciences, Inland School of Business and Social Sciences, Norway
Hanne.haave@inn.no
Ole.ranglund@inn.no
tone.vold@inn.no

Abstract: COVID-19 has contributed to a digitalization of communication, and in many cases to a distribution of an organization's workforce. Several organizations in Norway claim that they will adapt to a more flexible approach regarding allowing work from home (WFH) in a post-COVID-19 worklife and allow a more "hybrid" way of working. This paper describes how the long-term crisis has unfolded in a large governmental organization. The focus for the investigations have been on how the employees have experienced working from home, and how this will impact their post-COVID-19 worklife, all with a Knowledge Management (KM) perspective. Through qualitative interviews with managers' and employees' issues, like a lack of possibilities regarding informal communication and sharing of knowledge, have arisen. This implies that there is a need for addressing KM practices that secure a flow of information, learning conditions and job satisfaction in the post-COVID-19 workday.

Keywords: "hybrid" worklife, effects of long-term crisis, digitalization, lack of KM practices

1. Introduction

The COVID-19 pandemic caused many organizations all over the world to send their staff to work from home (WFH). However, this is not the first time that WFH has been utilized. During the oil crisis in the 1970s, there was a shortage of gas, thus preventing staff from driving to work. There were quite a few advantages with WFH: less time in commuting, a stable production rate or increasing and less traffic and queues (Nilles, 1988).

The pandemic has had a few other perspectives, as it has not only been about being forced to stay at home due to a lack of gas. The virus sent shock waves describing much worse conditions like having to stay at home, not having contact with friends and family, death rates for the infected, quarantines and isolation. And what was predicted to last a few months turned out to last for nearly two years and can be categorized as a long-term crisis (Coombs, 2019).

This has represented challenges in several areas, such as remote leadership issues(Bergum, 2009; Contreras, Baykal and Abid, 2020), work-life balance (Kossek, Lautsch and Eaton, 2009; Kelliher and Anderson, 2010; Kelliher, Richardson and Boiarintseva, 2019), collaboration issues (Wang *et al.*, 2021), and security issues (Herath and Herath, 2020; Pranggono and Arabo, 2021).

This paper presents a case study from a large public organization in Norway. As with quite a few other organizations, the technology was at hand, and they were able to do the transfer from the office space to WFH.

This transfer has represented a change for the staff. Hence, we wanted to investigate whether this transfer had a "cost" for the organization and its members regarding Knowledge Management issues and practices. We thus focus on knowledge sharing and management and about work-life balance. How to facilitate for knowledge sharing in a distributed setting? How to manage knowledge – and lead remotely? And how would this affect family-life or life in general for the employees? And also; how would these issues impact on the life after COVID-19? In order to investigate this, we defined the following research questions:

How has the staff experienced the transfer from the office to WFH?

How will these experiences impact the post-COVID work-life?

In order to investigate this, we first present a theory to enlighten our research questions before we present our data collection method. We then discuss our results, conclude and point towards further research.

2. Theoretical foundation

Knowledge is claimed to have been centre stage for several decades; hence, strategies for managing knowledge have been developed to secure competitiveness in organizations (Davenport and Prusak, 1998; Mårtensson, 2000). To organize, utilize, develop and retain the competencies of the employees may allow an organization to stay in the competition within a changing market, changing conditions, changing access to asset and changing laws and regulations (Grønhaug and Nordhaug, 1992). Nordhaug and Grønhaug (1994) claim that competence in organizations also has a social dimension. In companies where they have teamwork that is goal directed and effective, and where coordination of the resources is good, they offer a stronger competition. Nonaka (1994) suggested knowledge sharing and a focus on tacit knowledge in the organization becoming explicit and shared among the employees. Knowledge sharing was also Lave and Wenger's (1991) message when presenting the theory on Communities of Practice, in which one forms a community over a mutually interesting topic in order to share experiences and learn from each other.

According to Örtenblad (2015), the knowledge not only needs to be "managed", but turned into learning to comprise a unique learning organization; indeed, Marsick et al. (1996) have previously claimed that an organization needs to learn continuously and transform itself. This was further developed by Senge (2006), in which he describes the learning organization and the five disciplines: team learning, personal mastery, shared mental models, shared visons and systems thinking.

However, most of the theory on learning organization and knowledge management is based on a "normal" worklife at work. How will working from home influence these theories?

Work from home (WFH) has been actualized several times during the course of history as several incidents, e.g., wars, environmental problems and traffic issues, have generated reasons for WFH. However, in those cases, WFH has mostly been agreed on, and in some cases been a convenient solution. WFH may also allow people from rural areas to work in city-based organizations, as it also embraces the opportunity of being flexible regarding family life and other private issues (Morgan, 2004). According to Morgan (2004), it also allow people with disabilities to be employed.

WFH requires a different approach to working in teams or Communities of Practices (CoPs). Cooper and Kurland (2002) even suggest that employees need to practice working effectively from home. Some employees experience a high job satisfaction when working from home (Kelliher, Richardson and Boiarintseva, 2019). Contreras et al. (2020) present studies showing that WFH is more effective and productive. They also claim that it leads to less stress and turnover. However, the downside is that social isolation may reduce production (Contreras, Baykal and Abid, 2020). The employees may also experience a possible loss of commitment, as they may work longer hours inducing stress and burnout, and feel permanently available; a work-home conflict may therefore arise (Cooper and Kurland, 2002; Kelliher and Anderson, 2010).

According to Peters et al. (2016, p. 2583), advantages regarding WFH are "enhanced job autonomy, time-spatial flexibility, work motivation, engagement, flow, and job satisfaction, and the reduction of commuting time and stress and work-life conflict".

Contreras et al. (2020) claim that leadership practices need to be changed and be more adapted to e-leadership utilizing ICT to maintain communication and execute interpersonal skills. They therefore need to be able to cope with complexity. Effective communication and trust building through an appropriate use of ICT are essential tasks for the e-leader.

Indeed, Flood (2019) claims that it is important for a leader to build a personal relationship with the employee at WFH, as this is the connection with the organization.

Remote work may also improve work satisfaction among employees (Kazekami, 2020). Bentley (2014) claims that this is also connected to support regarding management, technology and colleagues, as this will reduce social isolation, a work-family imbalance and stress. According to Klopotek (2017), remote work or WFH requires employees to be self-organized and master time allocation.

According to Spreitzer (1995), managers have five cognitive dimensions regarding empowering employees: a sense of competence, a sense of self-organization, a sense of being effective, a sense of being meaningful and a sense of trusting others. Amundsen and Martinsen (Amundsen and Martinsen, 2014, p. 489) presented the following definition: *"Empowering leadership is the process of influencing subordinates through power sharing, motivation support, and development support with the intent to promote their experience of self-reliance, motivation, and capability to work autonomously within the boundaries of overall organizational goals and strategies."* According to Seibert, Silver and Randolph (2004), empowerment contributes to positive outcomes for both organizations and individuals. Indeed, individuals who prefer the flexibility of WFH make a greater effort and perform more strongly, sometimes at a higher cost regarding spare time than working at the office.

However, for this particular situation of forced WFH, empowering leadership (EL) requires something more, as this involves what may be called e-leadership. According to Roman et al. (2019), this is about maintaining motivation in order for employees to achieve the agreed upon goals. Regarding e-leadership, the managers need to be democratic and allow access to information, and it is imperative to maintain an open communication (Contreras, Baykal and Abid, 2020).

A definition of e-leadership has been provided by Avolio et al. (2000 p. 617), "as a social influence process mediated by Advanced Information Technologies (AIT) to produce a change in attitudes, feelings, thinking, behaviour, and/or performance with individuals, groups, and/or organizations".

According to Van Wart et al. (2019), it is important that an e-leader has communication skills, social skills, teambuilding skills, change management skills, technological skills and show a sense of trust and consistency.

Technology development also contributed to the KM area, as one with systems were able to store data and retrieve it from databases (Heggernes, 2020). The technological development these last few years, in which data is no longer only what you register in your own organization, but is accessible from a multitude of sources, and is now also an analytical tool (Heggernes, 2020). Moreover, with the different solutions for storing and accessing data, the availability is enhanced to being accessible from almost everywhere. In the times of the COVID-19 pandemic, this has also been an enabler for work from home, as we have been able to access data/information needed from anywhere.

3. Method of inquiry

Our aim of this study was to acquire the informants' experience of WFH, as well as the consequences of the COVID-19 crisis on their worklife. We therefore chose to use a qualitative case-study design. We wanted to investigate how the situation of a long-term crisis was handled by both managers and staff in a governmental organization. We interviewed a total of four managers and three employees, with the informants selected by the top manager. We conducted in-depth semi-structured individual interviews that lasted up to one hour, using a digital programme (ZOOM). Because most people by now are used to communicating via digital means, we experienced that we had conversations with the informants being open and responsive to our questions. The interviews were recorded with the informants' written approval, and transcribed verbatim. The data analysis started by reading through all the data material and coding the interviews by highlighting sentences with relevance to our central issues and themes regarding our research questions (Miles and Huberman, 1994). Furthermore, we have discussed the findings against the theoretical perspectives presented above.

Table 1: Overview of informants

Informant	Gender	Time of interview
1 - Top manager	F	November 2020
2 Department manager	M	March 2021
3 Department manager	F	March 2021
4 Department manager	M	March 2021
5 Employee	M	March 2021
6 Employee	F	March 2021
7 Employee	F	March 2021

4. Results and discussion

In this section we will present the results from our study, where informants' quotations representing central findings.

After the lockdown, the main challenges in the first initial period were to keep up production and take care of the employees. The top manager's first worry was to whether they were able to serve their customers or not. *"I was very worried about how we were able to deliver our services to the customers…That was my first reaction. And then I started to worry about the staff if they would be ill".* (Top manager 1) The organization seems to have handled the situation in a relatively good manner, both regarding delivering customers services and taking care of staff. Yet, the statement does show an acknowledgement towards leadership being under different constraints (Flood, 2019; Contreras, Baykal and Abid, 2020).

How did a long-term home office affect the worklife for both managers and employees? The managers claim that productivity increased during the first year of the COVID-19 pandemic. This is in line with the theory on telework, as job satisfaction may increase (Seibert, Silver and Randolph, 2004; Roman *et al.*, 2019; Kazekami, 2020).

Digitalization has been a prerequisite for daily management and maintaining the contact between employees when working remotely. Microsoft Teams was used for meetings, but also for both formal and informal chat. The employees experienced that it took some time to make clarifications, and get answers to questions they might have. Working remotely has hence had an impact on the possibilities of informal communication and learning:

> *Regarding getting an answer fast when you have questions and don't know what to do, they were no longer fast. One had to write to each other, had to write a mail, or set up a meeting. Before, you could just go to the desk of your colleague or have a chat at the coffee machine and have your answer right away (Employee 6).*

These experiences were shared by other employees:

> *My threshold was high when it came to call someone to ask for help. The Teams meetings were formal and did not open up to informal talk, only professional issues. (Employee 7)*

One of the challenges when working from home has been that the contact is digital and mostly formal; if you want to get things done, it is often necessary to set up a meeting with an agenda. This makes it harder to keep a good environment for cooperation and an exchange of experience and knowledge in projects (Employee 6). This refers to a possible lack of communication that Van Wart et al. (2019) refers to, which may be a lack in what can be characterized as e-leadership (Avolio, Kahai and Dodge, 2000) regarding maintaining/developing trust and communication utilizing adequate ICT tools.

4.1 Work-life balance

> *Working remotely also causes problems with isolation and uneasiness and a feeling of physical stress. "It was the situation working from home, I felt isolated, working long hours alone with no break during the day"* (Employee 7).

This may be an example of the risks of remote work (Contreras, Baykal and Abid, 2020), as well as an example of persons who are is not able to organize their time according to a remote work regime (Kłopotek, 2017). It also implies that there is a work-life imbalance that potentially could lead to ill health (Kossek, Lautsch and Eaton, 2009; Kelliher and Anderson, 2010; Kelliher, Richardson and Boiarintseva, 2019).

This notion is also shared by leaders within the organization. One of the leaders expresses a worry:

> *I am more concerned about the employees in my department who lack natural meeting places during the day, as they work more individually [not in projects] and don't get the feeling of belonging*. (Manager 2*)*

How does the management meet these concerns? Our informant discussed the issues in the group of leaders, and with his two middle leaders, to initiate a closer follow-up of the employees. The measures that have been

taken in his department were: 1) Weekly status meetings for all employees, the meetings being both formal and informal; 2) Informal lunch meetings, and 3) Friday coffee on Teams in smaller groups, where more people attended. In case any of the employees dropped out of these fora, they were contacted by their nearest leader (Manager 2). This shows that the leaders in the organization worked more consciously to follow-up with their employees to secure their connection to the workplace when they are working remotely. As Contreras et al. (2020) and Avolio et al. (2000) recommend, the leaders sought to maintain a close contact with the employees, to secure communication and to sustain trust, as well as seeking to establish the well-being of their employees (Kelliher, Richardson and Boiarintseva, 2019).

We also found that there were signs of resilience in the organization when it came to the ability/willingness of the individuals to change:

> *The willingness to change, follow up on new things, as there are changes all the time. … It has been important to keep up motivation when unforeseen things happen. Then it is very important to be independent, because no one is following up or observing what's happening all the time. Being productive, even if no one is looking after you.* (Employee 6)

This may be a sign of employee empowerment. Here, the management should utilize the opportunity to share power, and motivate and support the subordinate's self-reliance and autonomy as suggested by Amundsen and Martinsen (2014). It also implies that the e-leadership could be stronger, and that the employees could be more closely followed up (Avolio, Kahai and Dodge, 2000; Cooper and Kurland, 2002; Contreras, Baykal and Abid, 2020).

4.2 New normal - back to the office?

Regarding what the employees find regarding the "new normal", the employees and managers have opinions about how this may be organized:

> *I believe that at my workplace it is possible to return to the office if you want to. If you prefer to work from home, you can also do that. I believe this is motivating – the flexibility of choose to work from the cottage on Friday – so there is a good thing about it.* (Employee 6)

> *The use of Teams has made us more productive even when working from home, and this means we will still also be productive after the pandemic. People find that the new normal [flexibility at work and use of digital communication] works well.* (Employee 6)

Our informant claims that to work physically at the office is necessary for maintaining a good work environment and keeping up production, which is in line with the flexibility and autonomy that working remotely provides (Spreitzer, 1995; Peters *et al.*, 2016).

Working at the office can also be viewed as an advantage when it comes to sharing information and taking part in learning processes:

> *It's been an advantage for me to be at the office, compared to those who have worked from home. Let's say four of us are at the office when eight work at home, and they don't have the same information as we do. I don't think they have learned as much as I did.* (Employee 5)

Lunch talk with colleagues can be a natural place for discussion and reflection*..."In a way, you learn something new all the time".* (Employee 5)

As described by Nonaka (Nonaka, 1994; Nonaka and Takeuchi, 1995), knowledge sharing is thus preferred in a physical proximity of each other. Nonetheless, they do find the tool (Teams) important for cooperation, collaboration, knowledge sharing and communication. This implies that the tool has been adequate for keeping up the work and keeping contact, to communicate with and such share knowledge, and to cooperate and collaborate (Contreras, Baykal and Abid, 2020).

5. Conclusion

When the pandemic hit and sent almost everyone to home offices, the management in the organization in our case reorganized in order to meet the changed conditions. The leaders of the organization made alterations, not

only in the structure of leading, but also in their management practice, all in order to adapt to a closer follow up of the employees, much in line with the theory on e-leadership.

The staffs' report on an imbalance between worklife and private life is disturbing, as this may end in burnouts and sick leaves. In addition, the home environment may not be optimal for all workers.

It seems that the employees who are working in teams or other work groups have a stronger sense of belonging than the ones who are not a part of any team.

The organization was unprepared for the abrupt change. From having only a few who had contracts allowing WFH, all employees were sent to a home office and the managers were to assume an e-leadership attitude, as they sought to follow up all their employees, maintaining trust, communication and personal relations. However, there are some recommendations for the future of WFH. As some employees experienced being left on their own, there needs to be a better balance between close follow up and autonomy, in the sense that they should trust them to do what is expected of them. Hence, it is about creating proximity in digital and distributed setting.

Regarding the "new normal", the employees express an attitude of "having their cake and eating it too", as they both appreciate being at the office, but also see - and want - the flexibility offered by the opportunity of remote work/WFH.

5.1 Further research

We suggest a follow up after the pandemic to investigate whether the work satisfaction has changed in the various work groups. It will also be interesting to find out about how much flexibility the workplace offers in terms of opportunities for a home office. How they have organized for supporting and strengthening the job satisfaction and sense of belonging is also worth exploring

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From NGOs with Knowledge: An Empirical Study on the Impact of Trust-Antecedents on Knowledge Transfer

Sheikh Shamim Hasnain
The British University in Egypt, Cairo, Egypt
sheikh.hasnain@bue.edu.eg

Abstract: This study investigates three trust-antecedents (competence, benevolence, and integrity) those influence knowledge transfer. These trust-antecedents play a key role in the transfer of knowledge from NGO employees to their beneficiaries. 2445 registered NGOs in Bangladesh are targeted for data collection. 460 useable questionnaires are taken into consideration (n=460) for the study. According to Correlations and Hierarchical Multiple Regression Analysis, these trust antecedents are having a significant positive impact on knowledge transfer. Because it is single-country research, one of the study's weaknesses is that its generalizability may be restricted. Future researchers may carry out similar studies in different contexts.

Keywords: Knowledge Transfer, Competency trust, benevolence trust, integrity trust, NGOs, Beneficiaries

1. Introduction

The transfer of Knowledge is an important part of the knowledge management process (Jasimuddin & Saci, 2022; Zhang & Jasimuddin, 2015). Organizations have paid close attention to knowledge transfer. Researchers (Lo, Tian & Ng, 2021; Lucas, 2005; Ko, 2010; Hasnain, 2019) have revealed the influence of trust on knowledge transfer.

Bangladesh has more non-governmental organisations (NGOs) than any other country of comparable size. Beneficiaries/clients, donors, and NGOs (Non-Governmental Organizations) themselves are identified by Najam (1996) as key players in the NGO sector. Millions of individuals around the country have joined NGOs in order to improve their quality of life. The understanding of the beneficiaries (clients) is essential for the NGOs' deployment, operations, and existence. For knowledge and assistance, the NGOs' trust in them is crucial. The major goal of this study is to see how the trust antecedents of competency, benevolence, and integrity-based trust, as proposed by Mayer, Davis, and Schoorman (1995), affect knowledge transfer from the perspective of NGOs to the beneficiaries in Bangladesh. The Research Question for this study is set as: 'What is the impact of trust-antecedents, such as competency, benevolence, and integrity-based trust, on knowledge transfer from NGO employees to the beneficiaries in Bangladesh?'

2. Prior literature

Mayer et al. (1995) proposed ability (competence), benevolence, and integrity as elements of perceived trustworthiness in their model of the antecedents and consequences of trust. A few past research papers provide useful information for this investigation. Mutaha et al. (2022) develop a model based on social exchange, where trust has an impact on knowledge sharing. They carried out the study in five Malaysian research institutions. They find that the trust has a positive and significant relationship with knowledge sharing. Lucas (2005) conducted research on a Fortune 500 organization using social information theory. His research looks at the effects of obstacles like trust and reputation on knowledge transfer. Ko (2010), for example, might look at the effects of benevolent trust and competence trust on knowledge transfer in project teams between consultants and clients. According to the findings, benevolence trust has a bigger impact on the success of implementation-knowledge transfer than competence trust. Evans, et al. (2019) investigated the various effects of trust-antecedents (competence, integrity, benevolence-based perceived trustworthiness) on the relationship between tie-strength and effective knowledge sharing in one of the largest law firms in Canada. The study came up with four major conclusions. The first was that strong links result in the acquisition of relevant information. Second, both competence- and integrity-based trustworthiness influenced the relationship between strong relationships and relevant knowledge receipt. Third, any favourable effect of strong links on the receiving of useful knowledge was lost when trust was taken into consideration. Fourth, the mediating impact of competence-based trustworthiness on readiness to employ explicit and tacit knowledge was identical in magnitude.

2.1 knowledge transfer

Knowledge transfer is receiving wide attention in the world (Zhou et al., 2022; Argote *et al*., 2000). New knowledge helps to increase customer satisfaction (Goh, 2002). In the NGO level, new knowledge from the beneficiaries may help NGO employees in their deployments and selection of new members. Mu *et al. (*2008) claim that successful transfer between different organizations strengthens trust and ties. Such trust in the NGO sector ensures future smooth knowledge transfer between the NGO-employees and the beneficiaries. Knowledge transfer helps to add force (Hall, 2001) and value (Hogberg and Edvinsson, 1998) to the existing knowledge of organizations. The NGOs may strengthen their knowledge from the beneficiaries. The purpose of knowledge transfer is to raise an organization's value by improving its capacity to perform things. Even if transfer and absorption are combined, new knowledge is useless unless it leads to a change in behavior or the creation of a new concept that leads to new behavior (Davenport and Prusak, 2000).

2.2 Trust-antecedents and knowledge transfer

Trust has an influence on knowledge transfer (Jasimuddin & Saci, 2022). Mayer *et al.* (1995) find three trust-antecedents: capability, benevolence, and integrity. These give a distinct perceptual perspective from which to examine the trustee, as well as a robust and sparse base for empirical trust research for another party. The domain of the ability is specific because the trustee may be highly competent in some technical area, affording that person trust on tasks related to that area. However, the trustee may have little aptitude, training, or experience in another area. In the NGO sector, capability can refer to the combined capacities of all beneficiaries working in a certain region. It might also refer to the recipients' resourcefulness and proper usage of those resources. In Bangladesh the majority of NGO beneficiaries live below the poverty line, looking at food, income, non-food expenditure, productive and non-productive assets, food security and employment creation (Ullah and Routray, 2007). NGOs come close to beneficiaries at the beginning of the preparation of the project proposals or before starting operations, and later during the implementation of the project activities or plan. It is the fieldworkers who establish the bridge between the NGOs and the target communities, with a view to delivering services to the beneficiaries. Field and project workers take help from local elites to identify reliable and trustworthy beneficiaries for membership (Devine, 2003). At this stage, they judge the beneficiaries, their characteristics, and mental and physical capabilities. In brief, the knowledge contributors are convincing themselves about the competencies of the recipients or beneficiaries, before transferral (Levin and Cross, 2004; van Wijk *et al*., 2008). The knowledge contributors also want to find that the recipients are also capable of implementing the transferred knowledge (Davenport and Prusak, 2000) with a view to developing themselves, and their socio-economic conditions. From the above scenario, the following hypothesis may be set:

H_1: NGO-employees' competence-based trust on the beneficiaries will have a significant positive impact on knowledge transfer.

Benevolence may be apart from an egotistical profit motivation, the amount to which a trustee is regarded to wish to do good for the trustor. Benevolence can take the form of intentions or reasons (Giffin, 1967; Kee and Knox, 1970). It is the love and devotion of the beneficiaries for NGO-employees that is beyond any official relationship. The NGOs want to feel secured in the deployed locality and the local The NGOs want to keep trust with the beneficiaries so that their field and project workers will not face security and social problems, social harassment, suspicion (Ahmad, 2002), or resistance and fear (Jackson, 1997), while discharging their duties in the field. They also expect that the beneficiaries would help them and will not hide knowledge and maintain beyond any official relationship.
So it may be hypothesized that:

H_2: NGO-employees' benevolence benevolence-based beneficiaries will have a significant positive impact on knowledge transfer.

The trustor believes that the trustee follows a set of principles that the trustor approves. In the case of non-governmental organizations, it is the recipients' (beneficiaries) honesty. The NGOs need to trust that the beneficiaries have enough integrity that they not going to leave their membership after receiving the various resources and knowledge. The NGOs also need to believe that the beneficiaries would not receive services or credit facilities from various NGOs simultaneously (Ahmed, 1999). They also want to believe that the beneficiaries will not deceive them. NGOs need to trust and convince themselves that the beneficiaries would not do anything against them which may put the NGO in an embarrassing situation before the donors and other stakeholders. So it may be hypothesized that:

H_3: NGO-employees' integrity based trust on the beneficiaries will have a significant positive impact on knowledge transfer.

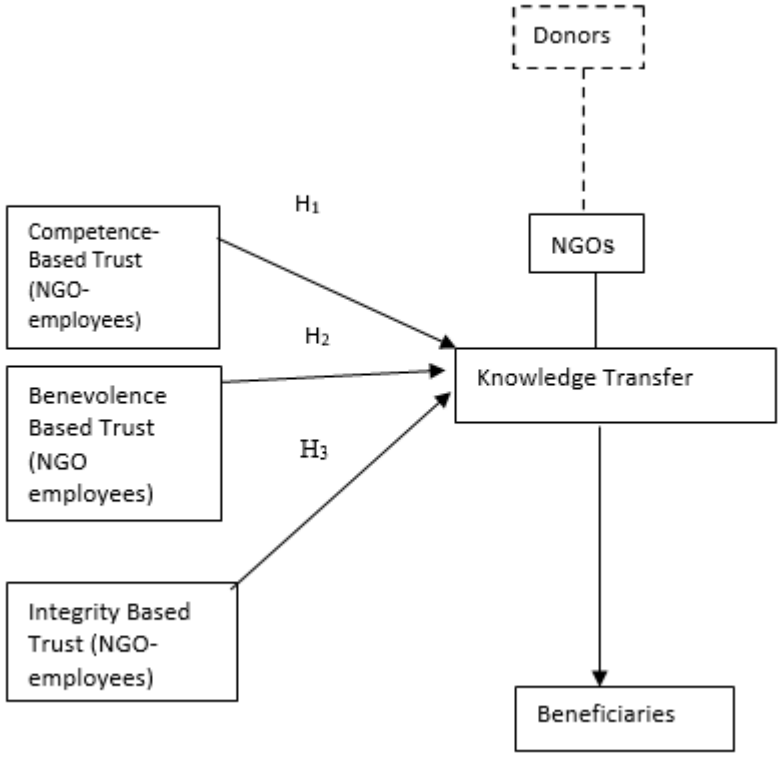


Figure 1: The conceptual framework of knowledge transfers and trust from the NGO-employees to the beneficiaries exhibiting the Hypotheses

3. Methodology

Instrument development

Knowledge Transfer (Dependent Variable): Prior research was used to design and adjust the scale. Six things make up Knowledge Transfer (A1, A2, A3, A4, A5, A6). Items from Usoro et al. (2007), Staples & Webster (2008), and this researcher were used. The elements mostly concern NGO staff's knowledge transfer to beneficiaries. These are rated on a five-point Likert scale from 1 to 5.

Independent Variables:

NGO-employees' Capability/competence-based trust: The scale was developed and adapted from prior research. NGOs' Capability/competence-based trust has 4-items (B1,B2,B3,B4). It was measured on five-point Likert scale ranging from 1-5. Bakker et al.(2006), Usoro et al. (2007) and this researcher constructed the items.

Table-1: Correlation matrix –NGO Employees (N=460)

Variables	T_KT	T_CT	T_BT	T_IT	AgeD41	SvcD16	SD6_10	EmpD0_2K	HSC_D	For_D
T_KT										
T_CT	.550**									
T_BT	.529**	.348**								
T_IT	.512**	.662**	.320**							
AgeD41	.019	.000	.005	.026						
SvcD16	.106*	.018	.033	.070	.390**					
SD6_10	.076.	.050	.043	.053	-.098*	-.143**				
EmpD0_2K	.085	.015	.032	.053	.439**	.576**	-.046			
HSC_D	.023	.004	.005	.086	.072	.206**	.107*	.085		
For_D	-.031	.032	-.007	.007	.047	.090	-.050	.189**	-.025	

Note: ** and * denote correlation is significant at the 0.01 and 0.05 levels (2-tailed tests) respectively. Variables are defined as follows: Knowledge transfer (T_KT), competence/capability-based trust (T_CT), benevolence based trust (T_BT), integrity-based trust (T_IT), age of the employees (AgeD41) , total year of service (SvcD6_10), total year of service in this organization (SD6_10), number of employees in the organization (EmpD0_2K) , educational qualification (HSC_D), type of organization (For_D). For brevity reasons, all the variables under control variables are not reported here.

(a) *NGO-employees' benevolence-based trust:* This Independent variable mainly focuses on the NGO-Beneficiaries' love, affections and their unofficial relationships with the NGO-employees. It has also 5-items (C1, C2, C3, C4, C5) borrowed from Bakker *et al*. (2006) and Usoro *et al. (*2007).

(b) *NGO-employees' integrity-based trust*: It has 5-items (D1, D2, D3, D4, D5). This Independent variable mainly concentrates on the honesty, trustworthiness, and sincerity of the clients towards the NGO employees. This researcher, Bakker *et al*. (2006), and Renzl (2008) have developed the items.

Control Variables: Age, Gender, Total Year of service, Total service in this organization, Total number of beneficiaries in the country, the Highest level of Education, types of NGOs

4. Data Analysis and Results

For Cronbach Alpha, all the items had the value above this, threshold (above 0.70) for internal consistency and reliability. NGO-employees' trust-antecedents (e.g. competency, benevolence and integrity) on knowledge transfer to the beneficiaries. Knowledge transfer is the dependent variable while competency, benevolence and integrity based trust are the independent variables. There are six items (A1, A2, A3, A4, A5 and A6) under the Dependent Variable (Knowledge Transfer). Competence Based Trust has four items (B1, B2, B3 and B4), Benevolence Based Trust has five items (C1, C2, C3, C4 and C5) and Integrity based Trust has five items (D1, D2, D3, D4 and D5). The value of the items falls between 1 and 3. So the descriptive analysis in relation to NGO-employees shows that the items of the respondents are consistent with each other

The main focal point here is to examine the relationship between the Dependent Variable (Knowledge Transfer) and main three Independent Variables (e.g. competence/capability-based trust , benevolence-based trust and integrity-based trust). This result finds that the relationship between knowledge transfer and the three independent variables is significant ($p < 0.01$ level) and has positive directions. Regarding the strength of relationships, different authors have different opinions. Cohen (1988, as cited in Pallant, 2007) finds that small (r= .10 to .29), medium (r= .30 to .49) and large (r= .50 to 1.0) strength of relationships between the variables in case of correlation. In this report it reveals that knowledge transfer and competency-based trust is having a large relationship (r= .55), and knowledge transfer and benevolence-based trust is having a strong relationship (r= .529) with each other. A strong relationship exists between knowledge transfer and integrity-based trust (r= .512).The results could primarily find that competency-based trust, benevolence-based trust and integrity-based trust have a positive influence on NGO employees' knowledge transfer to their clients. Further, hierarchal regression analysis could give more detailed results.

Hierarchical Multiple Regression Results for Effects of NGO-Employees' Competency-Based Trust, Benevolence-Base Trust, and Integrity-Based Trust on Knowledge Transfer

In Table-2 below is the result of the hierarchal multiple regression. It consists of 9-models. The table reports the unstandardized coefficient Beta (e.g. Friedrich, 1982), the relationship between the dependent variable (knowledge transfer) and the main independent variables (e.g. competency-based trust, benevolence-based trust and integrity-based trust . It also contains number of control variables and model fit. First this regression is run with couple of predictors (e.g. Field, 2009) and certain predictors are not included due to the tolerance reasons (e.g Field, 2009; Field, 2000; Pallant, 2007; Anderson, *et al*., 1999). ***Model1*** is highly significant as F-value is 123.033 at p< .001. The three main variables (e.g. competency-based trust, benevolence-based trust and integrity-based trust) give a 67.6% of the variable in knowledge transfer. The result in this model demonstrates that all three main independent variables are having a positive and significant relationship with the dependent variable *(*p < .001). ***In model 2***, Age variables (e.g. Age21-30, 31-40 and above 40 years) are added. The position (e.g. relationship) of the main three independent variables and the dependent variable is positive and significant (p<.001). In this model, it finds that the relationship between knowledge transfer and age carries negative value. F –value is 63. 596, which is significant at p< .001. R^2 has increased to 46.7%. Adjusted R^2 has also slightly increased (e.g. 45.3% to 45.9%). Model 3 carries a significant value (e. g. F= 54.571 at p<.001). R^2 has an increase of .001. Adjusted R^2 does not have any change. ***In model 3*** Female variable is added and it is

noticed that 'Female' is having a negative relationship with knowledge transfer. The relationship between the dependent variable and the main three independent variables is positive and significant (p< .001).
In ***model 4*** the 'Total year of Service' variables of the respondents is incorporated. The model is significant as F= 38.471 at p< .001. R^2 has increased to 0.471, while adjusted R^2 remains unchanged. Length of service does not have significant relationship with knowledge transfer is noticed. The relationship between knowledge transfer and other three main independent variables is positive and significant at p < .001.

Model 5 adds the variable 'total year of service in this organisation' of the respondents. There are two variables here (e.g. 6-10 years and 11 years and above). Both the variables are having positive relationship with knowledge transfer, but the relationship is not significant. The model is well fitted and significant (e. g. F= 32.091 at p < .001). Here R^2 has slightly increased to 0.472 from 0.471, while adjusted R^2 has slightly dropped from 0 .459 to 0.458. ***Model 6*** includes the variable ' total number of employees in your organisation' (e.g. 0-2000). The model is significant as F= 29.623 at p< .001. R^2 has increased to 0.473. Adjusted R^2 has decreased to 0 .457. The relationship between knowledge transfer and this variable e.g. ' total number of employees in your organisation' (e.g. > 2000) is negative. So it may be statistically mentioned that the NGOs which are having more than 2000 employees, they are not much interested to transfer knowledge to the clients. Probably, bigger NGO-employees suffer from pride and stubbornness, or they may engage themselves in any other business. The relationship between knowledge transfer and other three main variables are significant and positive.

Model 7 includes the control variable ' number of clients' (e.g.>4000). The model is significant (F=29.623 at p<.001). R^2 has increased to 0.474, while there is no change in adjusted R^2.This relationship is positive, but not significant. The relationship between knowledge transfer and other three main independent variables (e.g. competency-based trsut, benevolence-based trust and integrity-based trust) is positive and significant at p < .001. Next Model (e.g. ***Model 8*** related to education variables < HSC and Postgraduate) is significant as F= 24.086 at p< .001. R^2 has increased to 0.475. Adjusted R^2 has decreased from 0.457 to 0.455. < HSC is having a negative relationship with knowledge transfer, while Postgraduate is having a positive relationship with knowledge transfer. So postgraduate employees transfer knowledge more to the clients. The relationship between knowledge transfer and other three main independent variables is positive and significant at p < .001.

'Type of organization (Local)' variable is included in the last model (e.g. **Model 9**). The model is significant (F= 22.854, p< .001). R^2 and adjusted R^2 have increased to 0.478 and 0.457 respectively. The relationship between knowledge transfer and local NGOs is positive, but not significant. It may be noted that in this model also represents the relationship between knowledge transfer and other three main independent variables. These relationships are positive and significant at p<.001.So from all models of the Hierarchal Multiple regression analysis it is found that all the models exhibit that NGO-employees' competence-based trust, benevolence based trust and integrity based trust on their clients is having a positive and significant (p< .001) relationship for the purpose of knowledge transfer to them (clients). To further confirm the results, a sensitivity analysis is carried out, and similar results are noticed. So all the hypothesis-1, 2 and 3 are supported and confirmed.

Table-2: Hierarchal Multiple Regression Analysis: NGO- Employees (n=460)									
Independent Variables	Model:1	Model:2	Model:3	Model:4	Model:5	Model:6	Model:7	Model: 8	Model: 9
Competence Based Trust	0.362***	0.365***	0.367***	0.367***	0.365***	0.365***	0.367***	0.367***	0.371***
Benevolence Based Trust	0.424***	0.428***	0.429***	0.430***	0.426***	0.427***	0.424***	0.423***	0.422***
Integrity Based Trust	0.199***	0.194***	0.193***	0.190***	0.189***	0.190***	0.187***	0.189***	0.187***
Age 21-30 yrs (AgeD21_ 30)		(0.894*)	(0.853*)	-0.174	-0.23	-0.035	0.703	-0.083	-0.158
Age 31-40yrs (AgeD31_ 40)		-0.365	-0.352	0.253	0.207	0.387	0.65	0.337	0.268
Age above 41 yrs (AgeD41)		-0.46	-0.43	-0.19	-0.214	-0.173	0.583	-0.113	-0.181
Female (F_D)			-0.239	-0.261	-0.254	-0.264	-0.274	-0.276	-0.285
6-10 yrs service (SvcD6_10)				0.112	-0.273	-0.249	-0.226	-0.207	-0.157
11-15 yrs service (SvcD11_15)				0.055	-0.125	-0.213	-0.232	-0.238	-0.056
Above 16 yrs service (SvcD16)				0.784	0.608	0.487	0.375	0.392	0.55
6-10 yrs. of service in this organisation(SD6_10)					0.49	0.461	0.442	0.459	0.384
Above 11-yrs of service in this organisation (SD11)					0.147	0.217	0.241	0.285	0.099
Total number of Employees above 2000 (EmpD2K)						-0.284	-0.447	-0.384	-0.412
Total number of Clients above 4000 (D4K)							0.566	0.515	0.441
Education < higher secondary (HSC_D)								-0.153	-0.173
Education < PG (PG_D)								0.143	0.155
Local NGOs (Loc_D)									1.468
Model Fit									
R	0.676	0.683	0.684	0.686	0.687	0.688	0.689	0.689	0.691
R^2	0.457	0.467	0.468	0.471	0.472	0.473	0.474	0.475	0.478
Adjusted R^2	0.453	0.459	0.459	0.459	0.458	0.457	0.457	0.455	0.457
F-value	123.033***	63.596***	54.571***	38.471***	32.091***	29.623***	27.590***	24.086***	22.854***

Note: (i) Knowledge Transfer is the Dependent Variable (ii) *=p<.10, ***p=<.001 (iii) n=460

5. Discussion

The first hypothesis (for example, H1) is concerned with the competence-based trust of NGO personnel and its impact on knowledge transfer. The quantitative data study of the impact of competency-based trust on knowledge transfer to beneficiaries from the perspective of NGOs (e.g., H1) demonstrates that in the case of NGOs' competence-based trust on them, there is a significant positive impact.

This research supports Ko's (2010) findings, which explain the beneficial but small impacts of competence-based trust on knowledge transfer. Bakker et al. (2006) observed, on the other hand, that competency-based trust had a negative impact (negative impact) on knowledge transfer. In Bangladesh, it has also been observed that the maximum beneficiaries (beneficiaries) are uneducated and unable to grasp the knowledge provided by NGOs (Sarkar and Ahmed, 2000).

Benevolence-based trust and its influence on knowledge transfer is the second Hypothesis (H2). Several studies have discovered a correlation between benevolence-based trust and knowledge transfer in various contexts (e.g., Ko, 2010; Levin and Cross, 2004; Tschannen-Moran, 2001). In the current study, NGOs are found to have a significant relationship with benevolence trust and knowledge transfer (e.g. H2). Previous research on the impact of benevolence-based trust on knowledge transfer in a variety of contexts, including consultant-functional specialists (e.g., Ko, 2010), global virtual communities of practitioners (e.g., Usoro et al., 2007), academic environments (e.g., Tschannen-Moran, 2001), and large product development projects (e.g., Bakker, et al., 2006), have found similar results.

Integrity is founded on the knowledge of actors' previous experiences (Usoro et al., 2007). The building of trust based on honesty is required for knowledge exchange. The awareness of performers' honesty is connected to integrity.The influence of the beneficiaries' integrity-based trust on knowledge transfer is hypothesized in Hypothesis 3 (H_3). This finding show that integrity-based trust has a major impact on knowledge transfer. This conclusion is further supported by Usoro et al. (2007), Bakker et al. (2006), and Tschannen-Moran (2001). In the NGO context, it is also reported that, the beneficiaries, in certain cases are not honest, try to borrow money from the NGOs showing their false poverty level, or are reluctant to pay back their instalments on time.

The results indicate that trust-antecedents (capability, benevolence, and integrity) play a vital role in knowledge transfer between the NGO-employees and the beneficiaries. The main objectives of the NGOs are to develop the socio-economic conditions of the beneficiaries through the application of knowledge and resources. From the findings of this study reveals, the NGOs expect that the beneficiaries should be capable of utilizing the

transferred knowledge, they will have sympathy and soft corner for the NGOs and their employees, and the beneficiaries should be honest in their deeds.

In practice, when NGOs choose beneficiaries for membership, knowledge transfer, and resource allocation, the trust-antecedents (capacity, kindness, and integrity) should be given equal weight in their evaluation.

6. Conclusions, contributions, and limitations

Knowledge transfer is an important part of the knowledge management process, and it has become increasingly important in businesses. Trust antecedents, such as competency, benevolence, and honesty are the independent variables used to examine their impact on knowledge transfer. In Bangladesh, a large number of non-governmental organizations (NGOs) with various missions are working to improve the people's socio-economic situation. The influence of the aforementioned trust-antecedents on knowledge transfer in the setting of corporate organizations in various nations has been researched by several scholars. However, in the case of Bangladeshi NGOs, there has been little research on the influence of trust-antecedents on knowledge transfer.

The Bangladesh NGO industry has three primary stakeholders: donors, NGOs, and beneficiaries. The flow of knowledge is mostly between these three parties. The donors keep a close eye on the NGOs since they provide money and other resources to the NGOs, while the beneficiaries acquire knowledge and other resources from the NGOs. Donors occasionally check on beneficiaries to see if they are receiving the resources provided to NGOs.

According to this study, NGOs must first ensure that the beneficiaries are competent enough to implement the transferred knowledge and resources in the practical sector. Secondly, before transferring knowledge, non-governmental organizations must ensure that the beneficiaries will retain an unofficial contact with them. Thirdly, before transferring knowledge, NGOs must ensure that their beneficiaries are honest and truthful in their words and actions.

Following a quantitative approach, the influence of trust antecedents on knowledge transfer from NGOs to beneficiaries in the Bangladeshi NGO setting is carried out. This study develops three hypotheses based on the literature review and research question. A total of 460 survey questionnaires were operationalized from 460 registered NGOs.

In SPSS, the data were analyzed using correlation and hierarchical multiple regression techniques. According to the findings, competency-based trust has a good and significant influence on knowledge transfer to NGO beneficiaries. The transfer of knowledge from NGO staff to beneficiaries is greatly aided by trust-based on benevolence and honesty. It's worth noting that NGOs extensively analyze the capacities of beneficiaries before enrolling them on the membership list. Before passing on knowledge, NGO employees assess the beneficiaries' generosity and integrity-related characteristics.

It is colossal to find out the precision results of the impact of trust-antecedents on knowledge transfer. However, this experiment has made an endeavor to find out the accurate quantitative results. This research has both theoretical and practical implications. The impact of trust-antecedents is investigated in the setting of the Bangladeshi NGO sector. This contributes to the knowledge management literature deficit. This study fills up this gap. This study informs NGO beneficiaries on trust antecedents in order to get more knowledge from NGOs. Before passing knowledge to recipients (beneficiaries), NGO staff may use this research to assess their (beneficiaries) capacity, benevolence, and trustworthiness. In brief, the findings show a combination of theory and practice, which would be useful for both practitioners and researchers. One of the study's flaws is that its generalizability may be limited because it is a single-country study.

Future researchers may carry out a similar study in different sectors and countries. Future researchers may also adopt a qualitative approach in order to extend this study.

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Lessons Learned Process case study: An Unintended Enabler of Upstream and Downstream Knowledge Management Capabilities at the European Space Agency

Andrew Herd and Francesca Piretti
European Space Agency, Noordwijk, The Netherlands
Andrew.herd@esa.int

Abstract: The paper presents a case study of the European Space Agency which has been coordinating internal knowledge management activities at the corporate level of the Agency for just over 6 years. In this time, previous, current, and future knowledge management activities have been respectively collected, supported, and planned with the immediate intent of addressing potential knowledge loss due to an on-going retirement wave – which will last until 2030. One of the ranges of knowledge management techniques applied is the lessons learned process, with associated means and tools being realised for the capture and exchange of experience. Through the focus on using the validated and evaluated lessons to achieve systematic learning, the lessons learned process has achieved learning at the point of use, rather than mostly keeping the learning within the established Lessons Learned tool, which has also had (unintentionally) caused an enabling effect for other organisational capabilities relating to not only knowledge but also information and data management. The Agency has then made a relatively rapid transition to adopting a systematic approach to Lessons Learned – by both creating the need for (pre-requisite) upstream and "downstream" capabilities. The downstream benefits (learning flowing out of the experience capture) has been achieved by identifying the process, product and people involved in the desired learning outcome, and assuring the learning is placed at this point. In taking the approach of broadening the reach of a traditional lessons learned process (mostly with the aim of more effectively addressing user needs), the establishment of lessons learned capabilities has also enabled the needed upstream development activities for the deployment of lessons learned itself. Aspects such as a solid IT infrastructure (common platform), a robust set of classification terms (taxonomy), and the existence of users with a clear identity (communities of practice). The paper will present the current (but rapidly progressing) status of lessons learned at ESA, and the upstream and downstream effects from the perspective of lessons learned as part of an overall organisational strategy to create a culture and climate of openness and sharing (knowledge management) and digitalisation (information and data management).

Keywords: space agency, lessons learned, case study, benefits

1. Introduction

The European Space Agency (the Agency) has been coordinating knowledge management activities at the corporate level of the Agency for just over 6 years. In this time, previous, current, and future knowledge management activities have been respectively collected, supported, and planned with the immediate intent of addressing potential knowledge loss due to an on-going retirement wave – which will last until 2030. One of the ranges of knowledge management techniques applied is the lessons learned process, with associated novel and innovative means and tools being realised for the capture and exchange of experience [1]. This paper will reflect on the case of the European Space Agency and how internally benefits have been realised outside of the lessons learned process – and how this might apply to other organisation endeavouring to do the same adoption of a lessons learned process.

Lessons learned (LL) provides for the capture and exchange of experience from the projects and activities of the Agency through the creation of a dedicated framework (policy and process documentation) and a web-based tool. The lesson learned process was developed within a well-established organisation with existing ways of working. Indeed, prior attempts to make lessons learned as a beneficial embedded process had not come to fruition (most notably in 2007 when a policy on Lesson Learned was published). The focus on achieving systematic learning through learning actions updating or creating generic or corporate processes, products, or training, has assured the lessons learned process achieved learning at the point of use, and minimised the learning only being retained within the (now) established Lessons Learned portal.

The introduction of a LL new process (conceptually old, but still an innovation in context for the Agency), meant that existing processes were inherently involved and responsible for the success (or failure) of the corporate adoption of this innovation [3]. Considering the lessons learned process as a "black-box", however not "plug-and-play", it is possible to consider the needed inputs and the expected outcomes from lessons learned (as a discrete process). This case study considers this approach and, for the benefit of other organisations also

considering undertaking the adoption (deployment) of lessons learned, proposes the possible pre-requisites and the possibility to prepare these enabling capabilities, prior to initiating the adoption process.

2. Research Design

To support this reflection, the concept of upstream and downstream aspects has been introduced to highlight the key aspects forming and being formed as part of lessons learned. "Upstream" aspects are those aspects, capabilities or processes that flow in to (and as such are considered pre-requisites) the lessons learned process. "Downstream" aspects are outcomes of the lessons learned process to beneficiaries or processes (some direct, others indirect). These labels are indicative and not absolute as the paper explores the cross-linkage between upstream and downstream processes.

Having identified these two "axes", upstream and downstream – an analysis of all involved processes was undertaken within the Agency. These were then mapped against the Lessons Learned process (as the central process) as either inputs or outputs and presented in a mapping type representation.

3. Results

Having gathered the data of what processes were undertaken within the Agency, and how these related to the Lessons Learned process (as the central process) as either inputs or outputs, the resulting mapping was achieved.

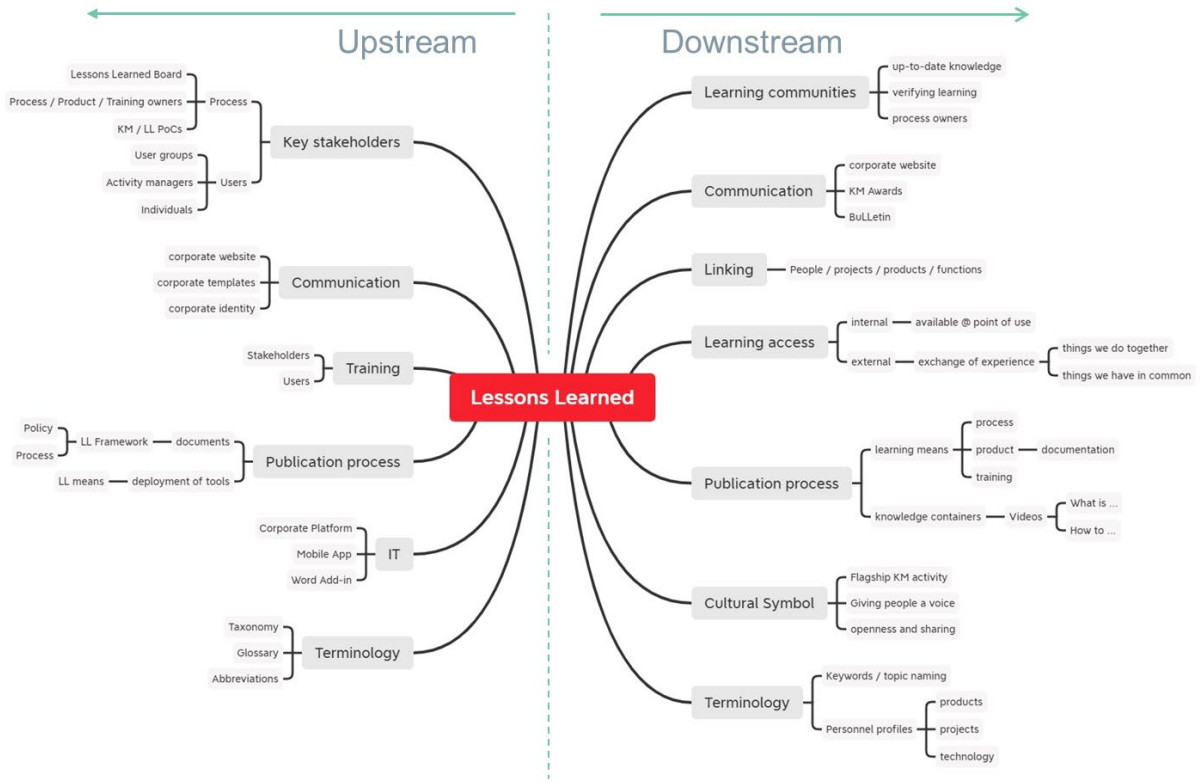


Figure 1.1: Representation of upstream and downstream activities of the Lessons Learned process

4. Discussion

4.1 The upstream benefits

In its most basic form, upstream aspects are the pre-requisites needed for establishing a Lessons Learned process (which can in many ways equally apply to any knowledge management process, or indeed for the support of any innovation adoption within an organisation) and assuring its long-term and effective operation. However, in this section the focus is on Lessons Learned and its direct impact on upstream processes or supporting capabilities. In considering these capabilities as "supporting" this does not diminish their individual contribution or importance towards achieving mission success at the Agency. Indeed, lessons learned itself (as a black box) can be considered as an improvement-based activity (and not fundamental to the organisation, but an optimisation activity). The benefits achieved (and achievable) can go well beyond the initial expectation of

"learning lessons". In the following sections the use case in the Agency is referred to regarding establishing and operating the Lesson Learned process, means and tools.

4.1.1 Stakeholders

The stakeholders of lessons learned is taken here to mean those involved or directly benefiting from the lessons learned process. These stakeholders can be split into those that assure the lessons process itself is run – "process stakeholders", and those involved in feeding lessons into the process and those who benefit from the learning outcome of the lessons process - "user stakeholders". The pre-requisite aspect relates to how these stakeholders are identified, approached and involved, and whether this stakeholder identification and engagement process exists within the organisation. However, in this paper the process stakeholders are put to one side and consider only the stakeholders that are users.

The LL process stakeholders were clearly identified in the Lessons Learned policy document – "who-does-what". However even though the policy document identified user stakeholders (as those working at the Agency), this was a high-level generic label which in practice needed specific focus and energy to turn into a meaningful and concrete accessible group. There are two aspects, one is identifying what are cohesive groups and the other is then contacting them. In the Agency there are a limited number of these identifiable communities, some of which are more formalised than others (with some preferring an informality of structure, and therefore much more challenging to identify).

When conducting a lesson capture event, it was necessary to identify those who should be involved in each discrete capture event (and this applies across the range of lessons capture techniques applied in the Agency). During the initial capture activities, and upon analysis of the nature of the lessons captured, it became apparent that the function of the participant determines the topic captured. The broader the range of participants (not necessarily the number - i.e., multiple individuals representing a single function, but rather each function being represented), the better the breadth of topic covered. In broadening the scope of participation, lessons learned process itself has then enabled these "peripheral" functions to became better recognised and being included in the activity of changing the way we work by giving their experience given value and their contribution made worthwhile.

4.1.2 Communication

With the introduction of a new corporate process, there is a need to create an awareness of the availability of the capability and to foster the motivation to use it. In organisations where there is an ease of creating new web-based resources, has created is a fundamental need (for effectiveness and efficiency purposes) to assure that these resources are known. With the Agency facing a recruitment wave, there are a significant number of individuals needing to learn where to access and how to use these resources.

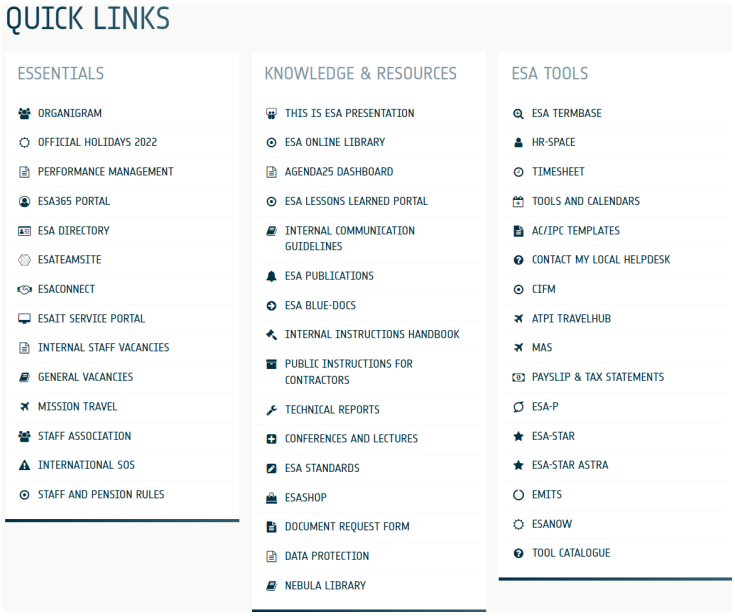
To a significant degree at the corporate level of web-based capability provision, these tools are given on the homepage of the Agency website "OneESA".

However, it has been established that only around 30% of those working at ESA regularly visit these pages (though some may have already stored the direct weblink to these resources). It is also quoted that corporate push-emails are also read at a level of around 30% of those working at ESA.

The concept of communication then needs to be considered in its broadest sense, for a campaign of awareness of an innovation, tool, capability or benefit to be effectively broadcast and received within the organisation. Communication at the corporate level using corporate capabilities, communication to the discrete stakeholder communities, and during regular status reporting meetings at Boards and Working Group meetings are all an essential part of getting the message across.

To this aim, the use of training and team briefings has also been found to be effective mechanisms to communicate (and transfer) the needed knowledge of and skills to use the enabling capabilities being deployed in the organisation. A campaign of awareness and skills transfer briefing has been systematically undertaken at the Agency to assure that commitments made at the policy level are fulfilled. It is worth noting that initially the commitment to diffuse the KM innovations within the organisation was made, however without effect. To address this an intervention was undertaken where KM briefings were brought to each organisational unit in order to assure the commitment of 100% awareness was achieved. This initiative undertaken within a specific

part of the Agency, has taken some 2 or more years to implement, has evolved with the increased maturity of the new means introduced and more recently moved from awareness (knowledge) of capabilities to also include skills transfer in the briefing sessions. The resulting increased understanding of user stakeholders has in turn prompted an improved dialogue during the briefings and more self-investment oriented questions from users.



4.1.3 Training

With the introduction of a new corporate tool, there is a need to provide the necessary skills to use the tool and to enter the needed data (for capture) and the understanding of how to retrieve experience for the purpose of learning through application. Whilst there was some consideration that tools should be training-free zones (immediately intuitive to all users) this was clearly not an appropriate means to validate a system, mainly due to the different needs and preferences of the wide range of users – what is intuitive to one person is nonsensical to another.

Whilst on the issue of providing appropriate training material for tools use, more recently the focus has shifted towards providing short user videos – called “How to …” with one short video for each capability the user needs to perform to achieve an effective outcome (capturing or retrieving lessons). These videos are a narrated guided tour of the web-based portal, indicating exactly how to move around the site to perform certain functions. These have been received well and have reduced the number of enquiries about tool-use to the Lessons Learned Secretariat who administer and maintain the tool (and collect and deal with user feedback). This approach of local training resources – with a “help yourself” (in both senses) approach – is novel to the Agency and is now being more widely used and adopted.

On the aspect of having the necessary skillset to use lessons effectively, there is also a need to equip a user with their own mental toolset. One such aspect includes the necessary critical thinking skills. This skill is needed in order for the user to assess where the experience provide was received within a specific context, and if in its raw form the experience or learning needs some transformation into the new application. Knowing when to apply the learning as is, and when not*. This application of the proposed learning can be either adopted (applied without modification) or adapted (applied with modification – specifically to allow the experience to be applied effectively in the new context).

*As the learning actions predominantly result in updates to an existing process product or training, this need for a decision of when to apply literally partially or not at all is removed, and hence critical thinking skills are only needed for the minority of lessons. Having said this, it is now being found that topic or function-base communities are taking it upon themselves to further evaluate lessons and to determine themselves when and how lessons should be learnt (giving learning at a community rather than an individual level).

4.1.4 Publication Process

Differentiating between communication (to people) and publication (deployment of information) is an important part of addressing this specific need. Publication relates to the release of formalised information into the organisational zone (and for lessons learned this is from the corporate or "OneESA" level).

So as an example, publishing the policy and the handbooks developed, needed a formal process (review and approval) to be formally recognised and have (an appropriate level of) authority of content. This formal process not only included the identification of the body through which the documentation would be processed, but also in the choosing of the documentation templates (for example a handbook is only considered a guideline for working). In addition, each body (in this case a Standardisation Board responsible for publishing internal Agency procedures and processes) has its own publications website for the documentation it administers (whilst each document has its own nominated custodian for the maintenance of that document). At the Agency working on a consensus basis means that the review process is also an inherent internal negotiation on how things should be set out and be operated. This is important as it directly determines the level of resources needed to support the process, and to maintain it (and its relevance to evolving ways of working) over the longer term.

With the creation of innovative ways of working, this has also meant that lesson learned processes have evolved (and been more formalised) and have resulted in an update to the documentation set. As such publication process should be seen as a repetitive process (not a permanent process, though) which is needed to establish the framework upon which a lesson learned system is built. Indeed, the internal Quality Management System at ESA, seeks for formalised documents to be revisited every 3 years to assure their effectiveness (and efficiency) of achieving the desired organisational goals.

Publication though also includes the deployment of IT assets – in this case the ESA Lessons Learned Portal. This publication process is somewhat novel at the Agency, resulting in discretion of formality of publication somewhat less defined for applications developed outside of the core Agency IT function. Lesson Learned has fallen in to this this category, and so direct involvement of this function has been achieved with an outcome of both being supported by and learning from corporate IT. The aspect of webpage templates however has required a broader involvement outside of corporate IT, as the template for such developments is more loosely defined, and therefore an assessment of a commonality of approach was undertaken to provide a template (of the website) that had the look-and-feel of a corporate application, and provide an appealing interface for the user. The publication process itself does not entail a review process of this look-and-feel – however other aspects are needed and addressed in subsequent sections (for example a tool security certification plan and data protection application process).

4.1.5 Information Technology

To create the necessary capability and to comply fully with ESA Digital Agenda for Space (EDAS), and the aim for the digitalisation of the Agency's processes and information, documentation and also in the Lesson Learned application the Agency's knowledge and learning, there was a need to identify the most suitable IT platform on which to build the needed Lessons Learned capability. For IT choices, the corporate IT function provides specific services, and one of the newer services for the Agency (and rapidly evolving in terms of capability) is the provision of Sharepoint platform combined with an ESA-Cloud provision. In order to reinforce the corporate nature of Lessons Learned and fully embed Lessons Learned as a corporate process and means, the Sharepoint platform was chosen as the most suitable. Understanding the limitations of the Sharepoint platform and a perception as a poor user interface, the development of the Lessons Learned portal placed a high emphasis on usability and providing a highly visual experience (classified as the User Experience – or UX) when using the tool.

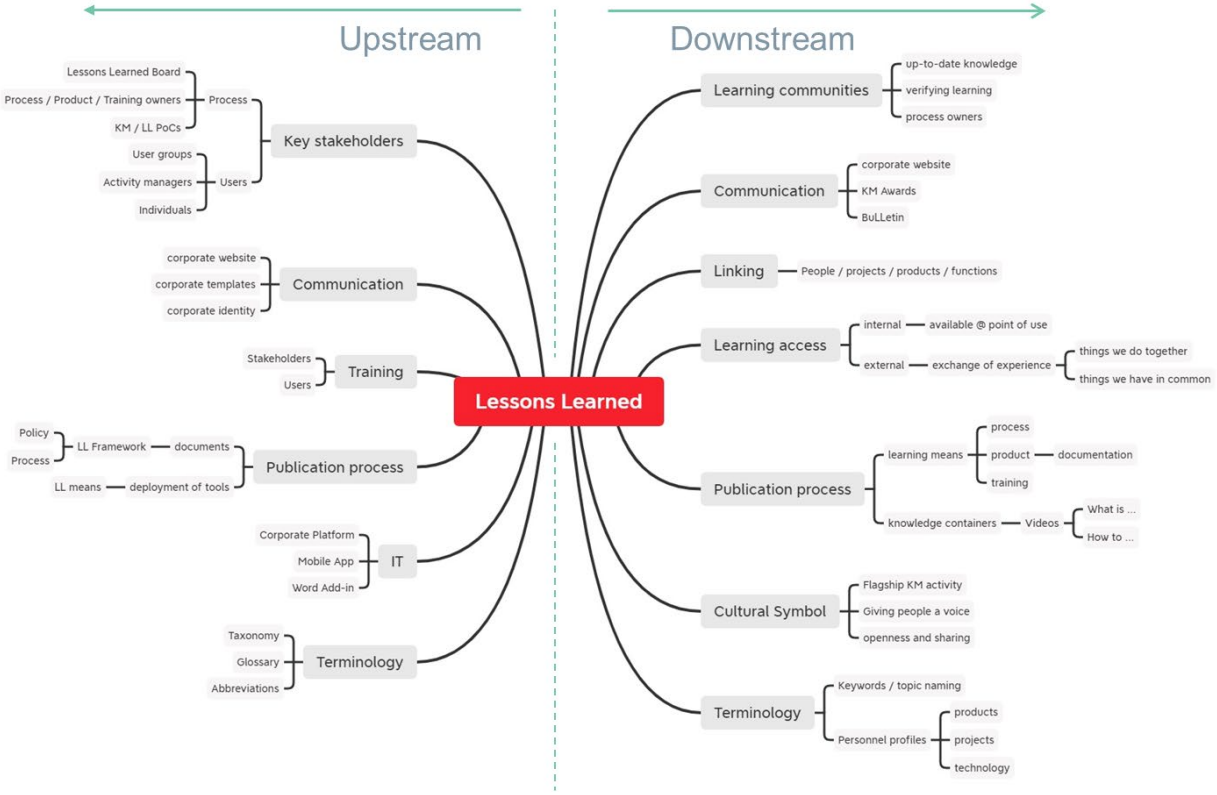
In todays' organisations Information Technology while an enabler for access, this access also brings with it a need for information security and data protection – all of which are then added to or embedded in the IT infrastructure as needed. It is this aspect of controlled access which in terms of climate is a significant conceptual challenge for openness and sharing. The result is controlled sharing within a declared and defined community, i.e., all those working at ESA. As the Agency has a remit from its Members States to also directly support all European space organisations (national space agencies, industry and academia), this aspect of controlled access is being further explored and enabled, in many ways as a ground-breaking activity in Lesson learned - how can the Agency effectively openly and securely share its experience with external parties for the benefit of both parties.

4.1.6 Terminology

To support accurate retrieval, the existence of an agreed set of terminology (at all levels of the organisation) is essential. In an ideal world this would form part of the pre-requisite set prior to embarking on the adoption of the lessons learned innovation within an organisation. ESA does have (and has access to) relevant sets of terms [2] (whether formally classification sets or not) that are appropriately agreed and controlled to allow for adoption within the Lesson tool and the capabilities it provides. As the provision of a standard set of terminology (a set of terms used for classification) is to be embedded in IT tools as a capability, then aspects such as a solid IT infrastructure (common platform), a robust set of classification terms (taxonomy), and the existence of users with a clear identity (communities of practice) commonly co-exist when addressing the introduction of e-capabilities. Lesson learned has been advancing a more systematic approach in the Agency on this aspect, by identifying the need and then pushing for a more integrated rather than instance-specific solutions.

4.2 The downstream benefits

On first reflection the downstream benefits would be considered the outcomes of the lessons learned process – those related to learning. The expected downstream benefits (learning flowing out of the experience capture) has been achieved by identifying the process, product and people involved in the desired learning outcome, and assuring the learning is placed at this point. However, during the application of lessons learned process, the benefits to the Agency have been manifested in a broader manner.



4.2.1 Learning Communities

The identification of learning communities, or more simply groups of experts who have common experience or learning needs is key to disseminating the captured experience into an organisation. The Agency being a bureaucratic organisation has many defined processes, and this has enabled focussing the needed learning to be applied to these already existing processes (and to those who are their custodians). This learning through existing (embedded process) covers around 60% of the experience captured. However outside of these constrained processes, the remaining 40%, are to be learnt through more informal processes, which still can benefit from the experience of others. These processes (in the Agency) still though have a functional responsible, and the learning action in this case is provided to the functional responsible for them to address how the needed learning can be integrated in to specific or generic process. In doing so the connection to these more informal processes with the functional responsible creates the need for the creation of a body-of-thought to assess the needed learning (who will capture, how will it be captured and for whom is it being developed). This helps

communities to be established, and it is not uncommon for these communities to seek for additional learning from the lessons learned system (which in turn leads them to consider capturing their own experience in lessons for others to learn).

It is in these (new) communities that lessons learned is providing *content* for dialogue, a *language* to support the exchange, and the *justification* for that exchange. In addition, in providing content, language and justification lessons have also addressed issues such as cognitive dissonance, justifying decisions to commit resources to learning activities.

4.2.2 Communication

The sense of communication here focusses more on the aspect of promoting the benefits of organisational learning though lessons learned (i.e., demonstrating that a culture and climate of openness and sharing can be achieved, has a positive impact, and relates to the sharer of the experience as much as with the user of that experience).

This has been done both at the corporate level of the Agency, using corporate capabilities such as the internal ESA website (OneESA) to highlighted positive outcomes from capture events and through the giving of recognition and celebration for demonstrations of openness and sharing. To complement this the Agency is supporting more local (community-based) types of communication – through the identification or establishment of communities (referred to as Communities of Practice) and then the communication to these groups with a form of informal bulletin. Communication between members of these groups has been facilitated through chat rooms (for the Agency previously "ESA Connect" and now through Microsoft Teams). Some more active (but still informal) communities have created their own news leaflets, whilst for others it is still being established what would be the most effective means (creation and delivery, and, receipt and learning). The aspect of lessons providing content, language and justification also applies as equally in communication as previously stated for communities.

4.2.3 Linking

One of the key downstream (and upstream benefits) of lesson learned as part of knowledge management has been the linking of experts through their process / product or training custodianship to the experience of those undertaking activities or projects at the Agency. Simply, joining the problem (needed learning) to those that have or should have the (need for) solution. So those that own a process are typically not those who are implementing it. This separation then can result in a process, the product that records that process, or the training that assures that the people effecting the process are doing so in an informed and skilled manner, are not "in touch" with the realities of everyday work. Lesson learned has created this link.

In some cases, the need to identify exactly who is responsible for what to set the learning action has provided greater clarity and understanding within the Agency of who does what. To this end, individuals are finding that their roles and the function they provide are better known, appreciated, and understood (and indeed better justified).

The concept of ownership (of the needed learning) is a key part of lessons learned and is a fundamental aspect of being able to systematically assure organisation learning (setting the Agency as a Learning Organisation). In this regard lessons learned has significantly activated process responsibles to assess learning needs.

4.2.4 Learning Access

The learning access should be interpreted in the direction of diffusion of organisational learning (through means achieving push to and pull from the users) – be that the organisation from which the experience was derived or indeed an organisation that could benefit from receiving that experience through a learning exchange.

Within the Agency the intent is to create learning at "point-of-use". This has led to the development and deployment of novel interfaces to support this diffusion. Embedded glossary in Microsoft Word (which needed to approval of the capability to insert Add-Ins), and a mobile app for a formal definitions of space terminology (which needed the agreement on content and template of the Agency shop front of the two primary App stores).

Most access to learning (around 60%) is achieved using embedded documents during the everyday execution of processes. Some learning can be conveyed externally by implication – so requirements levied on an external

party as part of a contract may then transfer inherent learning in the system where this process has been updated by already incorporating the lessons learning. This is however invisible learning as typically the lesson itself is not visible or even reference in that document – and hence the user is unaware they are accessing the learning of the Agency.

4.2.5 Publication Process

The downstream publication differs from the upstream as it is only involved in the assured flow of the learning outcomes into the organisational domain. Typically, this relates to the more formal publication processes used by the process custodians to re-publish their documentation after update to include the learning. This increased overhead of publication can be justified by the value of the knowledge retained within the document and the benefits that are derived through its use.

However, this learning which is in its nature experiential learning is in most cases captured more in an informative sense rather than in a normative one. This is to say that learning seems to be more commonly captured in handbooks than it does in updates to standards (though it has depended upon the subject matter of capture). This impacts publication, as the more formal the document the more formal the publication process, and to use such a formal process (and potentially resource demanding) may not be so appropriate for an informative document – particularly if this document is regularly updated with new experiences. The advantage with the more formal publication process is that they inherently also contain a means to e-publish (such as a web-portal) at a level of organisation wide, as in the case in the Agency. A balance therefore needs to be made, and potentially negotiation with the publishing body itself that these "new" types of products can be flowed effectively through the system, and that the members of this community are aware how to handle such informal documents during the review and publication process.

Lessons learned then has brought to these publication bodies a wider view of what is (needing to be) published and how this is achieved. In addition, more and a broader range of users are now referring to their portal to retrieve documentation.

4.2.6 Cultural symbol

Lesson learned, for multiple reasons, has established itself (through use and benefit) as the flagship of knowledge management. It has engaged a wide range of communities, both upstream and downstream. It has at the various stages of its development, deployment (including means) and operations brought together generic corporate entities (IT, communication, human resources, documentation management and so on). In short it has engaged those working at ESA, not least due to the high attention along this path to both manage user expectations but also each step of the way to pay attention to providing a positive user experience (significantly contributed by requesting and processing post activity feedback).

In addition to this, it has been a significant tool to give those working at ESA a voice in what they do and how it is done. This later part is significant as giving an individual the opportunity to have a stake in changing an organisation, to support the way it is run provides greater buy-in and commitment to that organisation. In valuing their opinion and taking this to the process owners who were previously unaware or unable (having not the content, language nor the justification to act), the Agency has validated its commitment to listen and respond accordingly in the pursuit of its mission.

This latter aspect is also key to demonstrating that, whilst the lesson learned process worked with individuals and seeks for them to be open and share their experiences for the benefit of the Agency, the process owners are equally open to listen to the experiences received and to share the outcome of the incorporation of that experience within the process for which they are custodian

4.2.7 Terminology

In lesson providing a language of communication, it acknowledges the terminology used by those having the experience and matches these with the terminology of those implementing it in the process. This also then applies and influences those retrieving lessons as they are also then bound by using same the terminology.

Traditionally data retrieval has been based on a classic logic of what you put in (i.e., the search term used) you get out (matches the metadata stored alongside the documentation stored) with only the exact matches being produced.

The Agency is exploring capabilities that will extend this capability to match like terms and not only exact terms. This capability is important as even though intelligent search systems might learn what is being requested based of varied terms used, the number of uses in the Agency will always be limited and therefore the rate of learning of an intelligent system be rather (too) slow.

5. Conclusion

When considering the case study and its application at the European Space Agency the methodology proposed would seem to provide credible and constructive insights into the possible inputs (needed) and outputs (expected) when introducing lessons learned into an organisation. However, the validation of whether this approach could be applied to other organisations would require further research (case study-based or otherwise) to check the robustness and consistency of what is being applied and realised at the Agency as also relevant as a generic approach for any other organisation. Influencing aspects to consider (and gather data on) might be the type or size of organisation to which lessons learned is being applied and the age or degree of existence and establishment of the intra-organisational processes, which could be influencing factors affecting to usefulness of this approach.

Regarding the outcome of this case-study research within the Agency, it is interesting to reflect on ISO 30401 (Annex B) it sets out the "adjacent disciplines" to knowledge management. This list of disciplines, information management, data management, business intelligence, customer relationship management, training / learning & development, organizational learning, innovation management and management systems are provided and their separation from knowledge management explored.

It would seem though, on reflection, that this is provided to be able to separate and justify knowledge management as a discrete discipline. Whilst this is not challenged (though change management could have been added to the list, for example) the positive interactions between these disciplines are not explored in the Annex.

Within an organisation, and the Agency is one such, it is all too easy to get overloaded with new initiatives. The list of potential candidates of new initiatives is given in Annex B of the ISO 30401 standard (though there are more – Lean Management as an example). The overload level (at the individual and organisational level) is all too easy to reach, particularly when these adopted initiatives are accompanied by separate processes, means and particularly tools.

During the initial phases of introduction of the lessons learned process at the Agency a question was asked – "will the introduction of knowledge management, solve my information management needs". At the time, the answer given (by the author) was very much along the lines of Annex B of ISO 30401 – an explanation of what knowledge management is, and, why knowledge management is separate from other management (systems) such as information management.

However, in retrospect, looking at the upstream and downstream benefits of lessons learned as a key (and flagship) knowledge management process realised at the Agency, the answer probably should have been a simple "yes".

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How to Exchange Tacit Knowledge in Multicultural Discussion?

Yayoi Hirose
Toyo University, Tokyo, Japan
yayoi.hirose@iniad.org

Abstract: This qualitative study highlights the importance of considering the cultural gaps in interdisciplinary discussion, as people cannot transfer and exchange tacit knowledge without considering the cultural context. Past literature claims that the dialogue style of discussion is an effective approach for interdisciplinary discussion. However, specific cultures, such as collectivist and high-context cultures, do not accept conflict of opinions. The current study defines a two-part research question: How do cultural gaps affect the dialogue process among people who have different cultural values? How can tacit knowledge be exchanged in multicultural discussions? The study considers Japanese organisations which implemented dialogue-style workshops, as Japanese organisational members have cultural values, such as collectivism and high context, which do not match a dialogue style of discussion. Regarding the first question, the findings show that the participants do not understand tacit knowledge regarding dialogue when they are simply taught the process of how to conduct a dialogue style of discussion. Instead, they tend to use the discussion method based on their cultural context. The study clarifies that simple implementation of dialogue in organisations whose culture does not match it will not enable transfer of tacit knowledge, and participants will not use the dialogue method as expected. For the second question, the findings show that to exchange tacit knowledge, Japanese participants need a place where they feel safe to share tacit knowledge and build trust on others' personality rather than their ability. The tendency to trust is related to the Japanese cultural value of low assertiveness, while assertive people tend to build trust based on others' ability. This finding suggests that people will not exchange tacit knowledge with others who have different cultures without building a trust relationship. An organiser needs to provide a safe place, considering the difference in the trust-building process among people from different organizational cultures.

Keywords: Dialogue, tacit knowledge, trust, multicultural discussion

1. Introduction

As global competition grows more severe, a wide range of experts must constructively communicate with each other in order to generate new services or products. Past literature claims that the dialogue style of discussion is an effective approach for interdisciplinary discussion (Hyde & Bineham, 2000; Isaacs, 1999). Dialogue clarifies and accepts the conflict of opinions among participants through disclosure, questions the participants' assumptions, and generates a new idea by overcoming the conflict (Marquardt et al., 2018; Tsoukas, 2009).

However, the dialogue style needs to consider that the conflict may not be clarified among people who have different cultures. For example, in countries that have collectivist and high-context cultures, people tend not to clearly express their own opinions and to avoid conflict to maintain harmonious relationships (Hartog, 2004; Nisbett, 2003). Under this cultural value, people do not value dialogue and lively discussions because they may disrupt harmony.

Thus, even if the participants learn explicit knowledge on dialogue, they do not necessarily understand the tacit knowledge of the dialogue, such as how to draw out others' opinions and what questions can encourage other participants to challenge their conventional assumptions. The simple implementation of a dialogue stye of discussion is not effective for knowledge exchange and creation among people who do not value dialogue. To promote the exchange of knowledge among different cultures, it is necessary to consider the cultural impediments and factors which promote the exchange of tacit knowledge.

This study adopts as its cases Japanese organisations that implemented dialogue-style workshops to develop management ability, as their cultures do not value the dialogue style of discussion. It aims to identify the cultural impediments to implementing dialogue in Japanese organisations and how Japanese participants overcame them to exchange tacit knowledge in the workshops.

2. Literature Review

2.1 Knowledge and Culture

Sveiby (2001) divides knowledge into "a justified true belief" and "capacity-to-act". People often develop ways to justify that their beliefs are true based on the ambient cultural norms and values, rather than questioning whether those beliefs hold true for changing circumstances. A capacity-to-act is an individual competence that

is shown in action and developed through experiences (Calhoun & Starbuck, 2003; Sveiby, 2001). People's capacity to act may be limited by the cultural norms and values that they have absorbed and rely on. Thus, even if they learn something new from a cognitive perspective, i.e. they understand it, it may be hard to put it into practice, and so they do not change their behaviour. Knowledge should be widely shared because a belief held by only one person would be subjective and result in just that person's action (Brunsson, 1982). Collective behaviour is generated when the collective tacitly accepts it as holding true for them and relies on it to guide collective behaviour (Calhoun & Starbuck, 2005). Polanyi (1966) distinguishes tacit knowledge from explicit knowledge (1967). He explains that while explicit knowledge can be transferred via writing and verbal expressions between people, tacit knowledge cannot, as this knowledge is produced based on human experiences associated with their contexts. Tacit knowledge consists of people's cultural values, beliefs, and assumptions, which cannot be clearly expressed, so people cannot easily obtain each other's tacit knowledge (Baumard, 1999; Nonaka, 1994; Polanyi, 1966).

Knowledge transfer can be defined as the process of transferring justified true beliefs and the capacity to act. Knowledge transfer cannot be just a process of putting new knowledge in the receiver's mind. It is important for a knowledge receiver to internalize the new knowledge (Inkpen & Tsang, 2005; Leonard & Swap, 2004). Nonaka (1994) and Carlile (2004) suggest ease of transfer depends on how tacit the knowledge is, and having the right conditions in which knowers feel able and disposed to share knowledge enables learners to understand and interpret what it means for them in their own context. It may also need to be transformed in order to apply it to a different context (Carlile, 2004). Thus, when knowledge is transferred between organizations with different cultures, the knowledge receiver should understand not only the new justified true beliefs but also the new organization's cultural norms and values to adapt to them (Reid et al., 2001) because the new knowledge has been created in a different culture.

Consequently, when the receiver learns the capacity to act, he or she also needs to change his or her practices and rules (Kumar & Nti, 1998). On the other hand, changing only practices and rules may be a slower process than changing the mental schema because it requires action to be put into practice. However, it is not easy to change a mental schema because of the stickiness of tacit knowledge. This means that the knowledge receiver needs to change his or her norms and values, upon which his or her practices are based. Thus, although past literature suggests that conventional cultural values may impede transfer of tacit knowledge, there are few discussions on how and what cultural factors can impede transfer of tacit knowledge and how to promote knowledge exchange among people with different cultural values.

2.2 Dialogue and Culture

Past literature suggests the effectiveness of a dialogue style of discussion for knowledge exchange and creation by offsetting the difference in background (Marquardt et al., 2018; Svare, 2016). Dialogue is a sustained and open-ended collective inquiry and challenge into processes, assumptions, and certainties that an individual composes based on everyday experiences, and it produces an environment where people consciously participate in the creation of shared meaning by mutual influence (Bohm, 1996; Isaacs, 1993; Senge, 1990; Shaw, 2002). In knowledge-productive dialogue, participants provide awareness to each other by questioning their conventional assumptions (Mintzberg, 2004; Tsoukas, 2009). Dialogue is frequently used as an effective tool for collective knowledge generation to solve a problem or improve business performance (Heikka & Carayannis, 2016; Marquardt et al., 2018; Ratner et al., 2017; Remnyi & Griffiths, 2009; Tsoukas, 2009).

The past literature on dialogue assumes the people who ask, answer, and clarify the conflict of opinions in a knowledge exchange process are from a low-context and individualistic culture (Brymer et al., 2018; Ferraro & Beunza, 2018; Isaacs, 1993; Peters & Besley, 2021; Walton, 1989). However, there are few discussions on dialogue between people who rely on high-context culture and collectivism, which value low assertiveness and avoid conflict of opinions.

Japanese culture, which values high-context and collectivism, does not see the value of dialogue, as it encourages participants to think independently and critically and reflect on that thinking (Remnyi & Griffiths, 2009). Japan is a unique country which, around AD 400–550, integrated Buddhism and Confucianism into its original religious philosophy, Shinto. Since then, the three philosophies have sometimes blended into each other as well as influencing Japanese society. Affected by Confucianism and Buddhism, Japanese people have constructed the image of a leader as a person who should be able to lead harmonious groups based on the value of collectivism in a hierarchical society (Inamori, 2009; Nitobe, 2014). They also value humility and low

assertiveness to construct a harmonious collective group and lead the group to reach sustainable success (Inamori, 2009).

Collectivist cultures encourage people to develop interdependent selves where people are interconnected and prioritize good human relationships rather than individual goals (Davis & Ikeno, 2002), while dialogue encourages people to develop an independent sense of self and accept conflict of opinions (Remnyi & Griffiths, 2009). A high-context culture makes people less specific in their communications, and people avoid saying "no" directly in order to maintain politeness (Davis & Ikeno, 2002; Hall, 1976; Kim et al., 1998; Petkova, 2015). As a result, Japanese people tend to believe people should not explicitly express individual opinions, so under normal circumstances they would superficially agree with others, even if they actually disagree, obscuring their own opinions (Davis & Ikeno, 2002). There are few discussions on how high-context culture and collectivism affect the dialogue process, and it is necessary to consider it as global discussions increase.

3. Research Method

This research adopts a case study of Japanese organisations which rely on Japanese cultural values and implemented a dialogue style of discussion for the first time. The researcher conducted semi-structured interviews with 25 middle managers and performed qualitative analysis. The managers are from various departments, such as sales, engineering, marketing, human resource, and accounting, in Japanese companies founded more than 40 years ago. This membership composition is expected to enable an effective analysis on knowledge exchange among different cultural backgrounds. Their companies adopted the Coaching Ourselves (CO) method in their series of 30 workshops to develop their management ability. In every session, a management topic is discussed among members by sharing their related experiences. CO adopts dialogue-style discussion, where a participant is supposed to be asked probing questions by team members, answer the questions, and self-reflect about his/her management (Mintzberg, 2004). CO was developed based on Mintzberg's management discipline so that business leaders can develop in the context of their practical management and can significantly improve their effectiveness given the opportunity to learn thoughtfully from their own experience. Mintzberg calls for a more reflective approach to management education (Mintzberg & Gosling, 2002).

The participants are expected to conduct self-directed learning through reflection. The key point is that simply listening and accepting others' experiences and opinions are not effective for their reflection (Mintzberg, 2004). They need to reflect on their conventional management style and challenge their conventional assumptions by being questioned by other members or themselves (Mintzberg, 1973).

The study analyses how Japanese cultural factors affect the process of dialogue and how the participants reflect on their management style. The reason that the study chose the CO workshop is that this workshop considers the characteristics of Japanese organisational factors. In many Japanese organisations, the decision-making style is based on the bottom-up system in which middle managers collect enough information and propose and proceed with new projects rather than the top-down system in which the employees strongly commit to the CEO's clear strategic vison. The CO method emphasises that the empowerment of middle managers and workshop participants in Japanese organizations are limited, as they will not be able to express their opinions to their executive managers based on the Japanese seniority mindset. Furthermore, CO requires context-based dialogue among middle managers who have a certain degree of management experience. In other words, it encourages the sharing of tacit knowledge accumulated from managerial experiences in each field.

4. Findings

The findings suggest that the cultural gaps impeded learners' understanding of tacit knowledge on dialogue. Twenty-two out of 25 participants stated that they did not understand why dialogue can be effective for self-reflection and development of management ability.

> *In the initial period of sessions, we were taught that we should ask good questions in this way or something like that. But I did not intend to consider how I should ask good questions in some particular situations. I was just told.* (Interviewee 21)

As a result, although they learned the whole procedure of dialogue in the workshops based on the guide documents, they did not know what questions can be effective for self-reflection.

> *I actually listened well, but I felt it was difficult to understand what kind of question I should ask, how I should lead the discussion, and whether I should attain the conclusion.* (Interviewee 16)

> *I did not understand what to ask as I had no experience. In my experience, I just listened and learned the contents of the session in the seminar*. (Interviewee 14)

They did not understand that to carry out dialogue, they needed to transform their conventional Japanese cultural values and understand the other values based on which dialogue was generated. This suggests that simple implementation of a dialogue style of discussion is not enough for participants who have collectivist and high-context cultural values because they do not have the experience of self-directed learning needed to understand effective dialogue. They did not understand how dialogue had to be carried out to be effective in multidisciplinary discussions because they tended to avoid conflict of opinions, which may disrupt their harmonious mood. As a result, they understood this dialogue workshop based on their cultural values and collectivism, which value low assertiveness and encourage them to listen to others carefully rather than ask questions and clarify the conflict of opinions.

> *I realised that the most important thing in the CO is to listen to other members' opinions. After that, I tried to listen to their opinions and became able to both talk and listen to them.* (Interviewee 3)

The participants thought that individual attainment of the CO was learning the other participants' experiences and opinions rather than providing the other participants with the opportunity for reflection. They were provided awareness by listening to others rather than being asked and clarifying the conflict of opinions. After every session, the participants were required to write down what they thought in 10 minutes, which was unique for a Japanese workshop. This opportunity encouraged the Japanese to reflect on their management style without accepting the conflict of opinions.

Through the workshops, most of the participants regarded the goal of this dialogue workshop as being to eliminate sectional barriers and create an open and harmonious atmosphere for collaboration in their companies.

> *(The main objective of the CO) I thought we needed to eliminate barriers between sections. I thought my role was managing capable people, so I tried to promote collaboration. In order to do so, I needed to talk to people in other departments.* (Interviewee 13)

Like Interviewee 13, the participants changed their management style to collaborate with other departments instead of deeply reflecting on themselves and started thinking about how to create new business through collaboration based on harmonious relationships.

> *The purpose of the CO was to activate relationships among middle managers. Actually, after the CO sessions, I contacted my CO colleagues when I needed to collect related information.* (Interviewee 12)

Most of the participants aimed to build a trust relationship among themselves for collaboration. Evans (2013) claimed that trust is one of the most important factors for sharing tacit knowledge, and 17 participants opened up with their tacit knowledge on the discussion topics after building trusting relationship with other participants.

> *When I had just joined the CO seminar, I hesitated to say anything to managers of other sections. I think this is because I did not know what kind of people they were. But I came to freely say what I was thinking. I think basically all staff members really like to speak, and when start talking, they do not stop. But we did not have any chance to say what we were really thinking.* (Interviewee 6)

Trust is the willingness of a party to be vulnerable to the actions of another party based on the expectation that the other will perform a particular action important to the trustor (Mayer et al., 1995). It depends on the trustee's ability and personality. People who value low assertiveness emphasise tradition, seniority, and experience and value personality over ability (Hartog, 2004). It can be said that Interviewee 6 built trust based on others' predictability rather than their ability.

The findings show that participants who built trusting relationships with others felt that a CO workshop would be a safe place where nobody would take negative actions against each other. Trust depends on the expectation

of perceived outcomes and risks (Uzzi, 1997). The CO participants were limited to middle managers, and their direct bosses were not allowed to participate in the sessions. They felt safe when they felt sympathy from other participants, as they had the same status and the same kind of experiences.

> *He was shocked when he was required to transfer to another office alone. Even a senior person who was more than ten years older than me said the same thing as me. I felt sympathy for him as I thought everybody had the same kind of experiences and got the present status . . . Even if I said something embarrassing, I felt relaxed because other members might have the same experiences*. (Interviewee 1)

He felt safe when he shared the same emotions and experiences with other participants. The findings suggest the importance of providing a safe environment that promotes participants' self-determination and interest in their work (Deci & Ryan, 1987). Through sharing them, participants started trusting others' personalities and expressing their thoughts.

> *We are the first six members, and we closely interacted with each other and created a new circumstance, WA.* (Interviewee 6)

"WA" means harmonious relationship in Japanese. Interviewee 6 suggested that the participants built a trusting relationship based on collectivism, which encouraged them to feel safe and disclose their tacit knowledge on the discussion topic even if the other participants belonged to other organisations.

As a result, the safe place strengthened the co-worker relationships.

> *I also came to frequently and freely talk to my colleagues when I needed to think about new projects. Before attending the CO seminars, I had been thinking about new projects by myself. Now, I will first contact my colleagues, and we think together.* (Interviewee 2)

> *I came into close contact with my colleagues. Before attending this seminar, I did not care even if a manager of another department talks to me. Now if a CO member asks for cooperation on his project, I am sure that I will support him.* (Interviewee 4)

They intended to share tacit knowledge which was generated in their cultural or specialised context.

Table 1 summarises the findings. Most of the participants did not obtain tacit knowledge on dialogue, in which a cultural context dialogue was generated. As a result, they reflected on their management style by listening to others' experiences rather than being asked. Most of the participants did not directly ask in-depth questions regarding their management style, as they did not come up with any questions to provide awareness to others. Rather, they just talked about their own experiences and listened to others. The participants who were provided a safe place to have a close private conversation with other participants tended to build a trust relationship among themselves. Through conversation, they trusted others' personalities rather than their management ability, and after that, they started sharing tacit knowledge with other participants. For example, sales managers actively shared tacit knowledge on sales with managers from other departments.

Table 1 Summary of Findings

	Understand tacit knowledge on dialogue to encourage other participants' self-reflection on their management?	**Opportunity to have a private conversation with others?**	**Build personal trust among other participants?**	**Share tacit knowledge on the discussion topic with other participants who belong to a different department?**
Interviewee 1	No.	Yes	Yes	Yes.
Interviewee 2	No.	Yes	Yes	Yes.
Interviewee 3	No.	Yes	No	No. Differentiated his real intention and his statement.
Interviewee 4	No.	Yes	Yes	Yes

	Understand tacit knowledge on dialogue to encourage other participants' self-reflection on their management?	**Opportunity to have a private conversation with others?**	**Build personal trust among other participants?**	**Share tacit knowledge on the discussion topic with other participants who belong to a different department?**
Interviewee 5	No.	Yes	Yes	Yes.
Interviewee 6	No.	Yes	Yes	Yes.
Interviewee 7	No.	Yes	Yes	Yes.
Interviewee 8	No.	Yes	Yes	Yes.
Interviewee 9	No.	Yes	Yes	Yes.
Interviewee 10	No.	Yes	No	No. Did not mention sharing tacit knowledge with others.
Interviewee 11	Yes. Made effort to ask to promote others' reflection.	Yes	Yes.	Yes.
Interviewee 12	No.	No	No	No. Simply focused on listening to others' experiences.
Interviewee 13	No.	No	No	No. He just attended and stopped participating.
Interviewee 14	No.	No	No	No
Interviewee 15	No.	No	No	No
Interviewee 16	No.	No	No	No
Interviewee 17	No.	Yes	Yes	Yes
Interviewee 18	No.	Yes	Tried	Yes
Interviewee 19	Partially yes. Frankly asked questions	No	Yes.	Yes
Interviewee 20	No.	No.	No.	No
Interviewee 21	No.	Yes	Yes	Yes
Interviewee 22	Yes. Made effort to ask probing questions.	Yes	Yes	Yes
Interviewee 23	No.	Yes	Yes	Yes
Interviewee 24	No.	Yes	Yes	Yes
Interviewee 25	No.	Yes	Yes	Yes

5. Discussion and Conclusion

The findings show that to effectively implement a dialogue style of discussion in organisations whose cultural values do not match it, organisers need to transfer tacit knowledge, such as the cultural context. Although the participants learned the dialogue style through the documents regarding questions, they did not understand in which situation they should ask, what kind of questions would be effective, and why they should be effective. Because the participants did not change their "*justified true belief*" in Sveiby's definition (2001), they thought clarifying the conflict of opinions would disrupt their harmonious relationship, which should be valued in Japanese culture. As a result, they did not change their "*act*" as expected for the dialogue style.

Although previous discussions emphasise that related prior knowledge is necessary to implement new knowledge (Cohen & Levinthal, 1990; Todorova & Durisin, 2007; Zara & George, 2002), the findings show that more context-based knowledge, which considers differences in cultural values, is necessary. They show that without transferring tacit knowledge, the participants will use new knowledge based on their conventional cultural values. Thus, when organisations with an incompatible culture aim to implement dialogue for multidisciplinary knowledge exchange, participants first need to change their conventional cultural assumptions.

This study highlights the importance of building trust among participants who have different backgrounds in the continuous knowledge exchange. It shows how in organisations which value low assertiveness, people build trust based on others' personal predictability rather than their ability (Hartog, 2004) and tend to share tacit knowledge that has been accumulated in their culture and specialised fields. The study also shows that they need a safe place to trust others and share tacit knowledge.

On the other hand, in more assertive societies, such as the UK and the United States, trust-building processes are mostly based on either calculation of the intentions of others or estimates of their capabilities to fulfil their commitments (Doney et al., 1998). Thus, when organising knowledge exchange between assertive and not-so-assertive organisations, not only is some informal mechanism for building trust needed (Lepore & Spigarelli, 2018), but so is making participants aware of this gap in trust-building. This finding is also expected to support remote dialogue-style discussion where members have different backgrounds to work more effectively.

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Business Analytics and Firm Performance: A Literature Review

Henri Hussinki
LUT University, LUT School of Business and Management, Lahti, Finland
henri.hussinki@lut.fi

Abstract: Technological advancements and increasingly available intra- and extra-organizational data have attracted firms to invest in business analytics. Despite the growing number of firms that have invested in business analytics, only some of them have been able to turn their investments into tangible business benefits. This has raised questions among researchers and practitioners about the causal ambiguity between business analytics adoption and firm performance outcomes. Consequently, academic research community has recently launched an endeavor to produce empirical evidence on the relationship between business analytics and firm performance, considering different complementary resources, capabilities, and mechanisms that could better explain what firms need to gain business benefits from business analytics (e.g., Brynjolfsson and McElheran, 2016; Gupta and George, 2016). The purpose of this study is to improve the current understanding on the relationship between business analytics and firm performance. This is done by reviewing 47 peer-reviewed studies that have empirically studied the phenomenon. Academic literature that examines how firms could benefit from data and analytics has separated into several parallel sub-streams, including business analytics, data analytics, big data analytics, and business intelligence and analytics. In this study, an umbrella term business analytics is used to cover all of them. Thus, another objective of this study is to merge the research output of different sub-streams related to business analytics and firm performance. This establishes a more comprehensive view of the literature landscape. This study finds that firms can translate business analytics into business benefits by ensuring that they simultaneously possess different complementary resources and capabilities, that are valuable, rare, and difficult to imitate. Also, business analytics literature has matured into a stage where it is not focusing solely on data and analytics technology, but also on talent (employees and management) and organization (culture) aspects, which together provide a fertile ground for the firm's business analytics capability.

Keywords: Business analytics, big data analytics, data analytics, business intelligence, data, firm performance, literature review

1. Introduction

The promise of significant business benefits has encouraged firms to start investing heavily in business analytics. So heavily, that it is estimated to attract more investments than any other information technology. However, despite the increasing number of firms that are investing in business analytics, only some have succeeded to translate the business analytics investments into improved business performance. This phenomenon, sometimes referred as *information technology productivity paradox*, has provided the business analytics research community with a topical and managerially relevant research agenda – to understand and untangle the ambiguous relationship between business analytics and firm performance. Consequently, it has become one of the most surging and managerially relevant discussions within the business analytics research literature in the last 10 years. However, the relevant research output has been labeled under separate concepts and generated in parallel subsets of literature, including, for instance, business analytics, data analytics, big data analytics, and business intelligence and analytics. Echoing the opinions of some of the leading authors within the field, there is no need to separate the concepts from each other as standalone concepts (e.g., Mikalef et al, 2018). Therefore, this study unifies all relevant concepts and subsets of literature under the umbrella term business analytics. By doing so, this study has the potential to cover more relevant literature and conduct a more comprehensive literature analysis than some of the previous ones (e.g., Mohamed et al, 2020).

The timing of this literature review is suitable, as there has been a rapid increase of relevant literature in the last five years. By covering the relevant peer-reviewed studies from all subsets of the literature, this study has two objectives: The first objective is to improve and update the current understanding of the relationship between business analytics and firm performance. Second, this study aims at unifying the relevant business analytics related research literature that has been developing in several overlapping sub-streams. Achieving these objectives will result a comprehensive overview of the current state-of-affairs in the business analytics and firm performance literature, as well as enables development of academically and managerially relevant future research agenda.

After introduction, this paper moves on to describe the methodological choices. Next, findings are presented and discussed. Finally, the paper is concluded with the limitations, future research directions, and final remarks.

2. Methodology

The objective of this literature review is to present the current state-of-affairs of the literature on business analytics and firm performance. The literature search was done in January 2022 by using the abstract and citation database Scopus. A search string "data OR business AND analytic AND performance" was utilized. The search was targeted on document titles and limited to empirical studies, including journal articles, conference papers, book chapters, and books written in English and published between January 2000 and January 2022. The first search produced 402 document results. After article screening for inclusion based on titles the number of potentially relevant articles reduced to 110. After article screening for inclusion based on abstracts the number of potentially relevant articles reduced to 70. At this stage, a significant number of articles related to firm's operational performance instead of business performance were excluded from further steps. Finally, after quality assessment based on full texts, the final number of articles included in the data extraction step was 47.

After literature selection, the initial coding scheme was developed. At first, it had the following structure: article author(s), year of publication, article title, research question(s), key concept(s), key definition(s), research method(s), empirical data source(s), key findings, and future research ideas. Based on the initial coding scheme, relevant data was extracted from the articles. After developing an in-depth understanding of the literature at hand, the coding scheme was amended with further codes which specifically to the research objectives of this study, such as complementary resources and capabilities for business analytics. Data was then synthesized based on the final coding scheme, and the findings were reported.

3. Findings

This literature review has three primary findings. First, the business analytics and firm performance literature shows signs of maturity and increasing business management relevance. Even though the earlier research, published in 2015 or before, focused mostly on technological aspects of business analytics, such as analytical tools, techniques, models, and methodologies (Klatt, Schlaefke and Moeller, 2011; Bronzo et al, 2013; Chae et al, 2014), the more recent research has extended the discussion to business analytics capabilities, that build on tangible, human, and intangible resources, such as data, technology, and other basic resources, technical and managerial skills for business analytics, and data-driven culture and intensive organizational learning (e.g., Gupta and George, 2016; Mikalef et al, 2020). Some articles define business analytics capability as the firm's ability "to capture and analyze data towards the generation of insights by effectively orchestrating and deploying its data, technology, and talent" (Mikalef et al, 2019, p. 262), or the firm's "competence to provide business insights using data management, infrastructure (technology) and talent (personnel) capability to transform business into a competitive force (Wamba et al, 2017, p. 358). In sum, business analytics capability does quite clearly refer to much more than data and technology. It consists of the necessary data and technology-related resources, but also, and more importantly, of analysts' and managers' skills, and the firm's cultural orientation for learning using data in business-critical decision-making.

Second, the relationship between business analytics and firm performance is significantly influenced by firm's complementary resources and capabilities (e.g., Brynjolfsson, Wang and McElheran, 2021). Several of the reviewed articles develop and empirically test research models that combine business analytics capability with different valuable, rare, and difficult to imitate resources and capabilities, which have theoretically significant roles in translating business analytics into improved firm performance. For instance, recent research highlights the complementary roles of dynamic capabilities (e.g., Wamba et al, 2017; Mikalef et al, 2020), business strategy alignment (Akter et al, 2016; Wamba et al, 2019), organizational culture (Behl, 2020; Upadhyay and Kumar, 2020), information technology capital, educated workers, high flow-efficiency production workplaces (Brynjolfsson et al, 2021), knowledge management (Ferraris et al, 2019, Shabbir and Gardezi, 2020), ambidexterity (Božič and Dimovski, 2019; Rialti et al, 2019; Aljumah et al, 2021), big data analytics management capabilities (Razaghi and Shokouhyar, 2021), and resource orchestration and circular economy implementation (Kristoffersen et al, 2021). In addition, business analytics positively influences firm performance through mediating outputs, such as informational benefits (Asadi Someh and Shanks, 2015), information quality (Ashrafi et al, 2019), technological innovation (Saleem et al, 2019), product and process innovation (Saleem et al, 2020), dual innovations (Su et al, 2020), sustainable product development (Ali et al, 2020), business process performance (Aydiner et al, 2019), business decision making (Chatterjee et al, 2021), and functional performance (Torres et al, 2018). Moreover, some studies have discussed about the moderating role of business analytics in the relationship between firm's strategic activities and business performance. These studies have

found that business analytics increase the business value that firm can create through open innovation (Arias-Pérez et al, 2022), business model designs (Sun and Liu, 2020), and supplier development (Gu et al, 2021).

Third, the findings also show that empirical research literature on data analytics and firm performance accumulates in three major subsets including big data analytics, business analytics, and business intelligence and analytics. In the big data analytics subset, the extant research has produced strong evidence on the relationship between big data analytics capability, including technological, human, and organizational aspects, and different firm performance outcomes (e.g., Mikalef et al, 2020). In the business analytics subset of literature, research is concerned with the effect of different analytics approaches (i.e., descriptive, predictive, and prescriptive analytics) on firm performance (e.g., Klatt, Schlaefke and Moeller, 2011; Bronzo et al, 2013). In the business intelligence and analytics literature, the focus is on data and its utilization opportunities (e.g., Torres et al, 2018). Thus, while the three subsets of literature have accumulated quite independently of each other, they have dealt with the same issue of how firms could utilize data to seize business opportunities and achieve improved firm performance.

4. Discussion and conclusion

The purpose of this study was to improve the current understanding on the relationship between business analytics and firm performance. The findings suggest that business analytics (capability) consists of tangible, human, and intangible resources, which cover, for instance, data and analytics technology, technical analytical skills, business analytics management, and data-driven culture of the firm. Therefore, firms should pay attention to all three resource categories. Even the best datasets or the state-of-the-art technologies cannot compensate the lack of technical analytical skills, good business analytics management, or the firm's data-oriented culture. Or vice versa. However, business analytics capability alone is not enough to secure improved firm performance, as the reviewed literature indicates that firms need complementary, good fit resources and capabilities to support their business analytics capability. As the firm's business environment and strategic goals change frequently, also the resources and capabilities must be adapted to different situations. This also concerns business analytics capability, which can provide business benefits only when it can address the firm's current and future business needs.

The relationship between business analytics and firm performance is ambiguous and complex. Drawing from the resource-based view (e.g., Barney, 1991), firms are more likely to attain business benefits from business analytics, when they possess or have access to valuable, rare, and difficult to imitate resources that complement their business analytics capability. Also, in accordance with the dynamic capabilities theory (e.g., Eisenhardt and Martin, 2000), firms need dynamic capabilities to gain business value from business analytics (e.g., Wamba et al, 2017). Business analytics capabilities are among many valuable capabilities of the firm, which interact to produce higher-order capabilities that enable the focal firm to achieve competitive advantage. However, as the firm's business environment is turbulent and highly dynamic, it is crucial that the firm can rearrange and refocus its capabilities in accordance with the changing business needs. That is, when a firm strives to be competitive in a highly dynamic business environment, it needs to be able to sense the opportunities and threats, seize opportunities, and transform the organization, including business analytics and the complementary resources and capabilities (cf. Teece, 2007).

For managerial audiences, this study provides interesting implications. First, all aspects (resources) of business analytics capability should be considered when a firm aims at translating its investments in business analytics into business benefits. If one or some of the critical resources are lacking, the projected firm performance impacts of business analytics will be sub-optimal. Second, business analytics (capability) is only one of the firm's valuable capabilities, and it does not affect firm performance in isolation. Thus, managers need to combine business analytics with other, complimentary resources and capabilities, to integrate it into the firm's value creation processes. Both implications should be considered by firms when they start new business analytics initiatives, or else they may face the business analytics productivity paradox.

This literature review is affected by some limitations. First, as the literature for this study was searched through a single abstract and citation database (Scopus), some relevant articles may have gone unnoted. The next step for this literature review is to perform "snowballing" to identify potentially relevant articles from the studies that were already included in this review. Second, the literature analysis was carried out by a single author. Triangulation between two or more authors could have provided slightly different findings.

This study also paves way for interesting future research directions. First, as different complimentary resources and capabilities were found to significantly impact the relationship between business analytics and firm performance, future studies could further explore this research direction. For instance, research on the role of knowledge management could provide valuable insights on how knowledge-based value creation is related to the firm's data-driven initiatives. Second, most of the reviewed studies were cross-sectional by nature, and data was collected from a single country or even from a single industry. To understand how business analytics influences firm performance over longer period, longitudinal studies would be beneficial. In addition, international datasets and cross-industry comparisons would contribute the ongoing discussion by revealing potential cultural and industry-specific conditions that either hinder or bolster the impact of business analytics on firm's business performance. Third, use of perceptual, subjective firm performance measures is a common ground within the extant business analytics literature. Even though some studies have found that subjective and objective firm performance measures correlate significantly (probably due to the key informants' deep understanding of firm performance measures, see e.g., Ramakrishnan et al, 2020), it is an area where future research could make improvements. Use of secondary data sources to collect data on firm performance measures could increase validity and reliability of the business analytics research literature stream.

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Knowledge Mobilization in Agile Information Systems Projects: A Literature Analysis

Eli Hustad[1], Makoto Nakayama[2], Norma Sutcliffe[2] and Merri Beckfield[2]
[1]University of Agder, Norway
[2]DePaul University, Chicago, US
eli.hustad@uia.no
mnakayama@cdm.depaul.edu
nsutcliffe@cdm.depaul.edu
mbeckfie@cdm.depaul.edu

Abstract: This study focuses on how knowledge is mobilized in agile information systems (IS) projects. One crucial success factor of those projects is to mobilize knowledge through different knowledge management processes. It is vital to establish efficient knowledge management (KM) processes to generate a knowledge culture based on transparency and communication. Communication channels, digital tools, and platforms are essential for establishing a KM infrastructure supporting the knowledge work of the project organization. Thus, each IS implementation team should maintain a knowledge base and a knowledge potential at some level. However, this is not always the case. We conducted a literature review to survey the extant research on the role of KM in agile system development projects. The agile approach is often associated with the networking model and tacit knowledge. The findings indicate that the agile approach is supposed to promote KM. While tacit knowledge is rooted in the analogue process of continuous actions and informal communication, explicit knowledge is captured in digital records of documentation and databases. In KM, the *personalization* model (behavioural, networking) and the *codification* (technocratic, repository) model is central. The choice of system development method (agile versus plan-driven) influences how knowledge is mobilized in the project organization. An agile approach heavily relies on informal communication, tacit knowledge sharing, and light documentation. In contrast, the plan-driven methods such as the waterfall approach generate more explicit knowledge through documentation. Communities of practice are important structures for transforming from plan-driven to agile approaches. We present a framework showing specific challenges the literature identifies concerning the efficient mobilization of knowledge in the agile context. For large-scale agile projects, informal coordination mechanisms were important. This study identifies several measures for overcoming barriers and risks for knowledge sharing in the agile context.

Keywords: knowledge management, knowledge sharing, knowledge mobilization, agile software projects, large-scale information systems (IS) projects

1. Introduction

In the last two decades, the agile software development approach has gained much attention since the introduction of the agile manifesto (Fowler and Highsmith 2001). The emphasis has been on faster deliveries of working software to customers who are actively engaged with developers in an iterative process of guiding and shaping the end-product of an information system (Zykov and Singh 2020). This contrasts the traditional plan-driven methods with heavy documentation, pre-defined requirement specifications, and less involvement of customers after the design process (Dingsøyr et al. 2012; Li et al. 2010). The agile system development approach requires self-organizing and well-functioning teams and efficient collaboration and communication routines (Batra et al. 2017). This is not always easy to establish, especially when agile projects increase in scope and complexity involving distributed coordination of large-scale information systems (IS) projects (Santos et al. 2015).

It is an increasing interest among scholars and practitioners regarding the role of knowledge management (KM) in agile software projects (Ghobadi 2015; Maudal and Dingsøyr 2021; Ouriques et al. 2019). Software development is a highly innovative and knowledge-intensive activity, and KM is therefore an important perspective for understanding the knowledge processes going on during the system development life cycle (Nakayama et al. 2021). However, the ways that tacit and explicit knowledge is transferred and how knowledge is optimally utilized in an agile software setting are still not fully understood (Napoleão et al. 2021). Tacit knowledge and especially sharing of knowledge during stand-up meetings, pair programming, post-mortems, and informal communication in general, are embedded in the nature of the agile approach (Ouriques et al. 2019). By comparing rigorous documentation in plan-driven methods, the agile approach seeks to develop "just enough" documentation, and working software is ranked higher than documentation (Marinho et al. 2019). One KM perspective combines the personalization (behavioural, networking) and the codification (technocratic,

repository) to develop relevant practices, strategies, and appropriate tools to support knowledge work (Alavi et al. 2005). The personalization model pays attention to tacit knowledge and seeks to support knowledge-sharing and rich communication activities in different types of groups, teams, and communities of practice (e.g., system development teams, professional networks) by providing them with interactive communication tools, such as collaboration platforms, email, videoconference, and social software. The personalization model focuses on networking, collaboration, communication, and informal relations in organizations (Wenger et al. 2002). In contrast, the codification model is more technologically oriented and pays attention to explicit knowledge and how to codify knowledge by creating documents for reuse purposes through repositories. Regardless of knowledge forms, knowledge transfer relies on individual motivations, formal and informal networks, and social cohesion (Sarker et al. 2005).

This study seeks to understand how knowledge can be efficiently *mobilized* in an agile software setting comprising IS development. We develop the concept of *knowledge mobilization* to understand how different knowledge processes can come into play both within agile intra-team and inter-team settings. To develop this concept of knowledge mobilization, we conducted a literature review to integrate extant research to get an overview of empirical studies focusing on different knowledge management processes in an agile software setting. The following research question has guided our research study:

How can knowledge be mobilized in agile information systems projects?

Thus, we systematically reviewed studies of relevance to understand how previous research has addressed the role of KM in agile software development settings. We organize our findings into recurring themes and patterns identified in the literature to understand knowledge processes and barriers to knowledge sharing. We also aim to clarify how the agile context enables knowledge mobilization.

The paper is organized as follows. First, we present our research method for conducting a literature review. Next, we present our findings organized into six recurring themes. After that, we discuss implications for future research. Finally, we make some concluding remarks and present a framework for understanding knowledge mobilization in an agile context for IS development.

2. Method

A literature review provides an overview of existing knowledge by identifying and combining prior research studies and recommends a future research agenda. We followed the procedure and practical guidelines of a systematic literature review developed by Kitchenham (2004). The review conducted followed these steps: 1) Identify important literature reviews already existing in the field, develop a protocol with relevant search phrases, and define inclusion and exclusion criteria; 2) Conduct the review including empirical research studies, select relevant studies, perform quality evaluation, and integrate related topics and patterns; and 3) Summarize the review results and prepare a write-up. The results of our literature study include research studies published during the last decade (2012-2022). In addition, a backward search is performed not to overlook important studies in the last decade.

To identify relevant research studies, we used search phrases related to knowledge management and agile software development (Table 1). We used the Scopus database as the search engine. The search was performed on “title” and “keywords” on the specified literature topics. The inclusion criteria were empirical research studies published in outlets comprising research articles, conference papers, and book chapters. Especially studies focusing on the role of KM and knowledge processes related to teamwork, collaboration, coordination, and communication in agile software projects were included. In addition, studies focusing on specific organizational context/structure and culture facilitating knowledge mobilization were of interest. We excluded studies on computer science topics related to specific agile methods, programming languages, and algorithms. However, technical solutions and infrastructures supporting knowledge work and processes in the agile environment were of interest. The primary focus was to understand the socio-technical processes that are unfolding in agile software projects and how knowledge is mobilized in these settings to enhance team performance.

Table 1: Overview of search strings

Search engine	Scopus
Search phrases in combinations (KEYWORDS or TITLE)	*Knowledge-related* "knowledge management" OR "knowledge sharing" OR "knowledge transfer" OR " knowledge application" OR "knowledge creation" OR "knowledge process" OR "knowledge mobilization" AND *Agile-related* "agile software development" OR "agile system development" OR "agile software engineering" OR "agile software project"
Inclusion criteria	Peer-reviewed, empirical studies, English language, research articles, conference papers, book sections Topics: agile software development contexts, socio-technical issues, team dynamics, collaboration, coordination, communication, culture, structure, knowledge processes, facilitating knowledge work, supporting technologies
Exclusion criteria	Books, conference reviews Topics: Specific programming languages and code, algorithm development and pure technological focus (e.g., in computer science, and part of software engineering)

Research in knowledge management and agile system development is multidisciplinary. Therefore relevant topics recurred in several subject areas comprising information systems, business, management and accounting, social sciences, knowledge management, software engineering, and computer science. The initial search provided 88 publications encompassing 65 conference papers, 22 journal articles, and one book section.

The abstracts of these papers were read to select relevant studies for the research question. The inclusion/exclusion criteria were used to select relevant studies or remove studies that did not match the topics of interest. After this step, we ended up with a shortlist of 54 publications, including 37 empirical studies, eight literature reviews, and nine conceptual papers. The empirical studies comprised 15 journal papers and 22 conference papers. We decided to focus on the journal papers to ensure the richness of the empirical studies.

The contents of these journal publications were completely checked, and both the inclusion and exclusion criteria guided this selection step. In addition, the quality of the research studies reported was carefully reviewed, and especially the research methods applied were evaluated. Only one of the journal papers at this stage did not match our topic of interest. After this step, we had a final body of 14 journal publications to analyse in-depth (Table 2).

These empirical studies comprise rigorous studies with rich material and are the subject of deeper analysis. The literature review studies and the conceptual studies identified were utilized to get an overview of the field. The limited number of empirical studies published in highly acclaimed journals indicates that the research area of knowledge management in relation to agile software development is an immature research area, and conference papers are dominant per se.

Table 2: List of selected empirical publications

#	Reference
	Empirical studies
1	Annosi, M. C., Magnusson, M., Martini, A., and Appio, F. P. 2016. "Social Conduct, Learning and Innovation: An Abductive Study of the Dark Side of Agile Software Development," *Creativity and Innovation Management* (25:4), pp. 515-535.
2	Batra, D., Xia, W., and Zhang, M. 2017. "Collaboration in Agile Software Development: Concept and Dimensions," *Communications of the Association for Information Systems* (41:1), pp. 429-449.
3	Dingsøyr, T., Moe, N. B., Fægri, T. E., and Seim, E. A. 2018. "Exploring Software Development at the Very Large-Scale: A Revelatory Case Study and Research Agenda for Agile Method Adaptation," *Empirical Software Engineering* (23:1), pp. 490-520.
4	Ghobadi, S., and Mathiassen, L. 2017. "Risks to Effective Knowledge Sharing in Agile Software Teams: A Model for Assessing and Mitigating Risks," *Information Systems Journal* (27:6), pp. 699-731.
5	Ghobadi, S., and Mathiassen, L. 2016. "Perceived Barriers to Effective Knowledge Sharing in Agile Software Teams," *Information systems journal* (26:2), pp. 95-125.
6	Gregory, P., Barroca, L., Sharp, H., Deshpande, A., and Taylor, K. 2016. "The Challenges That Challenge: Engaging with Agile Practitioners' Concerns," *Information and Software Technology* (77), pp. 92-104.
7	Heeager, L. T., and Nielsen, P. A. 2017. "Intrafirm Knowledge Transfer of Agile Software Practices: Barriers and Their Relations," *Journal of Information Technology Case and Application Research* (19:4), pp. 199-224.
8	Heredia, A., Garcia-Guzman, J., Amescua-Seco, A., and Serrano, A. 2014. "Study of Factors Influencing the Adoption of Agile Processes When Using Wikis," *International Journal of Software Engineering and Knowledge Engineering* (24:6), pp. 859-885.
9	Khalil, C., and Khalil, S. 2020. "Exploring Knowledge Management in Agile Software Development Organizations," *International Entrepreneurship and Management Journal* (16:2), pp. 555-569.
10	Khoza, L. T., and Bwalya, K. J. 2021. "An Insider's Perspective of Knowledge Sharing in Software Development Projects," *Journal of Information and Knowledge Management* (20:3), pp. 1-17.
11	Paasivaara, M., and Lassenius, C. 2014. "Communities of Practice in a Large Distributed Agile Software Development Organization - Case Ericsson," *Information and Software Technology* (56:12), pp. 1556-1577.
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3. Findings

Based on the keyword analysis, the findings from the literature review were classified into six main recurring themes of KM in agile software projects comprising (1) *Agile practices promoting KM*, (2) *Agile practices require efficient knowledge sharing and transfer,* (3) *Barriers and risks to knowledge sharing and knowledge transfer in agile projects,* (4) *Important conditions to resolve barriers and risks for knowledge sharing and knowledge transfer in agile projects,* (5) *Scaling up agile projects – inter-team structures and the need for coordination,* (6*) Dark side of agile projects.* These themes are mapped into a framework showing important conditions, characteristics, enablers, and inhibitors for mobilizing knowledge in an agile context (Table 3).

3.1 Agile practices promoting KM

The focus on tacit knowledge sharing and the networking model is a dominating research perspective on KM in agile software development. Studying agile practices and KM in Indian firms, Sing and colleagues (2014) show evidence that more than 60 % of the KM practices resulted in positive responses. This indicates that agile practices themselves promote KM. Those practices were related to KM environment, KM culture and policies, knowledge capture and organization, knowledge sharing, training, mentoring, and KM technologies. The most commonly used practice was learning and sharing through discussion forums. The least accepted practice was dependence upon documents for knowledge transfer, which indicates that explicit knowledge and the repository model of KM are less supporting. Overall, their study provides evidence that tacit knowledge dominates in agile software development and that the agile approach depends on tacit knowledge sharing. However, the Indian software industry with agile practices emphasized the need for more formality regarding KM. The formal role in handling KM was often lacking (e.g., employment of a chief knowledge officer). In addition, it was a need for a scrum master role, but this was seldom established. Reliance on authority that provides guidelines for using agile methods could be significant for the outcome of a project. Moreover, a

healthy KM environment and appropriate technologies are essential to establish. Most of the findings in this study agreed with the agile manifesto.

An informative workspace, knowledge repositories, engineering practices and cloud infrastructures, were all important elements of the agile environment leading to KM processes of knowledge capitalization, knowledge sharing, and knowledge creation. Knowledge repositories were, in some cases, critical formal structures besides networking. This was illustrated in a model depicting agile practices and cloud services supporting KM in large organizations (Khalil and Khalil 2020). The authors conclude that agile practices lead to a knowledge-intensive culture, and collaborative practices consisting of daily meetings, retrospective meetings with clients, and pair programming will promote knowledge capitalization.

Table 3: Framework to understand mobilization of knowledge in an agile context of IS development

Main themes	**Sub-themes**
Agile practices promoting KM	Tacit knowledge, the networking model of knowledge management
Agile practices require efficient knowledge sharing and transfer	Useful knowledge to share, tools to support knowledge sharing; Wikis, chat rooms, team networking, personal communication, social networking, social software, customer collaboration communication
Barriers and risks to knowledge sharing and knowledge transfer in agile projects	Different organizational roles have different barriers, lack of communication, lack of rewards, lack of trust, job security, motivational and psychological factors, organizational culture, time and resource, knowledge strategy, system methods, professional skills, cost, technology. Factors are interrelated. Risks are team diversity, team capabilities, team perception, project communication, low quality of collaboration technologies, complex and domain specific projects.
Important conditions to resolve barriers and risks for knowledge sharing and knowledge transfer in agile projects	Allocated time, supportive culture, organizational structure enhancing collaboration, pair programming, sprint planning, project retrospective, bridge communication gap, positive learning environment, avoid risks by engaging experienced team members, assign project full-time workers, allocate substantial time and resources, tailor the knowledge strategy, choose skilled and motivated people, consider the organizational context
Scaling up agile projects – inter-team structures and the need for coordination	Informal coordination; experience forums, lunch seminars, instant messaging, open work arena, formal coordination; Scrum of Scrums, MetaScrum, communities of practice for learning and innovation, for scaling up.
Dark side of agile projects	Time pressure – inhibiting team performance, wide scope of knowledge activities, formal and informal controls are important

3.2 Agile practices require efficient knowledge sharing and transfer

Several agile software studies examined knowledge processes regarding knowledge sharing and transfer in the agile environment. They report how contextual factors can promote efficient knowledge processes and avoid risks (Ghobadi and Mathiassen 2017) and barriers (Ghobadi and Mathiassen 2016; Heeager and Nielsen 2017) for knowledge flow.

Seventeen useful knowledge types encompass knowledge related to methodology and database design, software testing, communication skills, system integration, and writing business reports (Khoza and Bwalya 2021). Ways of sharing knowledge include wikis, chat rooms, team networking, personal communication, social

networking, and customer collaboration. At the same time, codified knowledge was also noted as essential means of supporting knowledge sharing. Social software, particularly the use of Wikis, provided understanding for learning and adoption of agile processes and was reported as beneficial for experience sharing and collaborative learning (Heredia et al. 2014). The learning of agile software processes was strongly related to actively being involved in tacit knowledge sharing during the collaborative learning process. Efficient collaboration in teams is crucial in agile software projects, and understanding different dimensions of the concept is a must. According to Batra and colleagues (2017), collaboration comprises mutual benefits, engagement, coordination, communication, and knowledge sharing. Thus, collaboration is much more multifaceted than presumed in the Agile Manifesto.

3.3 Barriers and risks to knowledge sharing and knowledge transfer in agile projects

Different organizational roles have different views of knowledge-sharing barriers. Ghobadi and Mathiassen (2016) identified 37 specific barriers. Causal maps for different roles (project managers, developers, testers, and users) were presented to get an overview of the barriers related to team, process, and context to understand barriers to effective knowledge sharing in agile software teams. Project setting barriers are crucial for project managers, project communication, and project organization. Also, team capabilities barriers are vital for developers, testers, and users. In addition, Khoza and Bwalya (2021) identified 33 factors influencing sharing of useful knowledge. They highlighted job security, motivational factors, time, psychological factors, lack of communication, lack of rewards, and lack of trust.

Heeager and Nielsen (2017) developed a conceptual model with barriers to knowledge transfer comprising organizational culture, time and resources, knowledge strategy, and motivation and willingness. These barriers should be looked at as interrelated and not in isolation. Concurrent with this last-mentioned study, Wendling and colleagues (2013) also showed the importance of understanding the relationships between barriers to knowledge sharing in global teams. For instance, cultural differences were negatively related to absorptive capacity. Some barriers were also enablers for knowledge sharing; time zone differences can be challenging but also positive since this increases time for activities and knowledge sharing in a global team. They presented a framework of enablers and barriers for knowledge sharing in global teams. The study confirmed existing barriers described in previous literature but also identified new knowledge-sharing barriers related to technology, professional skills, cost, and software development methodology.

Identified risks to knowledge sharing are team diversity (language, time, place, discipline), team capabilities (insufficient understanding of business domain, context, collaboration technologies, requirements, social skills), team perceptions (e.g., lack of motivation), project communication, low quality of collaboration technologies and development processes, complex and domain-specific projects (Ghobadi and Mathiassen 2017).

Gregory and colleagues (2016) aimed to map the landscape of agile practitioner challenges and identified seven main themes and 27 sub-themes. Sustainability was an important theme that included knowledge sharing, process improvement, documentation, and contracts. The challenge was also related to skills – and the need for developers to be “masters of all trades,” including social skills and business knowledge.

Important conditions to resolve barriers and risks for knowledge sharing and knowledge transfer in agile projects

Allocated time, supportive culture, the organizational structure supporting team collaboration, pair programming, sprint planning, and project retrospectives were important factors supporting knowledge sharing (Khoza and Bwalya 2021). Software development teams must bridge communication gaps and build a shared understanding to overcome barriers. In addition, the organizational roles’ diversity must be considered (Ghobadi and Mathiassen 2016). In addition, a positive learning environment was crucial to increase motivation and individual commitment to enable effective knowledge sharing (Gregory et al. 2016). Moreover, several knowledge-sharing solutions were suggested to avoid risks, engage experienced team members, assign full-time project workers, do mentoring, and create and develop shared goals (Ghobadi and Mathiassen 2017). Heeager and Nielsen (2017) developed some heuristics to handle barriers to knowledge sharing. They are: be aware of potential barriers and the relationships between them, choose skilled and motivated people, tailor your knowledge strategy, allocate substantial time and resources, and be mindful of your organizational context.

3.4 Scaling up agile projects – inter-team structures and the need for coordination

Coordination is crucial for agile software projects, especially when they scale up to larger projects requiring an inter-team structure (Batra et al. 2017; Dingsøyr et al. 2018; Santos et al. 2015). Different competencies and business languages exist in such complex settings, and knowledge sharing between client and vendor is part of the collaboration leveraging expertise and know-how. Business knowledge is shared from client to vendor, and technical knowledge is shared from the vendor to the client (Batra et al. 2017).

According to Dingsøyr and colleagues (2018), large-scale software projects require informal and formal coordination of inter-team knowledge sharing. Informal coordination comprises experience forums, lunch seminars, and instant messaging, and formal arenas are Scrum of Scrums (on sub-project level) and Metascrum (on project level). In this study, the informal arenas became more dominating over time, and an open work area supported efficient coordination and knowledge sharing. The organizational culture changed gradually towards more trust and collaboration. Customer collaboration involved knowledge sharing between people with business skills from the customer organization, and people with construction skills from the developers. Santos and colleagues (2015) provide evidence that more iterations that were undertaken improved coordination and knowledge sharing by the most agile companies, and knowledge sharing mechanisms proved to support the co-creation of business value. They developed a conceptual model explaining knowledge sharing across agile teams, including purposeful practices, organizational conditions, and stimuli. Important work practices were face-to-face conversations, informative workspaces, rotations among teams and projects, collective meetings, pair programming between different teams, internal seminars with technical presentations, marathons (competitions), coding Dojos (e.g., at lunch time). Important conditions were strategy, structure, culture and individual behavior, top management and leadership support, communication flow, integration among teams and projects, and successful agile method adoption.

In addition, communities of practice (CoPs) which are groups that share and create knowledge to enhance learning and innovation in organizations (Brown and Duguid 1991), generated valuable mechanisms for knowledge sharing related to inter-team coordination and communication (Paasivaara and Lassenius 2014). In this study conducted by Paasivaara and Lassenius (2014), CoPs played different roles in the transformation phase from plan-driven to agile software development and in the scaling-up phase from intra- to inter-team settings. They played a role in continuous improvement and showed it to be a valuable mechanism for knowledge sharing, inter-team coordination, and communication. They were necessary to implement a large-scale agile approach supporting the transformation process successfully. In this study, 20 CoPs were active, four of which were most important for the transformation process. Successful criteria for the CoPs and how they evolved were also elaborated. Some characteristics of CoPs were an interesting topic with concrete benefits to participants, a passionate leader, decision-making authority, supporting tools to create transparency, and cross-site participation when needed. The CoPs became important for knowledge sharing and learning in other projects after the agile project was completed.

3.5 Dark side of agile projects

One study reported on the dark side of agile projects regarding innovation and learning in organizations (Annosi et al. 2016), which implies knowledge-sharing problems. The study showed that applying agile approaches (e.g., Scrum) provided negative effects. Time pressure (deadline pressure) was found to be negative for self-regulated teams and inhibited team performance and engagement in learning and innovation activities. Other challenges were related to lack of support for technical implementation and product innovation, and that too broad knowledge was damaging expertise, difficulty in understanding the big picture of the product, and the teams had problems handling the broad scope of knowledge activities. Managerial practices and good work routines, including formal and informal controls, were necessary conditions for the teams' self-regulating learning and innovation. It is also dependent upon the teams' internal pressure. A paradigm model for time pressure was developed in this study. While not mentioned explicitly, this study has implications for KM. Both formal and informal controls are a critical part of a knowledge management strategy.

4. Implications for future research

Future research should assess the influence of different software development methodologies on knowledge sharing and how agile methods can facilitate knowledge sharing (Wendling et al. 2013). Moreover, there is a need to understand factors influencing knowledge sharing in different contexts (Ghobadi 2015; Ghobadi and Mathiassen 2016; Ghobadi and Mathiassen 2017; Khoza and Bwalya 2021) to understand factors related to inter-team knowledge sharing (Dingsøyr et al. 2018; Santos et al. 2015), to address strategies for knowledge transfer

between agile teams, and to develop measures against knowledge sharing barriers (Heeager and Nielsen 2017). Future studies should investigate incentives and mechanisms that may encourage knowledge sharing, compare its processes across different industries, and study knowledge sharing in different organizational roles (Ghobadi and Mathiassen 2016; Khoza and Bwalya 2021).

Moreover, future research should focus on high-performing and low-performing projects concerning knowledge-sharing risk profiles (Ghobadi and Mathiassen 2017) and on customer collaboration and inter-team coordination. The influence of culture, context, and the coordination mechanisms in larger projects should be focused (Batra et al. 2017; Dingsøyr et al. 2018), how practices are adopted to scale, and how the context of development programmes may influence the up-scaling approach (Dingsøyr et al. 2018). Future research should also determine antecedents of collaboration and study how collaboration affects capability, agility, and project success, in addition to team autonomy, competence, and trust (Batra et al. 2017).

Future research should continuously focus on the networking model of KM to get additional data on challenges and success factors regarding the role of CoPs for agile adoption (Paasivaara and Lassenius 2014). Especially the focus could be on contextual factors, organizational culture, structure, and national culture regarding the value of CoPs. Future studies should involve a diversity of industry sectors and large organizations to increase the understanding of the value of CoPs in large-scale agile IS projects. Further studies are needed to understand the agile practitioner's challenge landscape, measure the agile value, and understand the cultural change (Gregory et al. 2016). Finally, future research should focus on the dark side of agile projects and include teams from multiple firms to understand the impacts on team learning and innovation (Annosi et al. 2016).

5. Conclusion

This study examined the role of KM in agile software development projects. Our findings build on a literature study to overview how previous research has addressed this topic. The aim has been to understand how knowledge can and ought to be mobilized in the agile context. Table 3 shows a framework including elements enabling/inhibiting the mobilizing of knowledge in an agile context of IS development. First, the previous body of research clearly illustrates that agile software development practices and the agile manifesto promote KM, tacit knowledge sharing, and the networking model of KM dominate in front of the repository model and explicit knowledge. To understand how knowledge is efficiently mobilized in the agile software development context, we need to consider specific challenges, barriers, and risks to overcome them. Findings illustrate that mobilizing knowledge in the agile software development context embeds complexity, making knowledge sharing and knowledge transfer challenging. And the complexity increases when agile projects are scaling up into inter-team structures. Informal coordination mechanisms and communities of practice were important initiatives for dealing with large-scale agile projects. We recommend several measures for efficient knowledge sharing in the agile context.

Overall, this literature study revealed specific research gaps, providing evidence that the role of KM in agile software projects represents an immature research field. Future research recommendations have also been outlined.

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A Bibliometric Analysis Deconstructing Research on how Digitalisation Affects Knowledge Workers

Henry Isegran[1], Mats Kuvene[2] and Karl Joachim Breunig[3*]
[1]KPMG, Norway
[2]Inspirit365, Norway
[3]Oslo Business School, Oslo Metropolitan University – OsloMet, Norway
karl.joachim.breunig@oslomet.no

Abstract: Whereas previous waves of automation have predominantly affected labour intensive work, current cognitive technologies enable automation and commoditization of knowledge intensive work. However, extant research provides limited understanding of how this man-machine collaboration will unfold. Moreover, knowledge intensive firms, such as professional service firms, are characterized by how professionals show a preference for autonomy, exhibiting a distaste for control, supervision, and formal organizational processes. Therefore, it is particularly prudent to investigate how knowledge workers will be affected by the introduction of technologies like AI, IoT and Big Data, giving special attention to their professional autonomy. However, there exist limited empirical studies on how the interaction between autonomous professionals and machines unfold in practice, and there exist no unifying theory explaining the effect of digitalization on this type of knowledge intensive work. To provide a starting point for subsequent research, we offer a structured literature review aided by a bibliometric analysis to identify core contributions that can identify and synthesize main dimensions in extant research. We experimented with different searches phrases at Web of Science, and ended up with combining (Digi* OR techno*) AND autonomy, which resulted in 3961 articles. By excluding irrelevant categories our result was 815 articles. We then performed a bibliometric analysis aided by VOSviewer and narrowed our dataset down to 15 core articles. A content analysis of these core articles identified three different goals of digital implementation; digital tools to enhance communication and sharing of information, digital tools for better decisions and digital tools for monitoring and control. We found paradoxical relations regarding worker autonomy and technology within all three goals. The content analysis points in the direction that the increased control following the new technology dominated the gained autonomy for knowledge professionals. We found three dominating factors that could be used to explain how the professionals perceived the change in autonomy. These are; what kind of job, what kind of technology and the professional's attitude towards social status, technology, change and knowledge sharing. We suggest that practitioners who are implementing digital technologies must pay attention to relations that affect knowledge professionals perceived autonomy.

Keywords: Bibliometric analysis, Digitalization, Knowledge intensive work, Knowledge worker autonomy

1. Introduction

This paper offers a bibliometric analysis of prior published research addressing the autonomy paradox. The aim of this study is to explain how digitalization affect knowledge worker autonomy. Researchers have previously explored the interactions between man and machine, yet the accelerating digitalization creates new socio-technical relations, which makes further investigation pertinent (Drangsholt, 2014; Sannes and Andersen, 2018; Hermansen, 2017; McKinsey, 2017). As opposed to previous industrial revolutions, technologies such as Internet of things (IoT), Artificial intelligence (AI) and Big Data enables automation of complex and cognitive tasks (McAfee and Brynjolfsson 2014; Shrouf, et al., 2014). The effects digitalization has on knowledge worker autonomy is found to be contradictory. Mazmanian, et al. (2013) named this phenomenon "The autonomy paradox". This term emerges from findings that displayed paradoxal relations regarding the implementation of digital communication tools. On the one hand, knowledge workers experienced an increased autonomy, by receiving greater flexibility and control. On the other hand, increased workload and surveillance resulted in weakened worker autonomy (Mazmanian, et al., 2013). Similar paradoxal relations have been reported in other studies, also by utilizing other digital tools (Underthum and Steen, 2018; Brey, 1999; Gerten, et al., 2018).

Knowledge workers, such as management consultants, lawers, and physicians are characterized by their preference for professional autonomy, social status and esoteric knowledge. These workers also exhibit a distaste for supervision and control (Nordenflycht, 2010). Being that knowledge workers are experts, they often possess more knowledge than their supervisors, within their field of knowledge (Newell, et al., 2009). Thus, organizations may benefit from offering professional autonomy to their knowledge workers. Experts predicts that the future jobs will consist of complex problem solving and highly educated workers (Butollo, et al., 2018; Bonekamp and Sure, 2015). Further, millennials demand autonomy (Morgan, 2015), but also expects guidance on how to perform their job (Cognizant, 2012). These relations amplify the importance of addressing "The autonomy paradox".

Given the lack of consensus regarding how digitalization will affect knowledge-intensive work, and predictions concerning future work, we want to address the following research question: *"How can a bibliometric analysis of extant research addressing digitalization contribute to understand the autonomy paradox, and which factors should leaders consider when implementing new digital technologies in knowledge intensive firms?"*

To explore the research question, we conducted a literature review, aided by bibliometric analysis. We carried out a structured literature search by utilizing the ISI Web of Science's database, and the search phrases (Digi* OR Techno*) AND Autonomy. We carefully selected relevant categories and ended up with a database consisting of 815 articles. Further, we identified 15 core articles based on subjective and objective criteria. Finally, through a content analysis of our 15 core articles we identified three levels of digitalization, which have different impact on knowledge worker autonomy. Paradoxical relations between the implementation of hardware, systems, and algorithms, and worker autonomy, emerged. The findings indicates that increased control and monitoring following technological implementations, dominates the gained autonomy. We discovered two main factors that could be used to explain how knowledge workers perceive the change in autonomy: what technology, and the knowledge worker's attitude towards social status, technology, and knowledge sharing. Knowing this, we can provide change agents with valuable insight when implementing new technologies. This study has also extended the current understanding regarding this topic, which paves the way for further research. We present a framework identifying three levels of digitalization; each with different consequences for knowledge worker autonomy and related managerial considerations within.

2. Theory

The paradoxical relations between autonomy and control that emerged by using digital tools, has been named "The autonomy paradox" (Mazmanian, et al., 2013). In their study, Mazmanian, et al. (2013) found that the utilization of mobile email devices, on the one hand, offered knowledge workers flexibility and greater control over their own work. On the other hand, increased availability interfered with the work-life balance. Paradoxical relations were addressed already before the millennium (Brey, 1999). Technologies that enabled employees to work from home, offered flexible work hours, but also increased surveillance and standardization of tasks, which pulls the autonomy in different directions. Similar findings have been presented elsewhere in the literature (Underthun and Steen, 2018; Gerten, et al., 2018). Digital systems can enhance information sharing and transparency, which may empower workers and shift responsibility through the organization (Bouèe, 2015). Still, this also facilitates increased control and monitoring (Underthun and Steen, 2018; Gerten, et al., 2018).

Professionals, such as physicians, consultants, and lawyers are workers that traditionally enjoy autonomy, and express a distaste for surveillance and control (Nordenflycht, 2010). Further, autonomy is a job characteristic that is central in predicting the job satisfaction of a knowledge worker (Eaton-Wally and Lowe, 2017). Within their field of expertise, knowledge workers are often superior to their supervisors, thus giving them autonomy may be very valuable to the firm (Newell, et al., 2009). Being that the service knowledge workers deliver is specialized and hard to measure (Løwendahl, 2005), many believe that knowledge intensive work is beyond computerization (Christensen, et al., 2013; Frey and Osborne, 2013). Still, these claims are being challenged.

Automation of tasks, aided by AI and Big Data, is a form of digitalization that make up the biggest threat to knowledge worker autonomy. Utilizing digital technologies, also cognitive and complex task, or parts of them, is subject to computerization (Ford, 2009; Skidelsky, 2019; McAfee and Brynjolfsson, 2014). In particular, tasks like data gathering and data processing may be automated (Chui, Manyika and Miramadi, 2015). Some claim AI could contribute to liberation of resources and improve decision making, while retaining or increasing the professional autonomy (Dhanrajani, 2018). However, the support AI provides must be understood and interpretable by the knowledge worker. If not, there may be a loss in perceived autonomy (White, 2018).

The expectations about the future of work, is widely discussed. Some studies state that there will be a increased demand for highly educated workers in the future, which must be capable of complex problem solving (Bonekamp and Sure, 2015; Butollo, et al., 2018). Moreover, autonomy is a privilege that knowledge workers increasingly will expect in the future (Morgan, 2015), especially with the millennials entering the labor market demanding flexibility and constant feedback (Cognizant, 2012). These predictions indicated the importance of addressing and understanding "the autonomy paradox". Digitalization will bring changes to the workplace. Still, in what way it will affect jobs, is unclear. For the first time in history, cognitive and non-routine tasks are subject

to automation. Despite the knowledge worker´s demand for autonomy and the benefits autonomy brings, autonomous jobs are under threat. The uncertainty about how digitalization will affect knowledge worker autonomy, is illustrated in "the autonomy paradox". Further, there is no consensus about what an autonomous job is. Weisman (2014) suggests that employees can be allowed autonomy over the following criteria; what they do, how they do it, when they do it, where they do it, and with whom they do it. Seemingly, digitalization could alter all these criterias, both positively and negatively. These relations emphasis the need for further exploration, specifically a deconstruction on extant research.

3. Methodology

To advance our understanding regarding the effects of digitalization on knowledge worker autonomy, the present study offers a systematic literature review aided by bibliometric analysis. We conducted a structured literature search in order to identify and select core articles upon which further research on the relation between autonomy and digitalization could be built. These *core articles* were identified by using a combination of bibliometric method and different objective and subjective criteria. Finally, we conducted a content analysis of these core articles, which constitutes the findings of this study.

3.1 Structured literature search

In this study we collected the data from ISI Web of Science (WoS), which covers academic research from 1987 until today. By applying WoS's "Topic-search", we matched our phrases with the *titles*, *abstracts*, *author keywords* and *keywords plus*. After experimenting with different search phrases and analyzing the respective results, we decided to combine the phrases (Digi* OR techno*) AND "autonomy". Digi* covers concepts like digitalization, digitization, digital etc., while Techno* covers technology, technological, etc. This combination of phrases resulted in 3961 articles. Confined to the categories Management, Business, Law, Surgery, Automation Control System, Computer Science Information System, Computer Science Artificial Intelligence, and Public Administration, we got 815 results considered applicable for this study.

3.2 Bibliometric analysis

"Bibliometrics is a method that includes statistical analysis of published articles and citations therein to measure their impact (Maditati, et al., 2018)." The dataset from Web of Science was exported for further analysis. We utilized VOSviewer to graphically illustrate the dataset. VOSviewer generates a "map" where *clusters* of articles, keyword or authors are differentiated by colors (Figure 2). Each cluster is supposed to have bibliometric similarities, dependent on what method being used. In this study, we applied two methods; Co-Occurrence and Bibliographic Coupling. Co-occurrence is a method that extract keywords that are frequently used, from the articles abstract, title and given keywords. The distance between two keywords indicates how often two keywords are being used together, while the size of each keyword is dependent on how many times the keyword occur (Van Eck and Waltman, 2014). Bibliographic coupling illustrates the relations between articles based on their references (Boyack and Klavans, 2010).

3.3 Selection of Core articles

To further analyze our results, we carefully read the abstracts of the articles with more than ten citations, and also articles with autonomy in the title, to cover newly published articles. This resulted in 60 articles we considered interesting. Further, we graphically illustrated the full dataset of 815 articles in VOSviewer, using the bibliographic coupling method. The 60 articles we found earlier, were identified in the map generated by VOSviewer. We analyzed the clusters and links to each document, to gain insight to their bibliometric network. This analysis resulted in 40 articles, subject for careful investigation we further excluded 25 articles that did not suit the purpose of our study. Finally, we carried out a content analysis of 15 core articles, which will serve as the foundation for our discussion and conceptualization.

4. Findings

In this section we will first present descriptive findings from our database. Then we discuss the results of the content analysis, which identified three different levels of digitalization; hardware, systems and algorithms.

4.1 Descriptive findings

In Figure 1, a bar graph illustrates how the 815 publications are distributed over the last 28 years. By looking at the bar chart, it seems like the topic has been relevant for some time. The increased number of publications

over the last few years might be explained by the rapid technological development during the same period or that the relation between autonomy and digitalization has increased in interest.

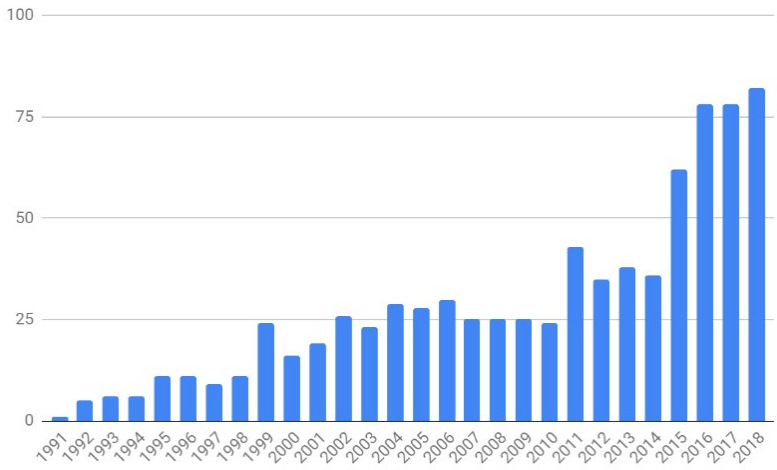


Figure 1: Graph illustration of number of publications per publication years (N=815)

Figure 2 illustrates central clusters and articles utilizing the bibliometric coupling method in VOSviewer. We used this as a tool to select our core articles. The clusters are recognizable by different colors and each cluster includes articles which covers the same themes. The green cluster is dominated by articles that discuss the implementation of new technologies and how the user adopt these technologies. Telecommunication, and its effect on workers, are considered in the purple cluster, while the orange cluster covers multinational relations. The pink cluster treats how organizations and occupations are changing and the turquoise cluster have a team-level perspective. Lastly, the black cluster primarily focus on research and development. Our core articles are identified and selected from four of these cluster; the green, purple, black, and pink.

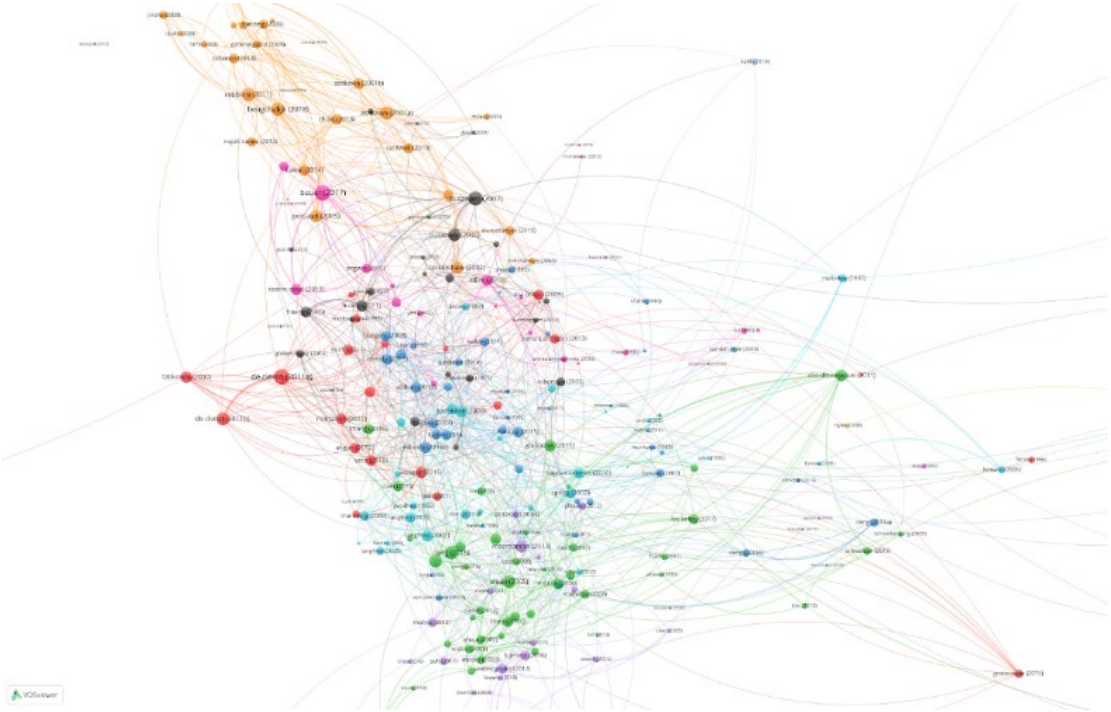


Figure 2: Illustration of central clusters

4.2 Findings from the content analysis

The content analysis of the 15 identified core articles revealed that prior research addressed autonomy in relation to three very different levels of digital technology: Hardware, systems and algorithms. We present our findings according to these three levels.

4.2.1 Hardware

Researchers have shown interest in explaining how autonomy is affected by technologies that disrupts the traditional nine to five workdays. Hardware, like smartphones and other mobile devices, enables employees to communicate and share information regardless of time and space. We have previously presented that digitalization may lead to increased flexibility and independence (Gerten, et al., 2018; Underthun and Steen, 2018). The content analysis points in the direction that a critical view towards these claims should be considered. Digital tools that enable enhanced communication and information sharing could lead to flexibility and transparency (Bouee, 2015), but also increased connectivity and work-related stress, emerging from being available 24/7. This constitutes the "autonomy paradox" (Mazmanian, et al., 2013; Cavazotte, et al., 2014). Additionally, this technology makes centralized decisions easier (Bloom, et al., 2014), and might facilitate monitoring and increase the need for IT-support (Brey, 1999; Gerten, et al., 2018). How the autonomy paradox is perceived, could depend on individual factors (Bader and Kaiser, 2017). E.g. a graduate will have different needs for flexibility, than a mother with three children. Thus, the perceived threat to autonomy will differ. Table 1 summarize how core articles identify effect of hardware on autonomy.

Table 1: Core articles regarding hardware

Author	Type of technology	Profession	Effect on autonomy
P. Brey (1999)	Computer connected to internet (Home office)	Not specified	+ Flexibility - Standardization - Need for IT-support - Surveillance
M. Mazmanian, WJ. Orlikowski, J. Yates (2013)	Blackberry (Mobile email device)	Private equity group, corporate law, venture capital, and investment banking	+ Flexibility - Availability
V. Bader, S. Kaiser (2017)	Blackberry (Mobile email device)	Not specified	+ Flexibility - Availability
F. Cavazotte, AH. Lemos, K. Villadsen (2014)	Smartphones	Law Firm	+ Flexibility - Surveillance

4.2.2 Systems

The next level identified in the content analysis of the 15 core articles was related to IT systems that are integral parts of work practices. Our analysis reveal digital systems, such as ERP or CRM systems, have been widely implemented across businesses and industries. However, digital systems seem to have contradictory effects on knowledge worker autonomy. On the one hand, digital systems could increase autonomy by enhanced information sharing and transparency (Gerten, et al., 2018; Underthun and Steen, 2018). Leaders could also utilize digital systems to empower workers and entrust them with freedom and responsibility (Bouèe, 2018; Bloom, et al., 2014; Tafti, et al., 2007). On the other hand, precise and efficient monitoring and control could override the positive effects (Gerten, et al., 2018; Underthun and Steen, 2018). Tafti, et al. (2007) points out that if the firm aims to empower workers and increase autonomy, the digital systems must support these relations and not the opposite. Further, the content analysis finds that not all workers necessarily are comfortable with responsibility, even with sufficient information (Morris and Venkatesh, 2010). This supports Cognizant´s (2012) claims about the future of work. In this report Cognizant finds that millennials expect frequent feedback and guidance, but still demand autonomy (Morgan, 2015; Cognizant, 2012; Nordenflycht, 2010). This could be an autonomy paradox at another level than what Mazmanian, et. al (2013) presented. We found similar paradoxical relations elsewhere in the literature. Still, monitoring and control seems to be the dominating effects. Project Management Techniques, with the aim to allocate resources to the most profitable research projects, were implemented in a information technology firm (Gleadle, et al,. 2012). This study found that knowledge workers in the R&D department experienced a significant loss in their professional autonomy, resulting in some workers leaving the company, while others engaged in leader positions or found meaning in ongoing projects. Studies

have also covered the implications of standardising medical practise. An example is how standardization of information sharing between departments in a hospital resulted in a shift of autonomy. The medical professional providing information felt limited and less autonomous, while following a "check-list" when sending patient information to another department. The professional receiving the information experienced a boost in autonomy, having received complete information about the patient (Petrakaki and Kornelakis, 2016). Medical professionals expressed significant displeasure after implementing standards regarding operations (Huber and Gärtner, 2018). Especially, the period that was scheduled for the operations, made the professionals feel less autonomous (Huber and Gärtner, 2018). The content analysis reveals how suppliers of digital technology have influence in on the technology use, by designing systems where knowledge workers experience a loss in decision-making power (Schneller and Wilson, 2009) and experienced autonomy. Table 2 summarize how core articles identify effect of systems on autonomy.

Table 2: Core articles regarding systems

Author	Type of technology	Profession	Effect on autonomy
D. Petrakaki, A. Kornelakis (2016)	Care record service system	Radiologist, nurses and doctors	+ Efficiency + Information sharing - Standardization
C. Huber, C. Gärtner (2018)	Hospital information system	Surgeons	+/- Transparency - Standardization
A. Tafti, S. Mithas, M.S. Krishnan (2007)	Information sharing	Not specified	+Information sharing - Surveillance
S. Rivard, L. Lapointe, A. Kappos (2011)	Clinical information system	Nurses and doctors	+ Liberation of time - medical dominance - Standardization
ES. Schneller, NA. Wilson (2009)	Not specified	Surgeon	- Medical dominance - Surveillance
P. Gleadle, D. Hodgson, J. Storey (2012)	Project management technique	R&D	- Decision power - Monitoring
N. Bloom, L. Garicano, R. Sadun, J. Van Reenen (2014)	ERP/Intranet	Factory managers	+ Information sharing + Decision power - Decision power
Z. Walter, MS. Lopez (2008)	Electronic medical record	Medical professional	+ Information sharing
MG. Morris, V. Venkatesh (2010)	ERP-system	Not specified	+/- Decision power

4.2.3 Algorithms

Two of the most prominent technologies the last few years is AI and Big Data (Shrouf, et al., 2014). In the literature, there is no consensus on how work will be affected by the digitalization. While some claim that digital technologies primarily will affect low-skilled workers and that knowledge work is too specialized to automate (Frey and Osborne, 2013; Christensen, et al., 2013; Løwendahl, 2005), others argue that also these workers are subject for automation (McAfee and Brynjolfsson 2014; Ford 2009). The content analysis indicates that both AI and Big Date could affect knowledge workers. Increased availability of medical data made it possible for algorithms to make medical suggestions. Physicians experienced this technology as a threat to their professional autonomy, and a loss in social status. (Walter and Lopez, 2008; Ezmaeilzadeh, et al., 2015). McAfee and Brynjolfsson (2014) highlights that some tasks knowledge workers perform have the potential to be automated.

Dhanrajani (2018) claims that AI could improve decision making, while retaining or increasing autonomy by liberating time and resources. White (2018) emphasize the importance of separating between AI for decision making and AI for decision support. The content analysis suggests that, even while utilizing AI as support, knowledge workers showed resistance, as they experienced a loss in medical dominance, which in turn weakened their social status and autonomy (Adler and Kwon, 2012; Eaton-Wally and Lowe, 2017; Nordenflycht, 2010; Rivard, et al., 2011; Walter and Lopez, 2008). To limit the resistance towards implementations of AI, White (2018) points out that the decisions being made by AI must be understood and interpretable by the knowledge workers. We find support for these claims in the content analysis. Esmaeilzadeh et al. (2015) find that the knowledge worker´s IT-competence and their attitude towards knowledge sharing could reduce their perceived threat to autonomy. We also found that where medical professionals participated in the selection of technology, the resistant towards the technology decreased (Rivard et al., 2011). The findings indicate that the knowledge worker's perceived autonomy, regarding algorithms, may be influenced by several factors. Among these are social status, decision power, IT-competence, and the attitude towards knowledge sharing central. Table 3 summarize how core articles identify effect of algorithms on autonomy.

Table 3: Core articles regarding algorithms

Author	Type of technology	Profession	Effect on autonomy
Z. Walter, MS. Lopez (2008)	Clinical decision support system	Medical professional	- Decision power - Social status
P. Esmaeilzadeh, M. Sambasivan, N. Kumar, H. Nezakati (2015)	Clinical decision support system	Medical professional	-Decision power - Social status
PS. Adler, SW. Kwon (2012)	Clinical guidelines	Medical professional	+/- Decision power - Standardization

5. Discussion of results

In this study, we have identified three levels of digitalization, which affect knowledge worker autonomy differently. The aim of this section is to contribute with a framework (figure 3), including unique considerations, within the levels of digitalization. Leaders can utilize this framework to reduce knowledge workers resistance to digital change and gain insight to "The autonomy paradox".

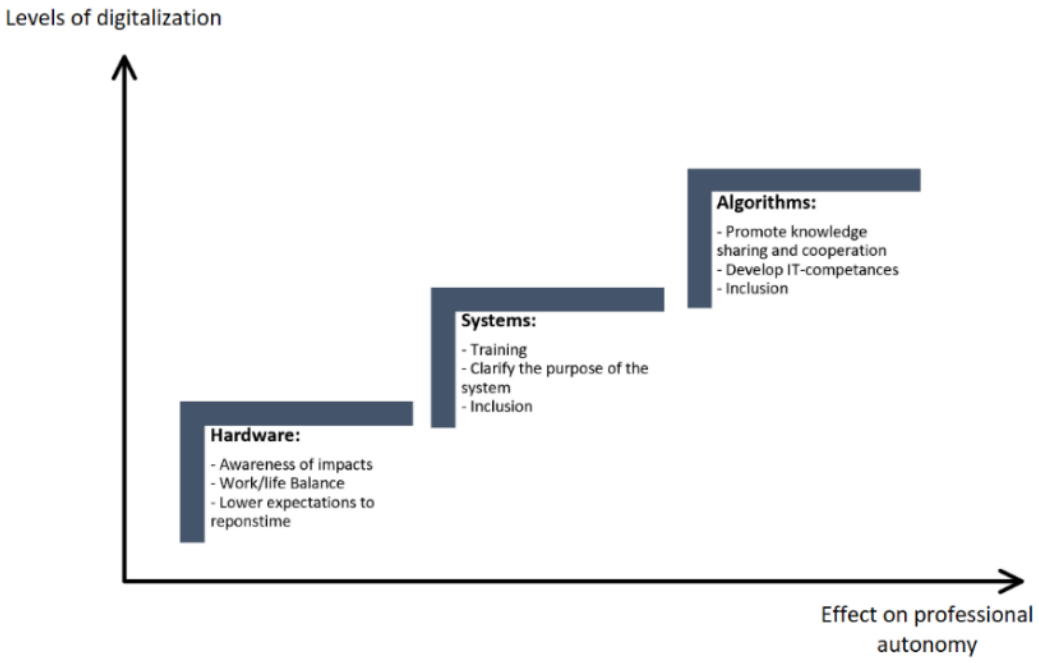


Figure 3: The effect of different digitalization level on professional autonomy

5.1 Hardware

On the first level, the effects on autonomy is quite predictable. Table 1 clarifies that the same effects on autonomy occur throughout the literature. We have also emphasized that perceived autonomy can differ between employees. Further, we notice that both leaders and employees are well aware of the negative effects digital communication tools may have on professional autonomy. The content analysis displayed few instances where knowledge workers resisted the use of mobile devices, even though the employees reports increased workload and stress. It is desirable to retain the positive effects displayed in Table 1, while reducing the negative. A factor responsible for increased workload and stress, is the expected availability. Thus, when implementing digital communication technologies, we recommend change agents to inform the employees about the downside related to unhealthy use, and create a culture where employees are given respite outside working hours.

5.2 Systems

The second level include several factors that affect the perceived threat to professional autonomy. Systems are, generally, being implemented with the aim to improve the efficiency and transparency. Even though control and monitoring are factors that reduced the worker autonomy, our findings suggest that increased transparency and empowerment of employees, often will increase the autonomy. As displayed in Table 2, standardization is considered to have a negative impact on professional autonomy. We discovered instances where knowledge workers expressed resistance to the newly implemented systems, due to a reduction in professional autonomy.

Factors that affect the knowledge workers perceived threat to autonomy, should be emphasized by change agents facing implementation of digital systems. By including the employees in the implementation process, clarify the purpose of the system, and provide a thorough training, the expected perceived threat to autonomy may be reduced.

5.3 Algorithms

The third level includes technologies that constitutes the biggest threat to knowledge worker autonomy. In the content analysis, implementations of algorithms aim to improve or simplify decision-making. Consequently, also non-professionals are able to make advance decisions, previously made by professionals, which reduces the need for expertise and weakens knowledge worker's decision power. Table 3 illustrates that loss of decision power has the biggest impact on knowledge worker autonomy, within this level. The content analysis indicates that knowledge workers experience a loss in social status when they, to a lesser extent, are able to exercise expertise and hold esoteric knowledge. We consider this to be a central reason why management meet resistance, when implementing technologies within this level. Change agents are encouraged to create an organization culture where knowledge sharing, collaboration, and helpfulness is promoted, with the purpose of curbing professionals' need for esoteric knowledge. We have previously discussed that employees must be able to understand and interpret decisions being made by algorithms. Change agents can influence this by including the employees in the implementation and make sure they possess the skills necessary to understand the technology.

6. Conclusion

The aim of this study was to investigate how digitalization affected knowledge worker autonomy through a rigours analysis of extant punished research. The understanding of how the knowledge worker's professional autonomy are affected by digitalization has been diffuse and paradoxical. Our findings confirms that digitalization affect knowledge worker autonomy in different ways, and extends current understanding by identifying three levels of digitalization, which have different impact on autonomy. Further, we have found that each level of digitalization could affect Weisman's (2014) five criteria differently. If leaders aim to utilize digital tools to fulfil these criteria, we argue that the considerations presented in our framework must be taken into account. The content analysis indicates that autonomy is hard to measure, thus interpersonal relations between leaders and employees are crucial to reduce the resistance to change and successfully implement new technologies. Based on our study, we can also suggest make some directions for further research. The content analysis included limited empirical studies covering the use of algorithms and only one industry were represented. The use of algorithms on the workplace are new, which might justify the lack of empirical studies.

Thus, we consider it interesting to make further studies about the effects algorithms have on knowledge intensive work. Our study also have limitations. To achieve a greater insight and foundation for our study, we could have included more databases and read more articles. Further, several of our sample criteria were

subjective, like the evaluation of articles based on abstract and title, meaning we could have excluded relevant articles. We filtered our database by choosing categories subjectively and only read the titles of the articles with ten or more citations. By using other sample methods, we could have taken into account more recently published articles and a broader scope of categories.

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Patterns for Personal Business Model Canvas Applications – BE(A)ST, an Approach for Aware Career Development

Jacek Jakieła[1], Joanna Świętoniowska[2] and Joanna Wójcik[2]
[1]Rzeszow University of Technology, Rzeszow, Poland
[2]University of Information Technology and Management in Rzeszow, Rzeszow, Poland
jjakiela@prz.edu.pl
jswietoniowska@wsiz.edu.pl
jwojcik@wsiz.edu.pl

Abstract: The model in which after formal education a person obtains a stable occupation has been replaced by the career model of building many, often different individual development paths throughout the course of one's life. It poses a huge challenge for higher education institutions. Universities must move from the current mode of 'mass production' of students to the approach that treats students individually according to their interests, values, passion and character traits. Furthermore, universities should focus not only on developing hard skills, but also universal competences that can positively affect their ability to adapt to the changing demands of the labour market. The education process usually involves many stakeholders: students themselves, academics, career office staff, parents, employers, or friends. Each of these groups has different levels of understanding of what a career is, what career planning is about, and what professional success means. Ideally, the university provides support for the personalization of educational pathways and career planning at various points of contact - classes, career offices, career related events. Students should also be motivated to actively develop their career identity and its connection to what makes them tick. Universities should offer career planning tools for various stakeholder groups tailored to their needs. Our approach called BE Aware STudent (BE(A)ST) is a comprehensive framework that enables universities to prepare students to be more agile in educational track individualization and increase students' adaptability in the process of conscious career development. The key technique adopted for the BEAST approach is the Personal Business Model Canvas (PBMC). This paper presents the patterns of PBMC applications in the form of possible scenarios that may be used by students, educational staff members, and career office workers. Students can use the PBMC for educational track individualization and early career planning. Educational Staff Members can use the technique to present the market potential of the subject they teach and to prepare a reference model for possible job positions related to the subject matter of the classes. Career office workers may use PBMC for counselling students and collecting information on occupation requirements from employers.

Keywords: Personal Business Model Canvas, BEAST Approach, Agile Career Design and Development, Career Awareness, Individualization of educational path

1. Introduction

The set of competencies sought in the labour market today is shaped by many factors, including characteristics of new generations, requirements regarding career development and learning, ongoing digital transformation of organizations, and globalization. The labour market has become extremely volatile. According to forecasts, by 2025 about 85 million jobs will be automated (Word Economic Forum, 2020), mostly in the case of performing repetitive manual activities. The reduction in employment, however, takes place not only in the area of physical labour, but also with regard to routine, white-collar jobs such as banking and clerical work. The same report also predicts the creation of 97 million new jobs in the same period, implying that more jobs will be created than eliminated. According to the Deloitte analysis (2021), the key drivers of the current job market are the democratization of technology and new opportunities for employees to use it, the data-driven culture of companies that influences decision-making processes, as well as the dynamic development of artificial intelligence algorithms and tools. PwC's research with over 2,000 participants from nine major industries and 26 countries has shown that it is still a problem to fill the gap in the labour market, i.e., finding the right talent for specific occupations. However, a bigger challenge than the ever-changing technology is a human factor (Geissbauer et al., 2016): In the IT sector, one of the most profitable in the EU economy, there is an estimated shortage of more than 0.5 million workers (Sedlar et al., 2018). The labour market is also significantly affected by demographic changes and globalization. Telecommuting has become one of the standard possible choices for young people, and the full-time model of employment has been replaced by part-time, temporary, and on-call employment models (Kergroach, 2017). All of these factors contribute to the wide variety of skills required and the need to adapt quickly to volatile conditions.

These insights have led us to the idea of a comprehensive approach to career development, named BE Aware STudent (BE(A)ST), that universities can adopt and that universities can implement. The BE(A)ST approach is

being developed by the authors of this paper in cooperation with scientists from partner universities in the framework of three projects. BEAST, DYLMIC, and OMNI-BEAST[1]. The projects are being implemented by the University of Information Technology and Management in Rzeszów, Alma Mater Studiorum - Universita Di Bologna, Instituto Politécnico De Portalegre and Université de Nice – Sophia Antipolis. The outcomes of BEAST family projects include process, driving stakeholders' activities, and the toolbox. The tool that we consider the most important in [this] career iterative development is Personal Business Model Canvas (PBMC) (Clark et al., 2012). This paper describes possible applications of this tool in the form of templates that can be used for career development activities carried out by students and supported by university staff members, academic teachers and Career Offices workers. The templates show how to use PBMC in different contexts, depending on the role of the stakeholder. However, in every case, the main aim of the application is to empower students' choices for their own aware and agile career development.

2. BE(A)ST Methodology as a Multi-sided Approach to Career Design and Development

Properly managed career development is a huge challenge not only for students but also for academic teachers and career offices staff. This has motivated us to start the development of the BEAST approach. Its main objective is to provide all stakeholders involved in the process of shaping the professional identity with a framework and set of tools that can be used to design educational and career paths with a focus on professional and personal fulfilment. The BEAST approach is a multisided, original methodology that integrates the following currently available frameworks:

- *Business Model Generation & Business Model You.* In the BEAST approach we have included a Personal Business Model Canvas (Clark et al., 2012) (inspired by a Business Model Canvas (Osterwalder, Pigneur, 2010) that promotes a "prototype, test, and revise" approach to career development. As will be shown in the paper, PBMC may be used by all stakeholders according to application patterns depending on the context and their specific needs.
- *Designing Your Life.* In the BEAST approach, personal resources of students are the most important drivers for defining professional identity in terms of values, interests, and passion. The application of the *Designing Your Life* framework and tools (Burnett, Evans, 2016) allows young people to self-reflect and find the connection between personal resources and possible career paths. Such a connection may result in the selection that will provides students with personal and professional fulfilment.
- *Design Thinking*. As career development is nowadays considered as a "wicked problem", i.e., one that cannot be solved using standard problem-solving techniques, integrating Design Thinking framework into the processes of the BE(A)ST approach usage enables individuals to be fully assisted when building the careers they desire and designing their professional way forward (Jakieła, Świętoniowska, Wójcik, 2021). With Design Thinking the career development process may be carried out in a flexible and nonlinear, iterative fashion.

The main assumption we take as our point of departure is that every job position in an organization has as its foundation the need for a human resource. When doing the job, this human being creates value for the business' customers. An employee working in a specific occupation can be considered as a human resource that has her own personal business model. In our BE(A)ST approach, the key technique supporting the "prototype-test-revise" approach to agile career development is the Personal Business Model Canvas. We adopted this particular tool due to its high level of flexibility, which has given us many options for different applications. PBMC is a one-page professional development tool, the structure and content for which is presented in Figure 1.

[1]The BEAST project has been financed in the frame of the ERASMUS+ programme (No. 2018–1PL01-KA203–051137) and led by the University of Information Technology and Management in Rzeszow (UITM) in a partnership involving universities from Poland, Italy, and Portugal (2018–2021). The DYMLIC project has been financed as part of the Strategic Partnerships Programme (No. PPI/APM/2019/1/00090) and led by UITM in a partnership involving universities from Poland, Italy, France and Portugal (2019–present). The OMNI-BEAST project has been financed within the framework of the ERASMUS+ programme (No. 2020-1-PL01-KA203-082198) and led by UITM in a partnership involving universities from Poland, Italy, Greece, Spain and Portugal (2020–present).

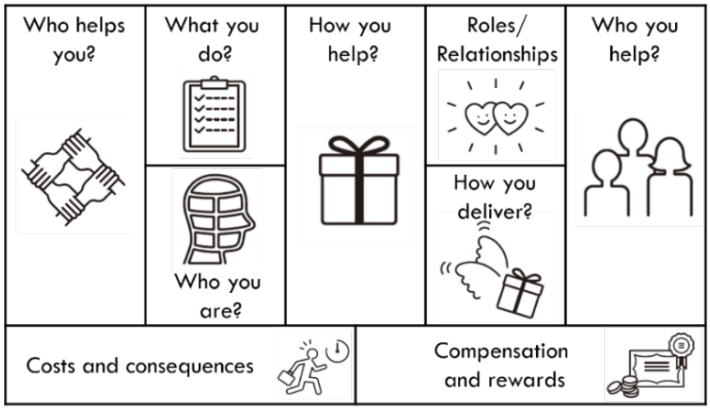


Figure 1: Personal Business Model Canvas

Detailed descriptions of all PBMC segments can be found in the book *Business Model You: A One-Page Method for Reinventing Your Career* (Clark et al., 2012). This paper discusses only patterns of applications for Personal Business Model Canvas. However, it is worth remembering that the BEAST toolbox includes more than 20 techniques that can be used by all stakeholders in the development of the student's career and the individualization of educational pathways (Vignoli at al., 2022).

As the BE(A)ST is a multifaceted approach to career development, it includes templates for possible applications of various tools that can support activities carried out by different stakeholders at the universities involved in career development processes: students, university teachers, and career offices workers.

3. Personal Business Model Canvas Application Patterns for Students

The main aim of students' development is to make them more self-reflective seekers of career opportunities who can plan and re-plan their learning path as well as adapt to a volatile labour market. All the templates for students have been designed for this purpose.

3.1 Scenario #1 Better planning of one's educational track at the university

Aim of the scenario: Selecting the most valuable elements – from the perspective of professional identity – of the educational offer: the major and/or subjects of greatest importance for the future occupation.

Application: The application of the scenario requires an analysis of the Occupation Canvas(es) related to the student's professional identity. A detailed description of all elements in the canvas will provide a view on the typical activities that a given position entails. The student may use the university's Catalog of Career Canvases related to job positions, important from the perspective of graduates' profiles for key majors. In an alternative approach, the student can prototype a PBMC for a chosen occupation, taking into account the results of the conducted analysis of the labour market requirements (job offers, articles, labour market reports, interviews with people employed in the position, etc.). Students should be provided with a course guide that describes the aims as well as learning outcomes of the subjects/courses on offer. Students who have selected their study program and career canvas for particular job position, can then identify the subjects of greatest importance for their future job position and professional development, namely, those that best align with the learning outcomes achieved with the job requirements described in the PBMC.

Key elements of the PBMC to analyse: What you do, How you help, How you deliver, Roles/Responsibilities.

Results: The student develops *a Plan for his/her educational path at the university* including the elements of the university's educational offer as well as additional opportunities in the field of informal education.

3.2 Scenario #2 Identification of personal resources and finding the best fit between them and market requirements

Aim of the scenario: Planning the personal resources development: to identify the student's current needs in terms of development of skills, knowledge, and interests with respect to the desired occupation.

Application: The scenario application requires an analysis of the PBMC describing the student's personal business model as well as the PBMC developed for the job position that is related to the student's professional identity. A comparison between the PBMC for a specific job position and the student's own personal business model (especially the WHO You Are part) will allow the student to assess if she/he is well prepared for the specific market requirements related to the occupation she/he is interested in, as well as identify skills and knowledge areas that he/she should develop (gaps to be reduced). She/he can then create an AS-IS version of the PBMC and then develop SHOULD-BE variants depicting the desired development plan. Then she/he can list the gaps referring to skills and knowledge that should be developed. With regards to this list, the student should analyse the additional educational offerings of the university that can support his/her knowledge and skills improvement outside the classroom (such as additional trainings organized at the university, scientific circles, student organizations, conferences etc.). Student may also consider a variety of other learning situations that are not related to "formal learning" at the university, but aimed to develop the skills or build the relationships (networks) in a professional environment – self-development activities. These can include searching for additional on-line courses, webinars, podcasts, books, events. As a result of the application the student should select the most valuable ones from the perspective of Professional Identity in the area of informal educational support.

Key elements of the PBMC to analyse: Who You Are.
Results: The student prepares *a Development Plan* including elements of the university's additional educational offerings as well as new opportunities in the field of informal education. The valuable outcome of preparing *the Development Plan* is the student's self-reflection to determine whether he/she is well-prepared to meet the specific market requirements of the selected occupations.

3.3 Scenario #3 Better understanding of the future job environment

Aim of the scenario: Understanding the ecosystem of favourite occupations.

Application: The application of this scenario requires an analysis of the PBMC that yields a description of how the specific occupation is related to the student's professional identity. The occupation canvas analysis can help the student to understand the ecosystem of a specific job position. With a PBMC for a specific occupation, the student can investigate the kinds of activities she/he would be doing and the characteristics of the specific business model environment: the partners the student will cooperate with, the roles she/he will play in carrying out his professional activities. She/he can determine if the work environment will offer her/him certain expected opportunities e.g., to work with a variety of people, in national or international teams. Self-reflection on the activities the student likes as well as his/her strengths and weaknesses and comparing them with the characteristics of the job position described in the occupation canvas will allow the student to answer the question whether this is a job that may bring him/her fulfilment and satisfaction in the future – not to mention whether s/he can meet occupation requirements. However, learning about the environment related to the selected profession can also take place during the process of preparing the PBMC of the dream job by the student himself. The canvanizing process will require the student to analyse the labour market requirements described in job offers posted by employers, branch reports, feedback from the professionals working on this particular position, etc.

Key elements of the PBMC to analyse: Who you help, Who helps you, How you help, Roles/Relationships, How you deliver.

Results: Better understanding of the ecosystem of a specific job position; insight into whether the job position selected is a job that the student can find fulfilling in the future and whether he or she will be able to meet the occupation requirements.

4. Personal Business Model Canvas Application Patterns for Educational Staff Members

Educational staff members at the universities can and should play a much more important role in the process of developing students than they are playing now. It entails not only shaping students' hard skills connected with their major, but also helping them develop their professional identity and integrating it with their interests and passion. One very important aspect is also how well the competences that are being developed during classes match with real market requirements. Therefore, there is a need for university teachers to undergo a transformation from passive knowledge providers to active mentors and coaches. Recommended scenarios are presented below.

4.1 Scenario #1. Finding the best fit between content of the classes and real market requirements.

Aim of the scenario: Defining learning outcomes highly correlated with graduate profile job market requirements.

Application: In the first step, the teacher should analyse the connections between the subject under consideration and possible occupations related with the graduate profile of the students' major. Each identified occupation will have specific job market requirements concerning skills, knowledge areas and universal competences. Based on information collected, occupations requirements may be mapped with PBMC. The mapping may start with naming *Key Activities* (What you do) associated with the specific occupation and then key *Personal Resources* (Who you are) required for these activities to be carried out in the most effective manner. Other important segments are *Roles/Relationships* and *How you deliver,* which can provide additional information on competences and possible interaction patterns as well as tools needed for getting the jobs done on the specific occupation in the company ecosystem. An analysis of *Customer segments (Whom you help)* will give teachers a better understanding of value provided by future employee and help to start thinking in terms of professional *value proposition* that could be developed during specific classes. The content of *Who helps you* segment is a source of valuable hints as to who usually supports the employees' activities in the areas that are beyond the core of the occupation's key resources or may support resources development. The mapping process should be done for all occupations related to the specific major's graduate profile. The resulting *Occupation Canvases* will serve as a reference model for setting the class's scope and careful planning its content. Such a holistic approach will enable teachers to focus on the topics that are most important from the perspective of current and future labour market requirements.

Key elements of the PBMC to analyse: What you do, Who you are, Roles/Relationships, How you deliver, Whom you help, Who helps you

Results: Class's content with learning outcomes adjusted to job market requirements.

4.2 Scenario #2. Better understanding of students needs related to personal resources connected to subject under consideration.

Aim of the scenario: Provide teachers with the opportunity to dynamically adjust the class's content to specific group/individual needs

Application: Occupation canvases developed for possible future job positions can be presented to students at first meetings (lecture, labs, project); this will give students the vision of the class's content and help them to understand its importance with regard to real market requirements and their professional identities. This approach is the source of several benefits for students and teachers. With the reference model describing personal resources in terms of skills and knowledge needed for occupation, students can inform their teachers vis-à-vis gaps they currently have. Any given subject usually has the content structure fixed before classes start. However, balancing the effort students put into different activities may be accomplished dynamically during the classes based on students' feedback. It is possible to dynamically personalize the scope of the topics, the number of assignments and their difficulty level according to the group's (or even individuals') specific needs connected with their professional identities. This will also improve the quality of the mentoring/coaching process conducting by teacher. Every group of students – or even individual students – will be treated according to their specific educational needs and will thus benefit from the classes as much as possible with regard to personal resources developed.

Key elements of the PBMC to present/analyse: What you do, Who you are, Roles/Relationships, How you deliver, Whom you help, Who helps you

Results: Class's content closely related to labour market requirements and adjusted to specific group/individual needs.

4.3 Scenario #3. Support to reduce routine teaching behaviors

Aim of the scenario: Determine the importance or priority of topics presented during classes and use this information for setting the class's scope and teachers' self-reflection and self-development

Application: It is quite common for university teachers to be biased with regard to subjects they are responsible for. They are often eager to incorporate content related to their existing knowledge into their lesson plans. This is understandable, but should not negatively impact the content being taught to students. This scenario represents a tool that may help reduce routine teaching behaviours. During the process of preparing/analysing occupation canvases, teachers have the opportunity to get a holistic view on personal resources that students should develop to be competitive on the job market. Deep understanding of what really matters with regard to required competencies may be very helpful when preparing the scope of classes and their content. When setting the scope, the most important characteristic of the topics taken into consideration is the topic's priority. Planning process driving by occupation canvases may simplify the process of selecting the most important content for the fixed timeframe set for the subject. After careful analysis of the occupation canvases it is easier to decide which topics fall into the following categories: must-be-learned, should-be-learned, could-be-learned, or will-not-be-learned – during specific classes. It also helps to reduce routine teaching, because the content adjustment is not based on the subjective view of the teacher and her attachment to her own expertise; the main lens is rather the importance of competencies students should develop well with regard to occupations related real market requirements. This pattern application and implementation are also very demanding, because teachers have to develop themselves constantly to keep up with job market trends. However, being up-to-date with regard to personal resources will determine the extent of their bargaining power on the educational market. Such occupation canvases for developing the teacher's awareness of her own personal resources (as well as ones she should still develop) can thus also be considered professional development tools.

Key elements of the PBMC to present/analyse: What you do, Who you are, Roles/Relationships, How you deliver, Whom you help, Who helps you

Results: Better understanding of course topics' relevance to the job market; insight into possible self-development points for teachers

5. Personal Business Model Canvas Application Patterns for Career Offices Workers

Employees of Career Offices and vocational consultants are professionally trained to provide counselling services to students in the area of career development. The BEAST approach offers them a framework for supporting students in developing relevant competencies in order to meet the requirements of the labour market and identifying career directions that match their professional identity.

5.1 Scenario #1 Cooperation with entrepreneurs in preparation of internship/employment offers

Aim of the scenario: Preparing a precise offer of internships and placements. Employers looking for students for internships and, in the long run, for employment, struggle with the problem of defining the precise characteristics of the future employee. The recruitment and selection process is very time-consuming and expensive, yet it does not guarantee the selection of the right person. When formulating advertisements, employers often use standard phrases that are not consistent with the real needs. This situation causes frustration for both employers, who often believe that the trainee did not meet expectations, and the employees of Career Offices, who are seen as ineffective brokers.

Application: Career Office staff conducts workshops for employers that last several hours and are designed to familiarize managers and recruiters with the PBMC tool for selected jobs. The workshop includes exercises to test the understanding of the various elements of the PBMC. Understanding the BMC and PBMC techniques and their application in job/position descriptions will help link key activities performed in companies to the skills/knowledge requirements of employees in specific knowledge areas. A validated Career Catalogue is presented to demonstrate the expected quality. In the next step, the representatives of the company create a canvas for the internship and apprenticeship, which they then discussed, correcting any potential errors. These one-page canvases are then described in detail by a member of the Careers Office staff so that they can be compared with the students' PBMC. Direct contact between Career Office employees and companies will also allow the Career Offices to fulfil another basic responsibility of monitoring the local labour market.

Key elements of the PBMC to analyse: What you do – core activities, Who you are and what you have – resources, How you help – value proposition

Results: A catalogue of PBMCs of sought-after professionals prepared by companies, used by Career Offices to find the most suitable future employees among students.

5.2 Scenario #2 Identify student training needs

Aim of the scenario: Develop attractive training in universal skills for students using Career Office services.

Application: The scope of responsibilities of Career Offices has evolved over time from providing students and graduates with information about the labour market and publishing job and internship offers to diagnosing how students' interests match with career opportunities. As part of this scenario, the Career Office staff prepare training materials in the form of attractive e-learning courses/videos presenting the PBMC technique. These materials are made available to students prior to individual sessions with a Career Office staff member. Students prepare a draft version of the PBMC. During the meeting, the Career Office staff member discusses the preliminary version of the PBMC and the results from the completed questionnaires (standard Career Office tools). It is the student's responsibility to revise the PBMC after the session and submit it to the Career Office. This will create a PBMC database of students from different majors and specialties. On this basis, Career Office staff define the weaknesses of students' universal competencies needed in the labour market (based on workshops with employers and PBMCs prepared for selected positions) and prepare a training offer in consultation with professionals (both from the university and external companies).

Key elements of the PBMC to analyse: How you interact – customer relations, How you interact – customer relations

Results: A list of new universal competency trainings entering the Career Office offerings along with a potential list of participants.

5.3 Scenario #3 Selecting the right student for the position offered

Aim of the scenario: Comparison of students' PBMC with job postings stored in the form of PBMCs

Application: Career Offices should target offers to the right students, however, profiling often proves ineffective or is simply unsuccessful. It is done on the basis of standardized questionnaires and assumptions about students in a particular field of study, and as a result, some offers do not reach the right students. Such an approach eliminates the individual and subjective treatment of persons seeking internships, and thus results in a moderately positive perception of Career Offices. The Career Services employee uses the database of students' PBMCs and the complemented and developed Catalogue of Career Canvases to selects potential candidates for a job position. In the case of a small number of offers and student profiles in the form of PBMC, the selection can be done semi-automatically. Bigger institutions, however, should invest in software dedicated to performing this selection stage automatically. Once the cohort of suitable candidates has been selected, the Careers Office employee contacts them and supports them individually in the process of soliciting the employment.

Key elements of the PBMC to analyse: What you do, Who you are and what you have – resources

Results: A table containing the job offer number with the names of eligible students assigned to it. This table should be kept up-to-date and contain only active offers and active students.

6. Conclusions

This paper discusses innovative scenarios of PBMC applications in the context of different roles in the process of personalizing students' educational path and career development, already at the stage of higher education. Skilful use of PBMC can support the activities of not only students, but also teaching staff and career office workers. The use of patterns or templates in the didactic process allows for a better correlation between students' skills developed during classes and the current requirements of the labour market. As a result, students are better prepared for professional work in positions related to the chosen field of study. PBMC also supports the transformation of teaching staff from passive knowledge providers to mentors and coaches who are the source of professional hints and questions stimulating students' self-reflection. Teachers can also use PBMC for continuous professional development towards delivering classes that increase students' employability and professional identity awareness. This can significantly reduce routine teaching practices. Moreover, students who use PBMC for iterative personal business model prototyping can better understand the areas they should take into account in the educational process and properly balance the focus and effort. PBMC used according to the prototype-test-revise method supports agile career development and fast adaptation to changing occupation environments. The BEAST approach is still under development, and the PBMC technique is thus continuously being tested during workshops with students organized in the form of summer schools. Workshops

for teachers are in the pipeline, the main goal of which will be to discuss possible testing strategies for the application patterns intended for teaching staff.

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Stimulating Eco-innovation Development in Small and Medium-sized Enterprises: Ecolabnet Eco-innovation Network

Waldemar Jędrzejczyk
Czestochowa University of Technology, Czestochowa, Poland
waldemar.jedrzejczyk@pcz.pl

Abstract: The issues of the article concern the development of eco-innovations, which determine the level of eco-innovativeness not only of individual enterprises but also of regions and countries. Given the low level of eco-innovativeness in many economies of the world, it is necessary to take action targeted at increasing the objective level. Such a result can be obtained by saturating all business processes with eco-innovative solutions. An example of an initiative aimed at stimulating eco-innovative behavior is the Ecolabnet project, implemented by an international network of partners (Network of Service Providers for Eco-innovations in Manufacturing SMEs - Ecolabnet) representing research and development units from six Baltic Sea countries. The network has been established as a part of the ongoing Baltic Sea Region Interreg Programme 2014-2020. In order to support enterprises—SMEs in particular—in the development of eco-innovation, it is first necessary to diagnose their needs and expectations in this respect. These needs have been identified using surveys carried out among SMEs based in the Baltic Sea countries. In response to the identified needs, eight packages of eco-innovation services dedicated to SMEs have been developed: Business strategy, Eco-innovation management, Bio-based materials, Product design and development, 3D printing, Environmental assessment, Marketing, and Other eco-innovation expertise. For targeting the offered services more precisely, companies were categorized in terms of their eco-innovative attitudes. Six types of eco-identity were distinguished: Eco-Opportunist, Eco-Booster, Eco-Developer, Eco-Optimizer, Eco-Cautious, and Eco-Laggard. A digital collaboration tool (DCT) has been developed to enable unrestricted access to network resources, such as services and products. DCT stimulates the creation of a service providers network to support eco-innovative activities in small and medium-sized enterprises. The main objective of the article is to present the potential of the international network of Ecolabnet partners to stimulate the development of eco-innovation in enterprises.

Keywords: Knowledge, eco-innovation, eco-innovation network, Ecolabnet, SME

1. Introduction

Today's economy is facing another major crisis triggered by the COVID-19 pandemic and exacerbated by Russia's military aggression against Ukraine. The pandemic resulted in global social and economic disruption, including the most severe global recession since the Great Depression. Following Russia's invasion of Ukraine in February 2022, many countries imposed numerous sanctions on the Russian Federation. In addition, many Western companies suspended, reduced, or withdrew from their operations in Russia. This has led to losses and financial crisis in Russia, but not only. The sanctions have also deepened the economic crisis practically all over the world. Price increases are accelerating. In many countries, inflation is reaching record levels. More and more often, one can hear about possible stagflation in the public space. If this phenomenon occurs, the crisis will intensify even more on account of a deepening economic slowdown – there will be a reduction in investment and an economic downturn.

The economic crisis caused by the pandemic and the war in Eastern Europe, which is slowing down economic development, is not the only problem for the economy. Another problem is the growing consumption, which leads to overexploitation of natural resources and excessive environmental pollution. Increasing urbanisation and existing production and consumption patterns are causing nature to degrade faster than ever before (Earth Overshoot, 2022). Humanity has already realised the severity of this problem. Various entities - economic unions, national governments, consortia, scientific research entities, corporations - have made numerous efforts to bring about, in the first instance, a slowing of the trend and then a reversal. This has resulted in the development of multiple concepts in economic theory and management science. The key ones include corporate social responsibility, sustainable development, and circular economy. However, the undertaken actions are not sufficient. The trend is still growing. This is, among others, because a significant part of the society still pursues the excessive and unjustified acquisition of material goods and services and ignores social and environmental costs. This attitude characterises not only individual consumers - individual consumer habits and choices, but also state governments - adopted policies, such as industrial, fiscal, energy or social, among others. All countries (national economies) strive for the greatest possible economic development. The primary factors of economic development are considered to be: human capital, land and raw materials, both renewable and non-renewable, technical progress, investment and entrepreneurship. However, innovation is of the most significant

importance. R.M. Solow (1957) showed, based on data on the American economy, that innovation is most responsible for the development of the economy.

As in the case of economic development, also concerning the problem of overexploitation of natural resources and excessive environmental pollution, very great importance is attributed to innovations, especially those referred to as eco-innovations. Eco-innovations are innovations that improve the efficiency of the use of natural resources in the economy, reduce the negative impact of human activity on the environment and strengthen the resistance of the economy to environmental pressures. They contribute directly or indirectly to improving the environment (Rennings, 2000; Daddi et al, 2012; Tamayo-Orbegozo et al., 2017; Pecorari and Camello Lima, 2020). They can be implemented in all business processes (OECD, 2019). In business practice, process and product eco-innovations predominate. The notion of eco-innovation is often identified with environmental innovation and green innovation, but they are not entirely identical (Karakaya et al, 2014).

The concept of eco-innovation emerged in the 1990s, sixty years after the concept of innovation was introduced into economics. It is a relatively young concept that is only beginning to develop. Therefore, the level of eco-innovativeness in virtually all economies of the world is low or very low, much lower than the level of innovativeness (Sobczak and Głuszczuk, 2022). Actions and initiatives are thus needed to increase this level by saturating all business processes with eco-innovative solutions. An example of an initiative aimed at stimulating eco-innovative behavior is the Network of Service Providers for Eco-innovations in Manufacturing SMEs (Ecolabnet) project, implemented by an international network of partners representing research and development units from six Baltic Sea countries. The network has been established as a part of the Baltic Sea Region Interreg Programme 2014-2020.

The main objective of the article is to present the potential of the international network of Ecolabnet partners to stimulate the development of eco-innovation in enterprises. The main focus is placed on the construction and functionality of the digital cooperation tool, referred to as the DCT system, which is a knowledge base of eco-innovative products and services offered in the network.

2. Ecolabnet Eco-innovation Network – synthetic overview

Ecolabnet (2019) is a transnational cooperation network between: Research and Development Institutes (RDI), Intermediary Organization (IO) and enterprises from the SME sector (Small and Medium Enterprises), in the area of the development of eco-products for small and medium-sized enterprises in the Baltic Sea region. Its origin resulted from the lack of solid links between small and medium-sized enterprises and R&D centres, resulting in a low level of adsorption of eco-innovations among small and medium-sized enterprises from the BSR. The aim of the network is to increase access to specialist knowledge, new eco-innovative products and services and to support their implementation by small and medium-sized enterprises. Ecolabnet increases the potential for commercialization of various eco-innovations from scientific and research institutions. It offers services and carries out research in the design and implementation of eco-innovation solutions in the following areas: Business strategy, Eco-innovation management, Bio-based materials, Product design and development, 3D printing, Environmental assessment, Marketing, and Other eco-innovation expertise. The underlined areas form packages of eco-innovative services.

The Ecolabnet eco-innovation network was developed as part of the following project: Network of Service Providers for Eco-innovations in Manufacturing SMEs (Ecolabnet)[i]. The total budget of the project was EUR 2.25 million. The project was implemented in the period from January 2019 to December 2021. The project leader was Design Center MUOVA from Finland, and the core consortia consisted of 11 partners from six Baltic countries: Centria University of Technology (Finland), Czestochowa University of Technology (Poland), Estrotech Ltd (Estonia), Kaunas University of Technology (Lithuania), Labsamera MB (Lithuania), Lithuanian Business Confederation (Lithuania), Sustainable Innovation (Sweden), University of Tartu (Estonia), VIA University College (Denmark), Vilnius University (Lithuania). On the part of the Polish partner – Czestochowa University of Technology, the interdisciplinary team implementing the project consisted of research and teaching staff from the Faculty of Management and the Faculty of Infrastructure and Environment. The author of this article was the main contractor in the project team from the Czestochowa University of Technology.

The primary objective of the Interreg Baltic Sea Region Programme is to foster integrated territorial development and cooperation to make the Baltic Sea Region (BSR) more innovative, greener and more resilient

to environmental pressures and more accessible and sustainable. The European Union finances the programme. It involves the transnational cooperation of partners from eleven countries around the Baltic Sea, who work together on various projects. Only international partner consortia can implement projects. The 2021-2027 programme distinguishes four priorities: 1: Innovative societies, 2: Water-smart societies, 3: Climate-neutral societies, 4: Cooperation governance (Interreg, 2021).

3. Ecolabnet Eco-innovation Network – fundamental stages of the knowledge management process in a project

The main objective of the project was to create a cooperation network for the provision of consulting services in the area of eco-product development and eco-services for small and medium-sized enterprises in the Baltic Sea region. Three main groups of actors can be distinguished in the established network: Research and Development Institute, Intermediary Organisation and Small and Medium Enterprises. Each type of entity is assigned a different role in the network. Research and Development Institutions are experts in eco-innovative solutions, offer eco-innovative services and products, and play an advisory role, both at the stage of designing and implementing eco-innovative solutions. Enterprises from the SME sector are the primary beneficiaries of the network. The network is primarily intended to meet the needs of these enterprises and contribute to their development. This does not mean that enterprises in the network only have to be buyers of eco-innovative services and products. They can also be suppliers. Companies range from those with a very high level and knowledge of eco-innovation to those with a deficient level and low expertise. The SME sector is dominated by those with a low level of eco-innovation. In turn, Intermediary Organisations act as integrators between research institutions and enterprises. They cooperate with both groups of entities. They facilitate the flow of information between them. They promote eco-innovative solutions, possess knowledge of available sources of knowledge on eco-innovation and encourage enterprises to implement them. At the same time, they know the specifics and problems of enterprises and can communicate them to scientific and research institutions. They do not have to be eco-innovation experts themselves.

The operationalisation of the objective required an understanding of the SME needs, vision, and challenges related to eco-innovation and how, and through which services, Ecolabnet can meet these needs and contribute to business development. The operational activities were divided into three elementary stages:
Stage 1. Gathering knowledge about enterprises in the field of eco-innovation.
Stage 2. Using the acquired knowledge to develop packages of eco-innovative services available in the created Ecolabnet network.
Stage 3. Creating a knowledge repository on eco-innovative solutions available within Ecolabnet, referred to as the Digital Collaboration Tool (DCT) system.

Defining the stages was based on the concept of the knowledge management process model (Davenport et al, 1998; Probst et al, 2002), which distinguishes three main phases of the knowledge management process:

- knowledge acquisition (knowledge creation),
- sharing knowledge,
- transforming knowledge into decisions.

3.1 Re. Stage 1

The starting point was to research and assess the level of eco-innovation awareness of enterprises from the SME sector and to identify their needs and expectations regarding eco-innovation. The research within this stage was conducted in July-December 2019. It aimed to identify, measure, and assess the relevance of drivers and inhibitors of eco-innovation diffusion in SMEs in the Baltic partner countries. In particular, it focused on: identification and classification of eco-innovations created or co-created by manufacturing SMEs, assessment of their knowledge about eco-innovations, categorisation of eco-innovations, motivators, needs, and barriers to eco-innovation development and implementation. The research was carried out in two phases. First, the partners, on the basis of the literature study (Burger, 2005; Triguero et al., 2013; Bocken et al, 2014; Karaarslan, 2015) and their own experience (numerous panel discussions), developed a portfolio of features attributed to the highlighted drivers and inhibitors of eco-innovation diffusion. The result of the first phase was the generation of a research survey questionnaire, which consisted of 26 questions, both qualitative and quantitative. Then, a survey was conducted using the CAWI technique. The research sample covered 298 entities, including from: Estonia – 23% of the research population, Poland – 19%, Finland – 18%, Lithuania – 16%, Sweden – 13%, and

Denmark – 11%. The quantitative research was complemented by qualitative research. Several in-depth interviews were conducted in each country.

The results of the study showed that the needs and expectations of enterprises in the area of eco-innovation are diverse, ranging from no need for external support, due to extensive experience in this field, to the need for appropriate support in all aspects related to the implementation of eco-innovative solutions – in terms of financing sources for eco-innovative projects, legal regulations and new eco-innovative solutions, especially in terms of materials, technologies, services, and products. The study results also showed that in the studied population of enterprises, there is a significant variation in the level of knowledge about eco-innovation and its importance in business. The results of project research in the field of the needs and expectations of enterprises from the SME sector in the area of eco-innovation are presented in more detail in Jędrzejczyk (2021) and Kucęba et al (2020).

3.2 Re. Stage 2

Within the framework of the first research stage, the SMEs' needs and expectations in terms of eco-innovation were determined, and the level of their eco-innovation awareness was assessed. The findings were used primarily to establish categorization of users to better adapt the network offer to customer expectations and to develop packages of eco-innovative services that should be available in the created Ecolabnet network. Furthermore, the partners' competencies were diagnosed in the context of the identified needs, and then the competence gap was determined. Specific measures have also been taken to minimise the designated competence gap – a strategy for the internal development of the project partners was developed, aimed at improving cooperation with SMEs and developing eco-innovative initiatives in relation to their needs, both current and prospective (issues of competence, competence gap, and internal development strategy will not be addressed in this article).

The identified needs of enterprises and levels of knowledge about eco-innovation made it possible to develop a categorisation of SME enterprises, mapping their eco-innovative nature. Six types of eco-innovative attitudes so called eco-identity have been distinguished: Eco-Opportunist, Eco-Booster, Eco-Developer, Eco-Optimizer, Eco-Cautious and Eco-Laggard. The first three types of eco-identity are the most advanced enterprises in terms of eco-innovation, and the last three are enterprises with a much lower level of advancement, which pay attention primarily to compliance with the legal requirements in terms of eco-innovation. The developed typology refers to E.M. Rogers' (1983) diffusion of innovations theory and partly coincides with his categorisation of participants in the diffusion of innovations. E.M. Rogers divided participants in the diffusion of innovations into five groups: 1) innovators, 2) early adopters, 3) early majority, 4) late majority, and 5) laggards. The main criterion for the division was the attitude to innovations and the propensity to implement them. It resulted in a peculiar gradation of participants: from those who are very keen on innovations and tend to take risks to those who are not in favour of innovations and display high resistance to innovations. The adoption of E. Rogers' typology in the project was insufficient given the purpose of categorising users – better adjustment of the network's offer to customers' expectations. In developing the eco-identity typology for enterprises, not only the level of eco-innovation knowledge and commitment was taken into account, but also the importance of eco-innovation for the enterprise, the main areas of interest in developing eco-innovation, and the main barriers for the enterprise in developing eco-innovation. Legal aspects, which are often very important in the case of eco-innovation, were also taken into account. Enterprises, even if they are not interested in implementing new solutions of an eco-innovative nature, are forced to do so by the legislation in force, for example, in terms of norms and standards for gas and dust emissions into the air or water pollution. The results of project research in the field of eco-identity of enterprises are presented in more detail in the study of Jędrzejczyk (2021).

The identified gaps and eco-innovation needs of SMEs enabled the development of the concept of eight eco-innovation service packages. The service packages address issues related to: 1) business strategy, 2) eco-innovation management, 3) bio-based materials, 4) product design and development, 5) 3D printing, 6) environmental assessment, 7) marketing, and 8) other eco-innovation expertise. Each package of services supports SMEs in a specific area, e.g., the environmental assessment package should include services that enable: 1) conducting impact analyses and evaluation of the environmental impact of investments, 2) determining ways to prevent, limit or minimise adverse effects of implemented projects, 3) testing of materials and products, as well as 4) carrying out research on end-of-life solutions. In this way, a specific categorisation of services has been made – the developed packages can be treated as portfolios of eco-innovative services. Each package has been assigned a specific set of services, consisting of services developed and offered in the first

instance by the project partners. Examples of services defined in the environmental assessment package are as follows:

- Analysis of compostability of plastics.
- Environmental impact assessment.
- R&D on end-of-life solutions to improve sustainability.
- Analysis of the impact of investment on the environment.

The developed service packages are not a closed set. They can be created on an ongoing basis as part of competence improvement by existing service providers, or completely new ones. The resulting packages of services may meet the needs of potential recipients – enterprises from the SME sector to an ever-greater extent, contributing to reducing identified gaps. SMEs are a possible direct group of recipients. Intermediary organisations can also use the network's resources to connect SMEs with service providers. The created typology of service packages was developed for the needs of the Ecolabnet Eco-innovation Network. However, the compiled portfolios are universal in nature. The research results concerning the developed eco-innovation service packages in Ecolabnet are more extensively presented in Jędrzejczyk (2022) and Kulej-Dudek (2021).

3.3 Re. Stage 3

To enable unrestricted access to Ecolabnet's eco-innovation resources, a concept of a knowledge repository of eco-innovation solutions available on the network, the so-called DCT system, was developed and implemented in September 2021. The created DCT system enables the collection and presentation of eco-innovative products and services developed by website users with the possibility of searching for connections between entities, services, and products. The concept and functionality of the DCT system are presented in more detail in the next section of the article.

4. Digital Collaboration Tool in Ecolabnet as a knowledge repository for eco-innovative services and products – construction and functionality

The DCT system is a tool that enables effective cooperation between research and development units, intermediary organisations, and enterprises from the SME sector in the field of eco-innovation. It provides a source of professional knowledge about eco-innovative solutions provided within the ECOLABNET network (Figure 1).

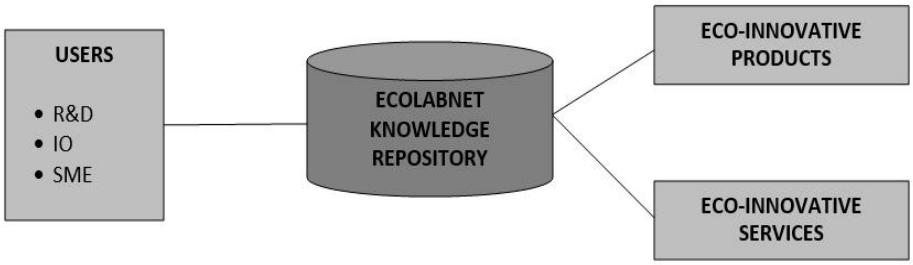


Figure 1: Ecolabnet knowledge repository: main objects

Source: own study

Each user, who has an account in the system, is described by the following attributes: User type, User name, Contact data, Trade, NACE code, Offer type, Expected support forms, and Green activities. They can offer eco-innovative products, services, or technologies. The expected forms of support are divided into four categories: 1. Business (branding communication, customer insights, supplier relations, business models, value chain assessment, financial aspects, intangible legal assets, legislation); 2. Finances (credits, loans, donations, capital venture, business angels, crowd financing); 3. Development (product design, packaging development, lifecycle assessment, service design); 4. Technology (biocomposites, bioresins, recycling, energy optimization, material efficiency, other alternative materials, certifications, 3d printing). The user profile is also assigned the main areas of green activity, such as: minimising waste, energy savings, material savings, water savings, waste recycling/reuse, eco-product development, waste material sale, res installations, and prosumer models. The distinguished attributes characterise the user in detail and define their role in the system.

Each service, determined in the system, is described in detail with the following components: Name of service, Offeror's logo, Offeror of product, Category of service, Type of service, Description of service, Areas of interest/Trade, Related services, and Status of service. It has a specific purpose and a described infrastructure of the service provider. The eco-innovation products defined in the system are also described using analogous components. The elementary attributes of the DCT system objects and the chief relations between them are illustrated in Figure 2.

The DCT system has a modular structure which consists of eight autonomous, integrated modules. These modules can be grouped into three groups: 1. information modules – News, Success stories; 2. modules in the operational layer – User module, Product module, Service module; 3. modules in the analytical layer – Module for searching and matching eco-innovative products and services, as well as surveying and reporting. Three types of interfaces have been defined in the system:

1. Basic interface (public level, not logged in user) including the following modules:
   - module for search for content according to basic criteria,
   - module for presenting basic information regarding the element searched for.
2. Extended interface that includes (classified level, logged in user) all the modules of the basic interface and also:
   - registration form and product and services forms,
   - extended search module, intelligent search for the relationships among elements according to the selected criteria: user, product, service, technology, type and kind of eco-innovation, implementation area,
   - search display module.
3. Administration interface that includes a module for managing the service and its content (administrative level, for administrators and editors of the system).

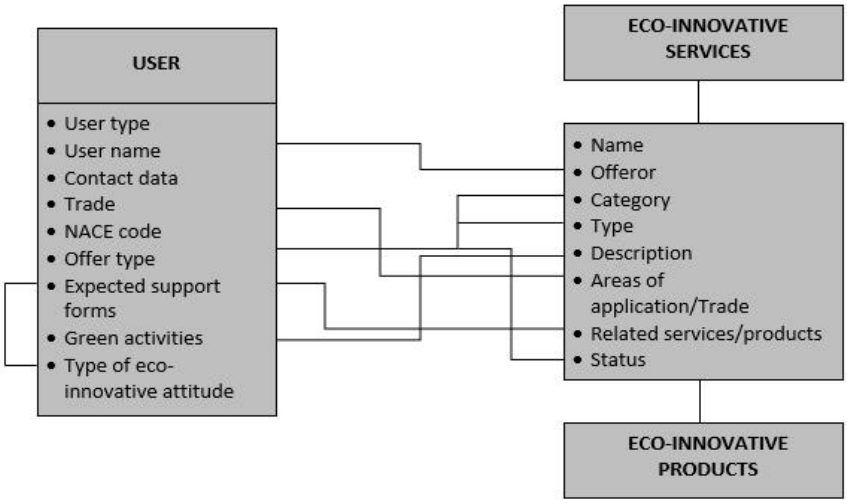


Figure 2: The DCT structure: elementary attributes of the DCT system objects and chief relations between them

Source: own study

The DCT system can be used by users, both registered and non-registered. Users can search for links between partners, services, and products in the field of eco-innovative solutions. The module for searching and matching eco-innovative products and services is supposed to filter the values of fields and display matching positions. The search is supposed to be based on the selection according to the list of keywords or terms. For example, while searching for and matching eco-innovative products and services, based on the list of related keywords or terms, information will be displayed on entities registered in the DCT system and their eco-innovative products, business processes or services that match: the offer, interests or orders of the company/user conducting the search.

5. Conclusions

The main issue of the article concerns the subject of eco-innovation development, which is a specific type of innovation. Eco-innovations are new or significantly improved solutions, primarily products, processes, technologies, and services, which create opportunities for businesses, contribute to increasing their business efficiency, allow the use of new opportunities for development, and positively affect the image of the organization. They also benefit the environment through more optimal use of resources and a reduction in the negative impact on the environment. Eco-innovations are closely linked to the way humanity uses natural resources. It is not only how goods are produced, but also how they are consumed. Therefore, eco-innovation makes it possible to manage resources more efficiently and contribute to economic growth in an environmentally sound way. Eco-innovation is connected with the concepts of sustainable development and corporate social responsibility.

The contemporary world needs eco-innovation to cope with critical environmental challenges such as climate change, depletion of natural resources, or biodiversity loss. New economic and social models and technologies that benefit the environment are needed. Unfortunately, eco-innovation can still be treated as an abstraction due to the substantial barriers to its implementation. The main barrier is not technology but economics, law, and human mentality. Another barrier is the growing global economic crisis caused by the COVID-19 pandemic and the war in Eastern Europe. As a result, the level of eco-innovativeness in almost every economy of the world is low or even very low. Therefore, actions and initiatives are needed to increase this level. An example of an initiative aimed at stimulating eco-innovative behavior is project Network of Service Providers for Eco-innovations in Manufacturing SMEs – Ecolabnet. The network has been established as a part of the Baltic Sea Region Interreg Programme 2014-2020.

Ecolabnet integrates research and development units, intermediary organisations, and small and medium-sized enterprises. It targets the SME sector, i.e., enterprises for which the barriers to implementing eco-innovation are significantly higher than those for large enterprises. The research conducted within the project has shown that both the level of eco-innovation advancement of SMEs in the Baltic Sea Region and their level of knowledge about eco-innovation varies considerably. Companies range from those with a very high level and knowledge of eco-innovation to those with a deficient level and low expertise. The diagnosed needs and expectations in the area of eco-innovation were also significantly differentiated, from no need for external support to the need for support in virtually all aspects related to the implementation of eco-innovative solutions. Thus, needs that could be supported by the environment were identified, including the Ecolabnet network. As a result, eight packages of eco-innovation services that should be available within the created Ecolabnet network were developed: Business strategy, Eco-innovation management, Bio-based materials, Product design and development, 3D printing, Environmental assessment, Marketing, and Other eco-innovation expertise. They do not constitute a closed set.

In order to tailor the network offer more precisely to the needs of SMEs, companies were categorized in terms of their eco-innovative attitudes. Six types of eco-identity were distinguished: Eco-Opportunist, Eco-Booster, Eco-Developer, Eco-Optimizer, Eco-Cautious, and Eco-Laggard. The created user typologies and service portfolios were developed for the Ecolabnet Eco-innovation Network. However, the compiled categories are universal. They can become usable for all entities operating in the market of eco-innovation services in the process of customer and service portfolio management.

Unrestricted access to Ecolabnet's resources is provided by the DCT system, a tool developed within the project that acts as a system for collecting and presenting eco-innovative products and services. The developed tool allows compiling a detailed characterisation of a registered network user and defining their role in the network. It also enables a precise description of eco-innovative services and products identified in the network. An important feature is the ability to search for links between partners, services, and products. The DCT system, constituting a repository of knowledge on eco-innovation, is an open database of eco-innovative solutions.

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The Knowledge work of the Future and the Future of Knowledge work

Birgit Helene Jevnaker and Johan Olaisen
BI Norwegian Business School
Birgit.jevnaker@bi.no
Johan.olaisen@bi.no

Abstract: Our paper investigates what forms the knowledge work design on a corporate level in the future. The future might be 2025, 2030, or 2035. The methodology includes interviews with researchers working with these issues in the Swedish telecommunication company Telia and the Norwegian telecommunication company Telenor. These companies make their living from understanding the future of work both on a corporate and societal level. The main finding is that AI and robotics will be more advanced, but the main changes will be management and organizational structure. The work will be done more as distance work and through virtual teams. The management and organization of work through the coronavirus have opened for more work done independent of time and the workplace and in virtual teams. There is also predicted a lack of professionals and all types of employees in the years to come, leading both to a competition for talent and increased importance in keeping the employed knowledge workers through internal career pipelines. AI and robotics will not reduce the need for professionals and employees. The steps will be taken one by one towards an integrated digitalization that makes new opportunities for collaboration, communication, and knowledge work. The fundamental knowledge worker will be using more of his working time on significant business issues. The skills needed are technical, information management, knowledge management, project management, collaboration, communication, rhetoric, virtual team, creativity, and green problem-solving skills. There is a corporate need for ethical, cultural, tolerating, and sexual awareness. We may summarize the needs as creative, sustainable, social and perception manipulation intelligence. The knowledge of the future will be complex, and the knowledge worker will handle multiple skills in different situations. The work of the future will be dominated by increasingly autonomous workers co-opting automated digital systems to create and capture value. The education might be revamped into a more task-focused education offered through the work life cycles. The revamping of education will also increase the overall employment and we will not experience the mass unemployment described in the literature as the result of AI, robotics, and digitalization. We have identified that the literature uses the unit occupation and not the unit tasks for the predicted higher unemployment and get a misinterpretation of negative consequences. The environmental issues and the climate crisis will be taken very seriously in the years to come and there will be a cooperation between the political economy and the corporate economy to do whatever is possible for sustainability in all internal and external processes to work greener and smarter. We will experience sustainability in action driven by a green leadership through a green strategy and green business models giving green services and products reusing as much as possible and using as few as possible resources to reduce the CO2 gases. This study concludes that there will be many small positive corporate and societal steps for each year towards 2030, improving the way of living and working together with environmental improvements. The reconstruction of the middle class is also emerging — neither a perfect nor an imperfect world.

Keywords: Future knowledge work, Innovation, Fourth industrial revolution, Robots, Automation, Artificial intelligence

1. Introduction

How has digital technology transformed occupations across sectors of the economy in terms of changing tasks and new skills to accomplish the digital transformation? We know that we must perceive the digital changes and that we must use our creative and social intelligence to meet the technological challenges offered by artificial intelligence (AI) and robotics. We also fear that the challenges might give us unemployment and a polarized working market. The dark side of the changes offered by information technology has always been that we will not be able to handle the changes and that significant parts of the economy will suffer and offer only fear and no hope. The literature has focused on the dark side of the moon for consequences. What if the changes offered by AI, robotics, and digitalization were mass employment? What if the literature offering no hope and only fear of unemployment is wrong? What if our creative and social intelligence save all of us from that offering us mass employment and growth? Our research question is exploring and exploiting the work of the future and the future of work through the essential research questions:

- How will digital transformation change the future of work?
- In what ways have digital technologies transformed knowledge work across sectors of the economy in terms of changing tasks and new skills to accomplish new tasks?

2. The literature review

In today's increasingly knowledge-intensive and turbulent economy, organizations face new levels of uncertainty and ambiguity (Ghobakloo, 2020). Many businesses must become more flexible and adaptive to survive in the future (Culot et al., 2020). However, they face an oxymoronic situation where efficiency calls for standardization and routinization, while effectiveness calls for flexibility and tailormade solutions (Spencer, 2017). In the literature, these considerations often are treated as separate streams of knowledge. For example, the KM literature has a bias in considering knowledge as a "thing" that should be distributed through digitalized processes, gaining efficiency through standardization (Beck, 2016). Knowledge is divided into tacit knowledge as what we do not know, how we know, and explicit knowledge, which is what we know (Pettersen, 2019). Tacit knowledge is hidden knowledge but is objective in the consequences of using the tacit knowledge. We add our experiences and attitudes to knowledge (Olaisen, 1984). Knowledge and competence are not a thing but a learning process (Olaisen and Revang 2017). The learning process cannot be standardized but is open and living (Olaisen and Revang 2018). The data and information processes are digitalized and ready for any case of reuse and systematization in new orders or new logarithms (Spencer, 2017). The logarithms are through AI, robotics, and digitalization becoming more advanced. However, the technology does not make knowledge, experiences, and attitudes into a thing but is still a secondary process assisting the primary human processes (Dengler and Mattles 2018). A medical technological assistant comes up with many diagnostics, but the decision of how to handle the diagnostic information is done by a medical doctor (MD). An MD does not end up as an industrial worker owing to technological advancements but will be more critical for handling multiple diagnostics and a more complex (Spencer 2017 and 2018, Pettersen 2019).

On the contrary, the literature about professional service firms (PSFs) considers expertise and knowledge as social constructions. The future workplace is not a concrete "thing" but a creation based upon subjective speculations about the consequences of globalization and technology on how we are organizing work in the future.

The first industrial revolution started in England (Taylor, 1911); the second one began in the US with the birth of standardization and the mass market, globalization, technology, and logistics drove the third one, while the fourth one will incorporate the second and the third revolution by adding workable artificial intelligence solutions, as well as life science inventions (Bravermann, 1974). The literature describes this as a coming revolution, but it might also be a smooth transition improving both the quality of life and the working processes.

This literature is about how robots and artificial intelligence will transform working life. The purpose is to understand what the workplace of the future will be. The researchers investigating these issues are writing about substantial changes where robotics and AI will take over the work and where the society will get a well-educated elite of 20-30% succeeding. The jobs of 50% of the people will change or disappear. A society where a sizeable portion of the workforce will be without possibilities for work. The literature describes the erosion of the middle class as the almost granted future. (Tuschmann 2011) Furthermore, Fukayama wonders if the process is the end of liberal democracies.

“Once the dust has settled from the fourth industrial revolution (4.0), workplaces and professions might be unrecognizable” (Johannessen 2018:19). A new class sees the light of day: the precariat (Dignan, 2019). The professional elite will live side-by-side with the "working poor" – people who have several jobs but still cannot make ends meet (Ehrenreich, 2001). There will be a small salaried elite consisting of innovation and knowledge workers. Workplaces will be unrecognizable. Robots will have destroyed bureaucratic hierarchies and torn apart the middle classes. What will remain will be contract workers with insecure jobs. Concurrently, the emergence of a new level of knowledge pajama-workers appears– people who can do their jobs in bed or at a café table.

There might be a significant transformation in professional environments slightly further into the future. Doctors will be medical engineers; nurses will be nursing assistants accompanied by robots. Robots and holograms might be replacing teachers (Johannessen, 2018).

Moreover, taking this further scenario, robots might diagnose and prescribe. (Susskind 2016). The standard issue of these articles might be summarized in one word: Mass unemployment (Hammershoj, 2019). Fukuyama (2022) describes the ultimate global use of technology as the end of the liberal democracy in the US and the start of the Chinese hegemony.

While the industrial society caused the middle classes to grow and live in greater comfort, much suggests that the Fourth Industrial Revolution would decimate the middle class. The decimation of the middle class might lead to that power and authority taking over the arena of knowledge management. (von Hippel 2003)-

Some jobs will change rapidly, some will disappear, and some jobs might be the same. Until now, educated people have been able to find employment. In the future, many educated people will not find jobs. It seems likely that most jobs will be those either at the bottom or the top of the wage scale. We will see the development of the precariat and the working poor, but also well-paid innovation workers and knowledge workers (Zuboff, 2018). Zuboff (2018) and Hammershoj (2019) describe the situation as a polarized job market.

Robots and informants are causing changes in employment structures. Old jobs disappear, and people are laid off. The public and corporate sectors create fewer full-time jobs and more part-time jobs. The experience will be a disrupted and transformed work life. These trends directly affect the transition to the fourth industrial revolution (Zuboff, 2018).

The increasing informational and knowledge-related content of jobs expresses the emergence of a new organizational logic, with its specific characteristic, Lego flexibility. Lego flexibility means that the production chain is outsourced to several countries by cost, quality, and innovation-and-competence logistics (Johannessen, 2019). Experience design is an innovative management and organizational model that focuses on user experience in the processes and the coupling between the customers and the workers who do what the organization is designed to do, i.e., the people on the front line. Also, the back office may change to a design perspective on organizational work where the back-office work will be the key to success (Pettersen 2019, Von Krogh 2000).

Any social system that fails to balance between stability and change and, at the same time, be innovative will not be able to steer the ship at a time of increasing complexity. A key trend is a transition from information and knowledge-intensive jobs to increasing demand for innovation-intensive jobs (West, 2018). The demand for creativity, problem-solving, and collaboration skills will increase Frey and Osborne, 2017; Dingler and Mattves, 2018).

Robots, nano-computers, and information will interact with each other permeating all areas of employment. We figuratively imagine this as neurons communicating in the human brain. Familiarity with contexts and a direct "hands-on" contact required by traditional industrial production will be less critical. The implications for educational institutions and their programs and methods are already apparent. (Hammershoj 2019, Zsiska 2018).

A tripartite organization will characterize the robots, network nano-computers, and informants. Firstly, the market is developed for robot operators who will not need background knowledge other than experience in their work, i.e., they are skilled production workers and will receive the appropriate training. The traditional knowledge professions will secondly be developed by reinforcing and translating their knowledge base about the design and development of the informants. Thirdly, new disciplines and trades will be generated that model, build, and maintain robotic machines, informants, and nano-computers. Robots, artificial intelligence, and informants are giving rise to such momentous changes that it is difficult to envisage how working life will develop in the future (Turner, 2000). Ghobakloo (2020) describes the situation as the digitalization and integration of the entire value chain of the lifecycles of products and services. Culot et al. (2020) add that globalization will not be reversed anytime. The hyper-capitalism transforming societies and occupations caused by AI, robotics, and digitalization is the 4.0 industrial revolution.

The car industry produces three times as many cars, with one-third of the workers in the last generation. There is a dismissing return on how much we can reduce the numbers of workers for AI, robotics, and logistics (Zuboff, 2018). Delivering education and health care will anyhow be a work-demanding human employee. Providing services might be more automated but will still be work demanding. There is no reason to believe that society neither has come to an end of the middle class or the number of people working. There might be more flexibility in the work-life, but in 2030, more people will be working than at any time, and more people will be educated at all levels (Tsoukas, 1996). Zuboff (2018) has concluded that the most significant change will be society's political, economic, social, and climate changes. The corporate changes will be done step by step and handled

without significant changes. Peters (2017), Johannessen (2018), and Ghobakloo (2020) summarized the literature as a wave where AI and robotics will change the way we live and work.

3. Design/methodology

The study is an explorative study using a survey, literature, imagination, and intuition. The study interviewed five professionals in the future research division of Norwegian Telenor (The world's 7th largest telecommunication company) in March 2019 about their views of the workplace of the future. We also have in March 2019 conducted five interviews at the Swedish telecommunication company Telia's future work-life department (The world's 12th largest telecommunication company). We followed up in March 2020 and March 2021with five interviews each year in Telia and Telenor about how the corona situation changed the working life. The interviews were conducted in March 2019, March 2020, and March 2021. The interviews were semi-structured, lasted 30-45 minutes, and were done through telephone, Zoom, and Teams.

The empirical data is compared with the results of the literature review. The literature review was done by searching journal articles about future work in four areas and the combination of these areas:

1. Digital transformation
2. The future 4.0 industrial revolution
3. AI and robotics
4. Remote working and distance work
5. Combinations of 1-4

We found 140 journal articles and eight books according to the title, abstract, and keywords. We sized the selection down to 40, which we read and used for our paper. We have the scientific opinion that the downsizing increased the methodological relevance and most of all the validity and the reliability of the study. The whole content of a study is important compared to only use the title, abstract and the key words.

4. Findings: The future workplace

Robotics and AI will surely be more advanced, but neither the way of working nor organizing work will change much in the years to come. The information processing will be an even more critical work task either or integrated into every work task. Every knowledge worker will have to try to see and think through what will be happening today and tomorrow. The past, present, and future will merge into a practical reality. There will be dynamic scenarios and the corporate, team, and individual networks. Those grasping and understanding the situations working in professional and organizational networks will be the winners. They will be the bottom-up needed for corporate success, still working in a top-down hierarchy delivering products and services through global logistics. The consumers are already prosumers in services like banks and shops and IKEA-like products. As the presumption will continue to get even lower prices, there will also be a reaction promoting that local small and green are beautiful.

The employees in the foreseeable future will be working smarter and greener, accepting new technology like robotics and digitalization AI solutions. The future in this kind of portrayal is brighter for knowledge workers than anything seen or documented anytime. According to informants in Telenor and Telia, zooming into what is already in the making, we may capture brighter and darker sides, which are worth unveiling.

5. indings: What skills are needed in future work?

According to the interviews, the findings are crystal clear for needed skills in future work.

- Technical skills for understanding and handling technological issues
- Information management skills for finding data and making the data into information
- Knowledge management skills for making information into knowledge
- Project management skills for working in temporary organizations and several projects
- Communication skills for
- Collaborating skills for teamwork and group work
- Creativity skills for looking at issues from different angles and for creating incremental innovations
- Problem-solving skills for delivering solutions in time
- Virtual skills for distance team and group work

What story does the above description tell about the future worker? The future worker is undoubtedly a multiskilled worker able to handle multiple skills in different working situations. The future work will need to be a manipulator of different perceptions in his work life. The future worker might be an expert in several professional ways but will certainly also be a generalist with a comprehensive working familiarity and a nodding familiarity with many situations. Learning new skills through the working life phases is a requirement to keep the job and make advances.

There will be job polarization with co-workers concerning advancements; there will be competition to advance in the internal pipeline since skills are broad.

There is also a set of more complex awareness skills needed to advance in the organization.

- Ethical awareness for keeping integrity and truthfulness, and transparency through all operations
- Cultural awareness for understanding and practicing different cultural values and norms
- Sexual awareness for me-too issues
- Mobility awareness for serving the corporations globally during the career pipeline
- Transformation awareness for learning new skills adjusted to different situations

In addition to these issues, there are environmentalism and sustainability. The future business strategies are green with a demand for working greener and more competent. The business models and the creation and capturing of value will be green. The environmental and climate issues have come to stay. The times of the green lip services are over. The entire value chain of the future life cycles of all products and services will be green. The corporations will not only cooperate with the politicians for a greener future but will be driving forces themselves for sustainability.

These issues are complex and demanding and define the increasingly autonomous corporate woman and the man who handles AI, robotics, and automated and digital systems to create and capture value for the corporation. More autonomous workers co-opting AI and automated systems will dominate future work to create and capture value.

6. Discussion

Like most of the literature reported, Telenor and Telia have no clear opinion of the future defined as 2030. There is an insecurity with a lot of options or possibilities. Perhaps working people will continue doing more of what people are doing today. Most of the technology development and AI literature are saying the opposite.

There might include industrialization of knowledge work with more robust control systems. There will be many people without work through the phase of robotics, and according to traditional Marxist analyses, they will press down the wages. Globalization will make the competition for a job stronger.

On the other hand, the more technology and AI-based the economy becomes, the more knowledgeable employees' corporations and societies need. The corporations will need people with knowledge (i.e., excellent education), experiences, and the right attitudes. Robotics and AI might give a working market with a higher demand for perhaps one-third of the workforce.

One-third of the workforce will provide the world with manual production and services. One-third might be without work, and the best solution paid a form of low public salary.

Telenor's solution will be a blue corporate world producing and delivering more than anytime with a green world taking care of the climate and public services. A yellow word with humanity and dignity together with a green world might be a utopia. In a red world with smaller entrepreneurs and corporations delivering frontend technology, changing the power of the large corporations might be a solution. The clear conclusion is that the future work might not be as different from today as many predict.

Loyalty, discipline, trust, and engagement will still be highly demanded. Project organizing and agility have been working well for a generation, and there will be less and less permanent organizational structure, as suggested by Mintzberg (1979).

There is one-sided literature describing the coming changes as a revolution in how people work and organize (Dignan, 2019). The more empirical research work from researchers living the differences tells us about a future very much like today's situation. There are few changes in developing large global corporations with more power and more employees. However, Chinese databases are reaching a critical mass of data, expertise, talent, and capital. The concentration called blue development by Telenor and Telia will continue.

The dominating economic blocks and countries will probably still be China, the USA, the EU, Japan, South Korea, and the UK. There will, however, be a more significant focus on environmental issues, including global decisions relating to global temperature and carbon use. The more giant corporations will support these issues to a higher degree and contribute to a greener world for all if alerted and enable practices to find new ways.

Telia and Telenor are optimistic about finding solutions for that there will be more educated people working in the global economy than ever. The threat not discussed here is a political threat to the free trade systems. The free trade systems will be necessary for keeping the economic growth and more work and welfare than ever.

7. Highlights

The future looks bright from the perspective of the two leading Scandinavian telecommunications corporations. The corporations and societies will gradually adjust step by step towards 2030. The consequences of AI, robotics, and information technology will be manageable. Scandinavia already works as a testing ground for new technology and knowledge-intensive products/services due to its high penetration of education, distributed wealth, technological adoption, and expected trust towards others. The individual qualifications are increasing for knowledge (formal education) — experiences, and the right professional work attitudes. Social and emotional skills for teamwork will be even more critical. The Scandinavian working arena will have more than 50% women as middle managers and 30% as top managers.

The eye-towards-the-future analyzing the future will be crucial for all corporations.

Bottom-up communication from those handling the most advanced customer needs will also be crucial.

Future analytical studies must be linked to the bottom-up and top-down management to coordinate all the corporation's activities. More and more of this coordination organizes in temporary teams and projects. Less and less of the organization will be a permanent organization. The leader teams might be temporary global, national, and local task forces.

Large corporations like Telenor and Telia will be more concerned about environmental issues. Working greener and more innovative will be an essential issue. The cooperation with regions, nations and national units will be much more robust in improving the environmental matters for customers and their organizations.

8. Future framework

The key for any organization will be an analytical eye toward the future where anything happening is analyzed and reported to the top management and coordinated into future deliveries. The key employees will be those implementing AI-based products and services on demand to advance customers. They will have a bottom-up understanding that is not yet common in the eye-towards-the-future and top management systems. The problematic issue for future work is thus the need for bottom-up understanding, sideways understanding, and senior-based strategy and organizational coordination where project teams are coordinated working in collaboration.

The main finding is the slow change in Telia and Telenor towards an honest knowledge worker using more of his/her working time to significant issues. Where a professional knowledge worker uses his/her qualifications or what she/he has of knowledge, experiences, and attitudes. The educated knowledge together with his/her professional experiences and attitudes are used in a positive way for delivering excellent results. The framework for the future will be ordinary people achieving extraordinary results owing to their combinations of education, experiences, and attitudes and becoming part of the right project. However, it will also be creative specialists (“talents”) and entrepreneurial groups meeting in workshops, cafes, coworking spaces, and elsewhere, in and across organizational boundaries. The future of knowledge work is giving people the opportunities to deliver excellent results and to be rewarded for these results as a part of their team. To make ordinary people and

talents produce extraordinary results in groups is the future and knowledge work. The knowledge work of the future is collaboration work in teams and groups.

9. Conclusion and the way ahead

The study has concluded that robotics and AI will be more advanced, but neither the way people are working, nor the way people organize work will change much in the years to come. The processing of information and its meaning will be an even more critical work task or integrated into every work task. Every knowledge worker will have to try to see and think through what will be happening today and tomorrow. The past, present, and future will merge into a practical reality. There will be dynamic scenarios and the corporate, team, and individual networks. Those grasping and understanding the situations working in professional and organizational networks will be the winners. They will be the bottom-up needed for corporate success, still working in a top-down hierarchy delivering products and services through global logistics.

The research needs to be expanded to different sectors within products and services. Tele- and communication corporations represent a knowledge-intensive service compared to future views within finance, shipping, property, consulting, and ICT service corporations. The results might be different or similar. There are many opinions about the future and all changes made by AI and robotics.

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Knowledge Ecosystem Approach to Addressing the Wicked Problems

Giedrius Jucevičius
Vytautas Magnus University, Kaunas, Lithuania
giedrius.jucevicius@vdu.lt

Abstract: Knowledge ecosystem is a relatively recent notion, which is primarily associated with the development of new knowledge through joint research and collaboration. They encompass the different actors that come together and search for new solutions and value propositions leading to the generation of new knowledge (Dattée, Alexy and Autio, 2018; Järvi, Almpanopoulou and Ritala, 2018). Knowledge ecosystems represent the networks of geographically co-located actors responsible for generating knowledge at the stage of pre-commercial engagement (Clarysse, 2014). The paper argues that the concept of knowledge ecosystems should not remain focused on public R&D-driven initiatives, but can be extended into the more complex social fields, such as addressing the "wicked problems" in multi-stakeholder environments. Wicked problems are characterized by the lack of clear problem definition and causality. They contain many inherent contradictions, complex stakeholder perspectives, and uncertain outcomes of intervention. The extant traditional research on addressing the wicked problems is dominated by the agent perspective (e.g. design thinking approach to resolving complex issues). In this paper, we argue that the effective tackling of the wicked problems owes primarily to the existence of effective ecosystems as platforms for accessing and managing the diverse social knowledge. We contrast the *ecosystem-as-affiliation* vs. *ecosystem-as-structure* approaches (Adner, 2017), and *prefigurative* vs. *partial* form of knowledge ecosystem (Järvi, Almpanopoulou, Ritala, 2018). The discussion presented in the paper shows that *ecosystem-as-affiliation* view and *prefigurative* form of KE is more suitable for addressing the complexity of wicked problems. On the other hand, the *ecosystem-as*-structure view and *partial* form of knowledge ecosystem is more appropriate for large corporate and public actors in search of the transdisciplinary solutions in a predefined area of expertise.

Keywords: knowledge ecosystem, wicked problems, complexity, complex adaptive systems

1. Introduction

The discourse on organizational and institutional ecosystems has been dominating the research on knowledge and innovation management for more than the past decade. The research on knowledge and innovation systems has seen certain "de-institutionalization" over the recent years by switching its focus away from the institutional systems of innovation (e.g. national SI by Lundvall, 1992, or regional IS by Cooke et al, 1997) towards a more organic fluid network-based ecosystem approach. Originating from the realm of natural sciences, the ecology-related concepts have penetrated the social sciences with notions, such as business ecosystems, innovation ecosystems or knowledge ecosystems (Oh et al, 2016). Compared to the earlier views, the ecosystem approach is often regarded as more appropriate for dealing with the issues in complex dynamic environments.

At the same time, we have also seen the growing preoccupation of social researchers with the wicked problems calling for the collaborative transdisciplinary solutions that cannot be effectively dealt with by individual fragmented actors. The wicked problems are characterized by the absence of clear-cut problem definition and the presence of inherent contradictions, the complexity of stakeholder perspectives and connections, unclear causality as well as the uncertain outcomes of managerial intervention. The extant traditional research on addressing the wicked problems usually takes the agent perspective (e.g. design thinking approach to resolving complex issues). In this paper, we argue that the effective tackling of the wicked problems is less subject to the cognitive and managerial capacities of key agents, but more to the existence of effective ecosystems as platforms for accessing and managing the diverse social knowledge.

This paper presents a conceptual discussion regarding the role of *knowledge ecosystems* in addressing the complex challenges posed by the wicked problems. Following the traditional definition, the knowledge ecosystems encompass the different actors that come together and search for new solutions and value propositions, which leads to the generation of new knowledge (Dattée, Alexy and Autio, 2018; Järvi, Almpanopoulou and Ritala, 2018). They usually represent the networks of geographically co-located actors (primarily centred around the local universities and public research organizations, PROs) responsible for generating knowledge at the stage of pre-commercial engagement (Clarysse, 2014). The classical approach to knowledge ecosystems stresses the public R&D-driven initiatives focused on new knowledge creation through fundamental research (e.g. CERN). However, we argue that such perspective has some inherent limitations. Therefore, we seek extend the concept of knowledge ecosystem into the realm of the wicked problems of social

and economic development, which offers a good potential for research novelty. In this paper, we ask to what extent the knowledge ecosystem perspective can be adopted and serve as an effective tool for addressing the wicked problems, which is an important ***research question***.

Therefore, the ***aim*** of our paper is to make a conceptual connection between the knowledge ecosystem and wicked problem research strands.

First, we discuss the notion of wicked problems and the latest research directions in the field. Second, we present the different views to knowledge ecosystems and the ways they may enrich the wicked problems research and practice. We discuss the different theoretical perspectives, such as the ecosystem-as-affiliation vs. ecosystem-as-structure approaches (Adner, 2017), or prefigurative vs. partial form of knowledge ecosystem (Järvi, Almpanopoulou, Ritala, 2018), and assess their potential suitability to the wicked system research. We also present the main challenges that the knowledge ecosystems have to overcome in order to perform the role of effective platforms behind the iterative solutions to the wicked problems.

2. Wicked problems: addressing the complex transdisciplinary issues

The notion of "wicked problems" initially emerged in the context of social policy planning (Rittel, Weber, 1973), but has latter spread into variety of social and technical fields. Nowadays, the wicked problem research covers the general fields of corporate strategy (Camillus, 2008) and public policy (Head, 2022), as well as more specific sectors and issues, e.g. environment and sustainability (Balint et al, 2011; Hull et al, 2020; Head, 2022), food waste management (Närvänen et al, 2020), healthcare (van Berkel, Manickam, 2020), development of software and information systems (Fitzpatrick, 2003), decision support systems (Courtney, 2001), education (Adam, 2016), or even philosophy (Tromp, 2018).

The wicked problems represent "a class of social system problems which are ill-formulated, where the information is confusing, where there are many clients and decision makers with conflicting values, and where the ramifications in the whole system are thoroughly confusing" (Churchman, 1967). They can only be addressed by stepping outside the organizational boundaries and working with various stakeholders, especially the legislators and decision-makers in the public and private sectors, as well as engaging local communities (Kumlein and Coughlan, 2018). They are associated with the so-called "grand challenges" (George et al, 2016), which are reflected by the UN Sustainable Development Goals (Sachs et al, 2018) that, despite their global reach, can be addressed on various levels (e.g. local initiatives that contribute to more global and boundary spanning solutions). Wicked problems are hard to define. They cannot be pinned down to one major cause, but have a variety of mutually reinforcing causes. The wicked problems are ill-structured, they are hard to understand before the solutions are developed. However, no solution is ultimate and neither fully "right" or "wrong", but it leads to further issues that have to be addressed. The wicked problems and their solutions are "one of a kind" and are hard to replicate. The potential for learning and feedback from the solutions to the wicked problems is quite limited not only due to their singularity, but also due to the new problems that emerge from the solutions. The agents dealing with the wicked problems are confronted with the challenge of addressing a constantly shifting target. They often concern the long-term strategic policy dilemmas "in which multiple and compounding risks and uncertainties combine with sharply divergent public values to generate contentious political stalemates" (Balint et al., 2011). The greater the social complexity of the problem and the divergence of different stakeholders in terms of their values and priorities, the greater the "wickedness" level of the problem (Camillus, 2008).

The resolution of wicked problems cannot rely on traditional processes, such as gathering additional data, defining underlying issues more clearly and breaking them down into smaller problems to be addressed (Rittel, Webber, 1973). Moreover, the intermediate solutions often lead to numerous unintended consequences and represents an important challenge in the strategy making (Camillus, 2008). The wicked problems are inherently susceptible to the 'law of unintended consequences' (Ritchey, 2011). Such unpredictability may be due to many components interacting in non-random ways, the chain reactions amplifying the initial events, reinforcing feedback, balancing forces, lock-in effects, adaptation, emergence or disturbed equilibria unleashing unpredictable outcomes (Sherden, 2011).

All of the above makes addressing the wicked problems an extremely challenging task. One can distinguish several major approaches to coping with such challenges.

Some researchers stress the importance of early engagement and collaboration with the diverse stakeholders outside the organizational or institutional boundaries (Kumlein and Coughlan, 2018) in order to receive different perspectives on complex issues. Addressing the wicked problems at the corporate level is usually based on involving the stakeholders, building and documenting the shared understanding of the problem as well as the joint commitment, defining the corporate identity through shared values, competences and aspirations, focusing on action in order to receive the early feedback and introduce the needed adjustments. Conklin (2003a; 2003b; 2006) proposes the 'dialogue mapping' framework as the means for overcoming the fragmentation of perspectives and building the shared understanding of wicked problems. Balint et al (2011) stress the role of the learning networks where public managers, experts and stakeholders collaborate in the analytic, iterative and deliberative decision-making processes.

Other authors stress the role of agents, their knowledge base and mindsets – both on the individual and organizational levels. It is based on the assumption that coping with the wicked problems calls for specific transdisciplinary competences and value systems that can be developed via educational means. Confronting the wicked problems calls for 'transdisciplinary imagination' in order to conduct the open-ended enquiries (Brown et al., 2010). Adam (2016) proposes the theory of bi-relational development that stresses the resolution of wicked problems through the reconciliation of opposites. It provides different actors in the system with conceptual tools for dealing with the strategic tensions and paradoxes in such complex settings. Addressing the wicked issues calls for the transformation of organizational culture away from integrated and monolithic models towards more pluralist, dynamic and flexible models and identities (Ney and Meinel, 2019). Large organizations can tackle the wicked problems by adopting the principles of design thinking and embracing 'messy' institutional frameworks in order to achieve breakthrough innovations.

Other researchers (Majchrzak, Malhotra, 2020) find value in adopting the crowdsourcing-based collaborative solutions by encouraging the open-ended innovation challenges through the IT platforms. The wicked solutions require us to go beyond the mainstream approach in the crowdsourcing practices that tend to lock out those without prior knowledge of the problem. The search for solutions to the wicked problems may challenge the very definition of the problem, therefore crowdsourcing platforms need to have very fluid boundaries.

To conclude, the debates regarding the potential solutions to the wicked problems revolve around at least two major aspects: the aspect of *knowledge* (i.e. regarding the problem itself, as well as tools, frameworks, mindsets for addressing it) and the aspect of *platforms / networks* (i.e. areas of interaction where new knowledge and solutions get generated). In our further discussion, we argue that the discourse on knowledge ecosystems shows some good yet underexplored potential to be adopted for approaching the wicked problems.

3. Knowledge ecosystems: diversity of views and their application to the context of wicked problems

In the general ecosystem-related research, the knowledge ecosystem is a relatively recent concept among other wider known concepts, such as business ecosystems (Clarysse et al., 2014; Iansiti and Levien, 2004) or innovation ecosystems (Adner (2006). Knowledge ecosystem can be regarded as a branch of the wider innovation ecosystem research (Almpanopoulou, 2019; Clarysse, et al., 2014) or an ecosystem in own right (Valkokari, 2015). It comprises „diverse actors bound together by a joint search for valuable knowledge while having independent agency also beyond the knowledge ecosystem" (Järvi, Almpanopoulou, Ritala, 2018). They take the shape of vertical and horizontal networks for generating the new knowledge in order to solve certain technological / societal issues or scientific problems (Jucevicius et al., 2021). In the mainstream literature, knowledge ecosystems are geographically co-located hotspots steered by either universities, research institutes (Leten, et al., 2013; Clarysse, et al., 2014), or firms (van der Borgh, Cloodt, Romme, 2012) that focus on collaborative knowledge search (Valkokari, 2015). The role of knowledge ecosystem is to enable the development of new knowledge / knowledge base through joint research work and collaboration. Knowledge ecosystems enable the different actors to come together and search for the new solutions and value propositions, which leads to the generation of new knowledge (Dattée, Alexy and Autio, 2018; Järvi, Almpanopoulou and Ritala, 2018). The *raison d'être* of knowledge ecosystems is enabling the joint search for solutions to the complex problems that cannot be solved by individual actors, and collaborative creation of knowledge (Jucevičius et al., 2021). The solutions and knowledge generated by the actor networks in knowledge ecosystem can be extended and put for a productive use in other above-mentioned ecosystems. Knowledge

ecosystems call for a sufficient diversity of actors, their different yet complementary competences, level of trust, as well as the adequate mechanisms for coordination across multiple organizational boundaries.

Knowledge ecosystems focus on the early stages of knowledge creation, i.e. pre-market stage as far as the innovation process is concerned (Clarysse et al., 2014). The majority of "wicked problems", however, are more of a complex social nature and only indirectly related to the processes of commercialization. On the other hand, in order to be effectively addressed, they usually have to involve various market actors (e.g. firms, employees, supporting organizations), each with their distinct competences in diverse knowledge fields. The engagement of actors from the private sector is also important for the latter stage of implementation of the newly emerged knowledge (aka "wicked solutions", Ranabahu, 2020). Besides, every knowledge ecosystem has to resolve the issue of the multidisciplinary knowledge brokering, which is often the core prerequisite behind the emergence of new knowledge.

Although the concept of ecosystem as used in the social contexts is often criticised for its vagueness (Oh et al, 2016) and unclear boundaries (Klimas and Czakon, 2020), it is also often praised for versatility and inclusiveness of the diverse actors in unstructured environment, thus promoting open-ended solutions (e.g. Aarikka-Stenroos and Ritala, 2017; Almpanopoulou, 2019). Knowledge ecosystems have the characteristics of complex adaptive systems as they represent the organizational and institutional *networks* characterised by the knowledge flows and intensive *interactions* of multiple actors possessing a significant degree of autonomy and self-organisation (Anderson, 1999; Laihonen, 2006).

Based on the prevailing discourse, we can approach the knowledge ecosystems in at least two ways with regard to resolving the transdisciplinary 'wicked problems'. On one hand, they can be treated as relatively structured and purposefully designed systems of knowledgeable actors in the general area of the problem that needs to be resolved. On the other hand, they can be approached as loose, emergent, open-ended networks of knowledge actors that have no specific boundaries and can be flexible (re-)arranged to address the constantly evolving problem area. Here we have several useful conceptual categorizations that can be adopted for the context of addressing the transdisciplinary wicked problems.

Adner (2017) makes the disctinction between the *ecosystem-as-affiliation* and *ecosystem-as-structure*. *Ecosystem-as-affiliation* approach stresses the affiliation of ecosystem actors (to the network or focal actor). It presents a more open-ended network perspective where spontaneous collaborations may lead to different outcomes and the network welcome different members with no prior objective in sight (Jucevičius et al., 2021). The boundary of such ecosystem emerges spontaneously from the relationships of network actors *Ecosystem-as-structure* view largely focuses on the value proposition that network actors are co-creating. It stresses the purposeful alignment of resources and activities of diverse partners in order to create new value proposition (or new knowledge), and members are invited to join based on these specific needs (Adner and Kapoor, 2010, 2016). The boundary of ecosystem is determined by the specific value proposition (in our case, the 'wicked problem' to solved) that collaboration is focused upon.

Järvi, Almpanopoulou, Ritala (2018) propose a complementary view with regard to knowledge ecosystems that involve users and producers of knowledge, organized around a joint knowledge search. The authors make distinction between the knowledge ecosystems, organized in *prefigurative* form, searching *for* a knowledge domain, and the knowledge ecosystems, organized in *partial* form, searching *within* an identified knowledge domain. The first type of ecosystems are focused on probing and formulating a common goal, whereas the later are focused on reinforcing the pre-existing common goal. One can assume that addressing the "wicked problems", due to their inherently complex nature, should call for the first type, i.e. prefiguratively organized knowledge ecosystems.

One can argue that the mainstream view to the knowledge ecosystems with its focus on large public R&D initiatives (e.g. CERN) still has strong elements of the *ecosystem-as-structure* view and *partial* form of knowledge ecosystem. Such public initiatives are often purposefully structured around the pre-defined (yet in broad terms) knowledge area with relatively clear set of knowledge actors that are expected to contribute to the new knowledge creation. Similar approach can be observed in the large corporate environments where the creation of new transdisciplinary knowledge is taking place in the 'leadership-based strategic communities' (Kodama, 2007; 2018). In such cases, the knowledge ecosystems are purposefully created by the corporations (across the organizational boundaries) in order to achieve the synergies out of the different disciplinary perspectives, yet

the processes of new knowledge creation are coordinated by the managers within the corporate hierarchy. Such ecosystems enable the creation of new knowledge (and new products out of unexpected technological combinations) for the strategic renewal of firms. We can argue that the *ecosystem-as-structure* and *partial* form of knowledge ecosystem perspectives are well applicable for addressing certain 'wicked' issues on the organizational or corporate level, but face limitations in more complex problem settings.

Thus, when dealing with the wider socio-economic challenges, the *ecosystem-as-affiliation* view (Adner, 2017) and *prefigurative* form of knowledge ecosystems (Järvi, Almpanopoulou, Ritala, 2018) are more reflective of the complex nature of the wicked problems,. They are more open to the exploration of the new knowledge domains outside the predetermined organizational boundaries. They encourage the open-ended communities of the continuously interacting and co-evolving actors. The general ecosystem perspective for addressing the issues of wicked problems has already been proposed by several researchers. For example, Kazlauskas and Hassan (2010) advocate the usefulness of digital ecosystems for providing social technological solutions to the wicked climate change problems. The Cynefin framework (Kurtz, Snowden, 2003; Snowden, 2002) provides a conceptual lense for the adoption of complexity-based ecosystemic view. The core emphasis here is the resistance towards the adoption of a single idealised model, but instead focusing on raising "an awareness and understanding of the borders between different domains and the acquisition of tools and techniques to enable border transitions when needed" (Kazlauskas, Hassan, 2010). The understanding and solutions to the wicked problems fall under the domain of unordered complex or chaotic systems with their emphasis on the dynamic, emergent, bottom-up approaches, instead of focusing on planning and idealised design.

So the traditional view of knowledge ecosystems as structured networks of knowledge actors centred around the public R&D projects has rather strong limitations when confronted with the context of open-ended wicked problems. Should the knowledge ecosystem be capable of addressing such complex issues, it has to possess the qualities and characteristics in line with the nature of problems to be solved. Our earlier research has shown that although the notion of ecosystem originates from complex dynamic contexts and phenomena, its current usage in the social-institutional contexts often becomes rather static (e.g. with greater emphasis on elements and system's structure than on dynamic relationships). Using Cynefin terminology, the *complexity* of the wicked problems can hardly be addressed by relying on the platforms that are designed with the mentality of *complicated* systems. To be effective, the knowledge ecosystems need to be accessible to the diversity of actors, encourage their spontaneous sociability, situational awareness and relations based on individual and collective learning. They have go beyond the disciplinary confinement, which can be achieved through transdisciplinary leadership. Such leadership does not imply the presence of top-down design or hierarchical structures. The leaders of effective knowledge ecosystems act primarily as moderators and coordinators who are well aware of the complex dynamic nature of both the ecosystem and the wicked problems at hand. It means focusing more on the boundaries and attractors in the ecosystem rather than on the rules and control. Building and sustaining the effective knowledge ecosystems for addressing the wicked issues also means avoiding the pitfalls of managerialism that can create perverse incentives and lead to the unintended consequences.

4. Concluding remarks

The conceptual adaptation of the knowledge ecosystem approach from the context of public R&D-centred large scale initiatives (e.g. CERN) towards more flexible, loose and open-ended networks of diverse actors is linked with adopting the *ecosystem-as-affiliation* view and *prefigurative* form of knowledge ecosystems. It is important to keep in mind that wicked problems call for a continuous adjustment to the evolving context. Their outcomes and solutions cannot be controlled with the fixed mindsets of knowledge actors, no matter their competence or diversity. Therefore, the emergence of new knowledge for dealing with the wicked problems is a continuous iterative process among the actors that do not necessarily share the same values, competence fields or levels of power. The knowledge ecosystem is not only about the collaborative generation of new knowledge, but also about obtaining the needed feedback and taking the corrective actions. It means that the ecosystem actors need adequate meta-knowledge as well as the collaboration and learning skills. These are important challenges to be considered when identifying the leverage points, designing and testing the systemic solutions, and minimizing the unexpected consequences.

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Co-producing Knowledge: Challenges of the Transdisciplinary Research in Pandemic Times

Maria Angelica Jung Marques, Eduardo Giugliani and Jane Lucia Silva Santos
Pontifical Catholic University of Rio Grande do Sul - PUCRS, Porto Alegre, Brazil
HFACTORS - Human Factors and Resilience Research Group
maria.angelica@pucrs.br
giugliani@pucrs.br
jane.santos@pucrs.br

Abstract: Human Factors is a broad area of interdisciplinary and transdisciplinary studies and research focused on the perspective of the interaction between organizational, group and individual factors that aims at improving the performance and safety of people in complex organizations and socio-technical environments. Knowledge to develop solutions to the complex problems that arise in this context can be co-produced by academic and non-academic actors through a transdisciplinary research framework that integrates the daily practices of stakeholders and creates structures that make co-production spaces effective for corporate's practices. This paper present and discuss the strategies and challenges for developing spaces for human factors-based knowledge co-production on a transdisciplinary research project during the pandemic period of COVID-19. This ongoing research was designed to develop interactions and to co-produce knowledge aimed at the safety culture of companies in the oil and gas sector. Under the imposition of social distance and its consequent challenges, strategies to promote interaction, iteration, sharing, integration, co-creation, and co-production of knowledge had to be redesigned. Based on partial results, the research discusses and analyze the main dilemmas for the knowledge coproduction focusing on the 30 researchers, and on the knowledge coproduction between researchers and stakeholders. Although the COVID-19 pandemic had imposed new forms of relationships, the main challenges remained on the integration of knowledge as perceived by the research team. This paper presents the confrontation of the knowledge co-production challenges imposed by the new context associated with addressing two new constructs for the oil and gas industry, human factors and resilience, to improve safety culture. The discussion suggests and presents possibilities to overcome these challenges to continuous stimulate co-production of knowledge in these organizational environments.

Keywords: co-producing knowledge; knowledge; transdisciplinary; industrial sector; human factors.

1. Introduction

Transdisciplinary research and knowledge co-production are by nature interactive and iterative processes of knowledge production used to address complex real-world problems. They require participants to have an ethic of openness, tolerance, and respect for different perspectives, and a commitment to mutual learning and mediation processes where conflicts and different values are negotiated when not fully resolved (Stokols 2006). Transdisciplinary projects usually demand that participants step out of their disciplinary "comfort zone" which leads, in most cases, to new conceptualizations about social and scientific phenomena transcending disciplinary boundaries (Klein 1996; Pohl, Klein, Hoffmann, Mitchell, & Fam 2021). In addition to the existence of spaces and mechanisms for collaborative action, since the act of engagement across domains and disciplines is as important as the production of knowledge itself (Marques 2020), the coproduction of knowledge is a process that includes a collaborative stage of problem structuring and trust building, through knowledge generation, to a stage of exploration of practical impacts (Harvey, Cochrane, & Van Epp 2019). Harvey et al. (2019) emphasize that co-production processes produce more than just knowledge, they develop capabilities, build networks, foster social capital, and implement actions that contribute to the issues at hand.

The pandemic of COVID-19 beginning in 2020, has presented challenges that directly impact how collaborative and co-productive actions are perceived and carried out, especially in interdisciplinary and transdisciplinary research projects. In Brazil, a transdisciplinary research project which aims to co-produce knowledge oriented to improve operational safety in the oil and gas (O&G) industry based on human factors and resilience, was initially conceived, and structured to develop its research activities face-to-face, with constant iteration and interaction between teams of researchers and workers from the O&G industry. This is a case of a project that had to adapt and reinvent its dynamics and its process of knowledge co-production, overcome barriers, and manage the unexpected. This article contributes to the debate about transdisciplinary knowledge co-production and (the creation of) co-production spaces, from the perspective of adaptability and management of the unexpected in the oil and gas organizations involved. Considering that existing theoretical and empirical studies on transdisciplinary knowledge co-production are predominantly focused on domains related to public

administration, education, environment, and climate change (Marques 2020), this study addresses a yet unexplored domain related to the context of industries in the O&G industries. In addition, this study covers a set of researchers from multiple disciplines, which increases the complexity of project management and the knowledge integration process. Furthermore, the main object of the project - Human Factors, by itself demands inter and transdisciplinary action to meet the objectives established with the O&G industries of the case in question. In this sense, the literature related to safety culture, associated with Human Factors in industry, does not include studies on application of research methodologies of transdisciplinary knowledge co-production for the resignification of operational safety practices.

Based on this context, the study seeks to answer what extent the transdisciplinary process is affected by the perception and experience of researchers in relation to the processes of transdisciplinary knowledge co-production. Therefore, it was considered the heterogeneous understandings of inter and transdisciplinary reflects on a diversity of practice and expectations across disciplines. Additionally, how the COVID-19 pandemic has affected the knowledge integration processes, and what is the effect of the strategies used to achieve the goal of transdisciplinary knowledge co-production.

This article presents and discusses some challenges, barriers, and strategies for knowledge co-production in a transdisciplinary research project during the pandemic period of COVID-19, based on partial results. The next section presents the concept of transdisciplinary and the relevance of knowledge co-production in inter- and transdisciplinary research projects, addressing the challenges posed by the COVID-19 pandemic to co-produce knowledge. The third section presents the context studied and the methodological approach employed to conduct the initial empirical study. In the fourth section, the main partial results are synthetically presented and discussed. In addition, in the last section, some final considerations and suggestions for future studies are pointed out.

2. Co-producing knowledge in the transdisciplinary research

The concept of transdisciplinary refers to different types of knowledge production for social change that are based not only on the integration of knowledge from different disciplines, but also on the inclusion of values, knowledge, know-how, and expertise from non-academic sources (Klein, Keestra, & Szostak 2010). The literature on transdisciplinary research presents a wide range of definitions (Boyd, Buizer, Schibeci, & Baudains 2015), and considers the complexity of an issue and its diverse perceptions about it, setting aside the idealized context of science to produce relevant knowledge from the input of various stakeholders (including interest groups from society, industry, and government). This means to say that, in practice, transdisciplinary research requires collaborative actions in iterative cycles (Lawrence 2015; von Wehrden et al. 2019). Transdisciplinary research, as well as knowledge co-production, are terms coined to refer to the processes of knowledge integration/connection between academic and non-academic actors that lead to the creation, communication, and use of combined knowledge (Bremer & Meisch 2017; Mauser et al. 2013). This iterative and interactive process of combining worldviews, experiences, and values with factual and scientific forms of knowledge leads to the generation of more comprehensive and inclusive understandings of a problem at hand. Some issues that underpin this process directly interfere in the success or failure of co-productive actions, such as trust, power and leadership, communication, governance, and engagement, among others (Marques, 2020). Trust, for instance is an important catalyst that allows passive information to be transformed into valuable knowledge (Qurniati, Febryano, & Zulfiani 2017). Communication in social relationships has also been widely recognized as a precondition for successful transdisciplinary projects (Tilo Weber 2018 - https://i2insights.org/2018/10/02/language-matters/).

Knowledge co-production has been an effective means of producing usable knowledge in science through a collaborative process between researchers (i.e., academics) and practitioners (i.e., decision makers). The growing field of research on knowledge co-production suggests that the strength of this approach is precisely the direct connection and collaboration between researchers and practitioners (whether policy makers or local resource managers) (Djenontin & Meadow 2018). Moreover, collaboration, inherent in the process of co-production, is a theme present in the literature on the subject since it refers to the act of engagement between domains and disciplines and is as important as the production of knowledge. Compared to disciplinary research processes, knowledge co-production extends from a collaborative stage of problem structuring and trust building through knowledge generation, to a stage of exploring the practical impacts of that process (Harvey et al. 2019).

The concepts of co-production, co-design, co-development, and co-evaluation belong to a family of collaborative terms (Bremer et al. 2019). Co-production is an iterative, interactive, and collaborative process that uses a diverse and plural set of knowledge sources (scientific and practical) to define and solve complex real-world problems (Armitage et al. 2011; Bojovic et al. 2021). In co-design, stakeholders and researchers work in a coordinated and integrated manner to establish a common understanding of the research and co-production goals and agree on the roles that different groups have in moving toward the research goals (Mauser et al. 2013). In co-production, a continuous exchange between researchers and stakeholders takes place, with scientific integration through inter- and transdisciplinary interfaces to ensure consistency of the research process and address questions about the uncertainty of the results (Mauser et al. 2013). Integration is an effective way to ensure that disciplinary research questions stem from the overall needs of the project and then researched by the respective discipline to then transcend in the transdisciplinary process where stakeholders and researchers dialogue to ensure the interaction of their respective knowledge (Bammer 2013, 2019; Bammer et al. 2020; Hoffmann 2016).

Although co-production processes are described as iterative, there is no single approach to implementing successful co-production actions (Brix, Krogstrup, & Mortensen 2020). Furthermore, research on co-production indicates that there is still no widely accepted understanding of what the term co-production means in practice (Bremer et al. 2019; Norström et al. 2020). A co-production space, for example, can be understood as "a complex meeting place where several different academic traditions and practices converge, overlap, affect each other, conflict, or cooperate to describe and effect co-production" (Bremer and Meisch 2017, p. 20). In this regard, beyond the conceptual discussion on knowledge co-production, there are pragmatic and solution-oriented research approaches (Hoffmann, Thompson, & Pohl, 2019; Jacobi et al. 2020; Popa, Guillermin, & Dedeurwaerdere 2015; Schneider et al 2021) that have given rise to laboratory and experimental environments for research with and for society in diverse fields, such as: business and innovation (e.g., Baccarne et al. 2014), urban development (Bulkeley et al. 2019), environmental policy and sustainability (Bergmann et al. 2021; Schäpke et al. 2018), among others. In addition to integrating scientific and practical knowledge, these approaches seek to turn co-produced knowledge into action, supporting practical transformation through learning.

The relevance of knowledge co-production, especially in complex contexts and problems, is unquestionable. However, there are still many challenges and points of attention to enable the experiential learning process in co-production spaces. Theoretical mediation and the establishment of bonds of trust among participants, for example, are fundamental to the unfolding of co-creation and co-production activities. Asymmetric forces and powers, as well as values, beliefs, and language can become barriers to knowledge co-production (Laursen, Gonnerman and Crowley 2021), also ethical and gender issues, academic tribalism (corporatism), etc. (Baptista et al. 2020). The pandemic of COVID-19, according to the World Health Organization (WHO), has changed the way life is conducted, and the resulting social legacy has brought about more social changes (World Health Organisation 2020), which even affect how research projects are developed. People and organizations have relied on digital media to cope with these changes in their daily activities, especially when it comes to digital communication. To reduce interpersonal interactions and respect social distance, contactless services have in many cases become "the new normal" (Ratten 2020). Whether face-to-face or not, transdisciplinary knowledge co-production is expected to integrate scientific and non-academic disciplinary knowledge into a transdisciplinary research framework for solving complex problems.

3. Study context and method

Transdisciplinary, interactive, and participatory research approaches are often suggested as appropriate means to meet both the requirements posed by real-world problems and the goals of science (Hoffmann, Pohl, and Hering 2017; von Wehrden et al. 2019). In this article we put the lens on a specific study context, i.e., a 36-month inter- and transdisciplinary research project (ITD Project) that - faced with the advent of the COVID-19 pandemic shortly after its initial months of research activities - needed to deal with the imposition of social distance and its consequent challenges, and to generate spaces and strategies to promote the co-production of techno-scientific knowledge. The ITD Project is developed by a multidisciplinary team of about 30 research scholars from various disciplines and research fields (including HSS - Humanities and Social Sciences; and STEM - science, technology, engineering, and mathematics) and counts on the direct involvement of five companies from the O&G industry that operate with the common goal of O&G exploration and production off the Brazilian coast. Once the project was conceived to be developed from collaborative interaction actions with companies in a face-

to-face format, the first major challenge was to manage the unexpected with the immediate adaptation of its research methods and the entire structure of communication and relationships for execution in the digital format. In this scenario, the process of co-production of knowledge, designed to be developed face-to-face, needed to be rethought and adapted, and the implicit dilemmas and challenges usually present in interdisciplinary and transdisciplinary research projects have become increasingly frequent and explicit.

To face the imposed challenges of knowledge co-production, the ITD Project employs two central constructs, namely: Human Factors and Resilience. To strengthen the safety culture, especially in offshore operations (O&G exploration and production units), the multidisciplinary team of researchers of the ITD Project seeks to develop jointly with the companies, tools, methods, and technologies based on concepts and principles of human factors and resilience. The set of actions are centered on three perspectives: (a) Applied Research; (b) Experimental Development; and (c) Practical Implementation. This means that new knowledge will be generated while experimental and practical application activities will be developed in the case study's operations. The project uses the expanded concept of transdisciplinarity defined by Jahn et al. (2012, p. 4) and proposed by Hoffman et al. (2019), where transdisciplinary research is a reflective approach that encompasses interdisciplinary collaboration among academics, added to collaboration among stakeholders concerned with a particular real-world problem, in processes of mutual learning and knowledge integration. Considering the proposed actions, centered on experimental development and practical implementation, it is sought that the various stakeholders participate in the identification and selection of results, and in the transdisciplinary knowledge co-production.

3.1 Initial empirical study

To better understand the studied context and the challenges related to the knowledge co-production in a transdisciplinary research project, some methodological procedures were implemented to conduct an initial empirical study with the team of researcher-academics of the ITD Project.

The study, still in progress, sought to raise qualitative data through semi-structured interviews, and quantitative data through an online questionnaire (survey via e-mail) using as response options a 5-point Likert scale of agreement (1- strongly disagree, 2-disagree, 3-non-disagree nor agree, 4-agree, 5- strongly agree). The guide script for the semi-structured interviews was based on the results of SHAPE-ID: Shaping Interdisciplinary Practices in Europe, which aims to establish a comprehensive knowledge base covering the different understandings of interdisciplinary and transdisciplinary research (IDR and TDR), the factors that inhibit or support them, and a set of success criteria for integrating the Arts, Humanities and Social Sciences and other disciplines, Science, Technology, Engineering, Mathematics and Medicine, into ITD research practices to solve real societal problems. The questions in the questionnaire consist of statements from the literature and previous studies on knowledge co-production, Marques (2020), SHAPE-ID (Baptista et al. 2020), Robledo and Hoffmann (2021). The questionnaire link was sent to all members of the multidisciplinary research team of the ITD Project, specifically its researcher-academics. By December 2021, 27 responses to the questionnaire have been obtained and 12 interviews with researchers have been conducted (another 10 are planned to take place later in 2022). The preliminary results of this study are presented below.

4. Presentation and discussion of results: initial study

The results presented below, still partial, instigate some reflections. It should be kept in mind that all questions were answered during the pandemic considering the conditions imposed by it since March 2020. The analyses also rely on extensive material collected during interactive meetings between researchers and companies during two years of the ITD Project.

Considering inter and transdisciplinary co-production in practice, this study sought to understand the perception of the team regarding these practices, evaluating frequency, collaboration, engagement, communication, knowledge integration, among other aspects. From the answers to the questionnaire, the following are some preliminary results organized into three macro-categories: (i) researcher's actions/experiences and choice/preferences, (ii) nature and characteristics of ID projects (general), and (iii) nature and characteristics of ITD projects (integration), the latter about the integration process in ITD projects, according to the perception of the researchers participating in this study.

About the researcher's actions/experiences and choice/preferences (Figure 1), one of the results that draw attention concerns the frequency with which researchers collaboratively produce interdisciplinary scientific work. When presented with the statement "I frequently participate in the collaborative production of scientific

work", 63% agreed with the statement, however, 55% agreed that the priority of production is related to their field of research. These issues also appear in the interviews, when the researchers explained that they see the importance of producing more interdisciplinary scientific work, but the concentration of activities of scientific production and participation in research networks is still quite concentrated within their disciplinary field. On the other hand, when working on an interdisciplinary project, 30% of the respondents stated that they prefer to "collaborate with researchers with whom they already work or have worked", but 34% said they had no such preference.

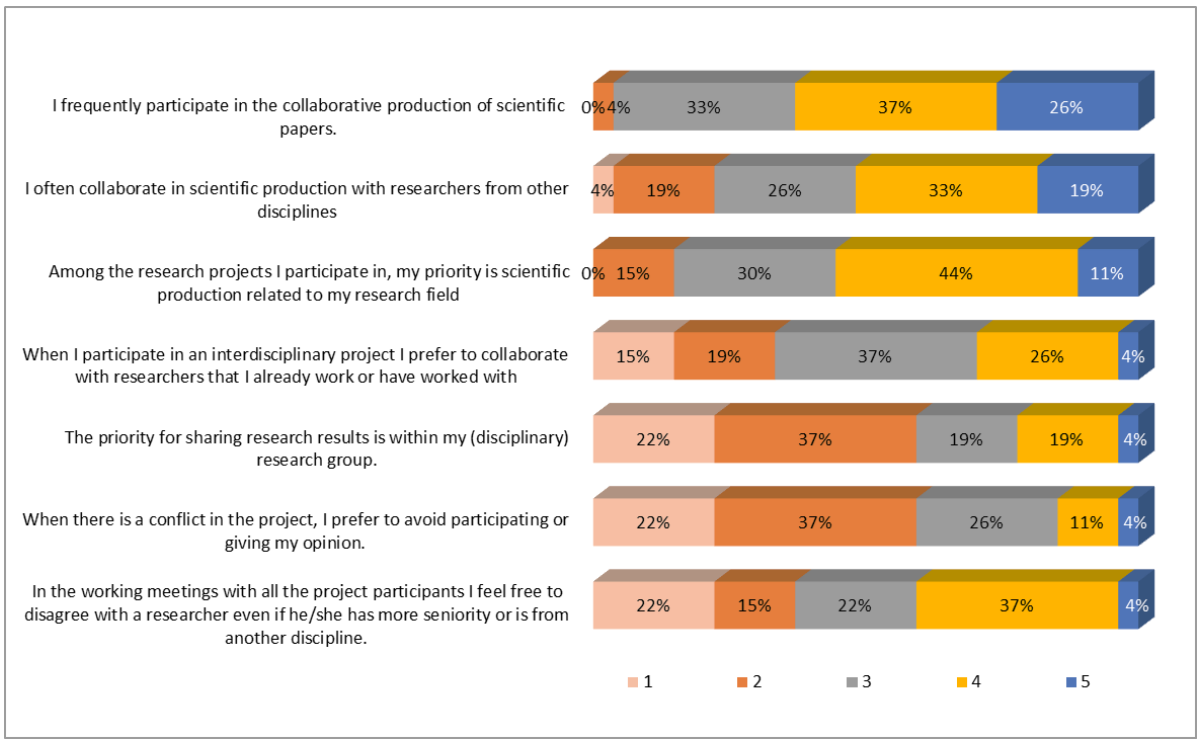


Figure 1: Researcher's actions/experiences and choice/preferences

Source: Elaborated by the authors

About the nature and characteristics of ITD projects in general (Figure 2), one can see that the questions/statements related to themes A (engagement, motivation, and dedication), C (coordination and sharing) and E (communication and interaction between teams / in planned spaces) are those that obtained the highest scores, all between 78% and 100% of partial or complete agreement (responses predominantly between 4 and 5). Another aspect that draws attention concerns autonomy (in thematic block B, representation, and autonomy of the disciplines - Figure 2).

When asked about the knowledge integration processes (Figure 3), an essential activity of the co-production process, 85% of the researchers agree that this integration happens during all phases of the project. However, 60% agree with the statement "integration requires specific skills" and 48% neither agree nor disagree with the statement "integration requires previous experience".

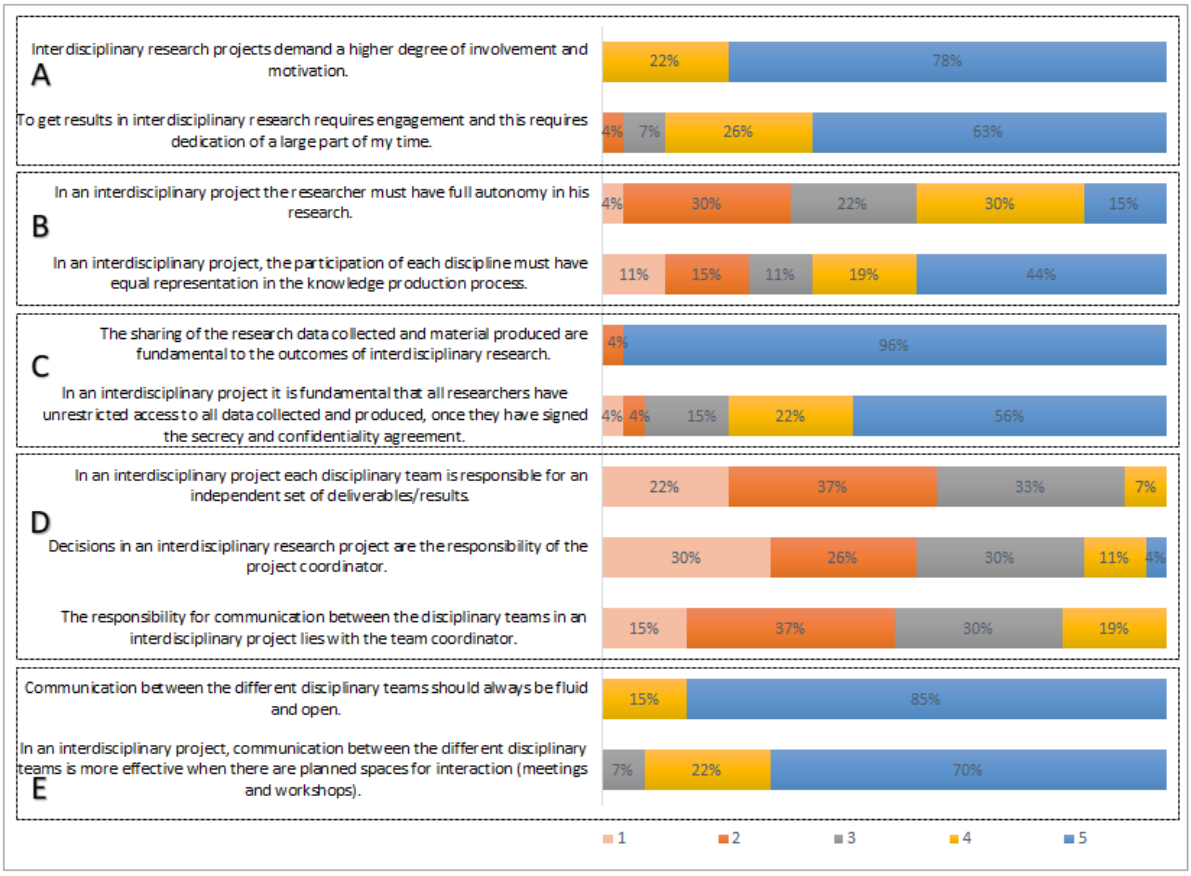


Figure 2: Nature and characteristics of ID projects (general) according to the perception of the study respondents, sorted by thematic blocks

Note: % from 27 answers. Thematic blocks of questions: A = Engagement, motivation and dedication, B = Representation and autonomy of disciplines, C = Coordination and Sharing, D = Roles and responsibilities, E = Communication and interaction (between teams / in planned spaces).
Source: Elaborated by the authors

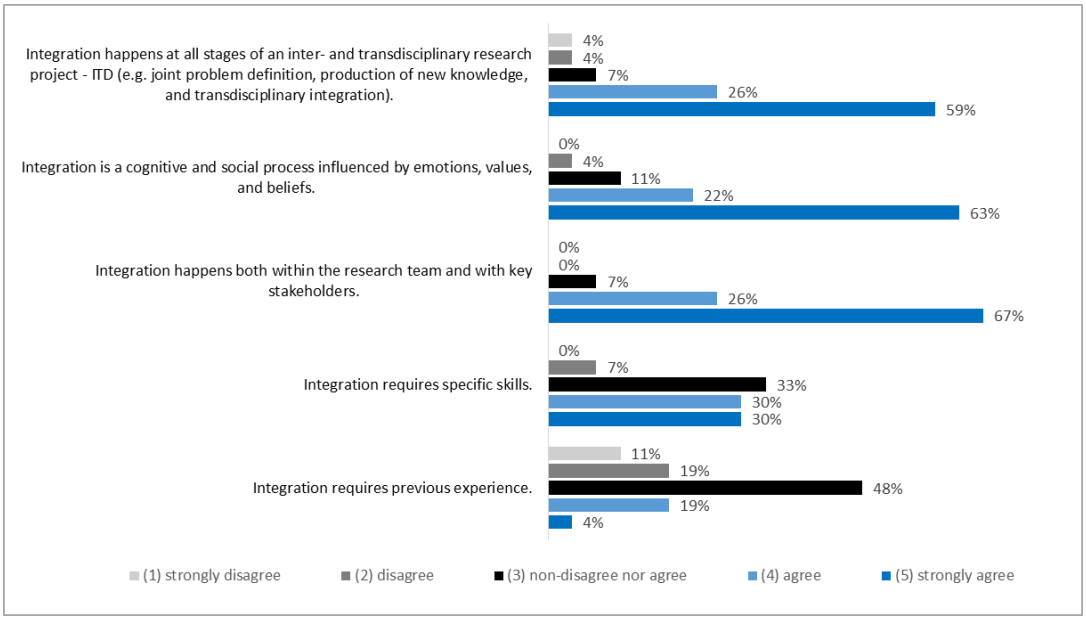


Figure 3: Knowledge integration on ITD projects according to the perception of survey respondents

Source: Elaborated by the authors

Respondents were asked to rank order the five potential barriers to inter- and transdisciplinary collaboration. Through their responses, the top barriers are listed in descending order in Table 1.

Table 1: Main barriers to inter- and transdisciplinary collaboration

Main barriers	% of answers
Cognitive and/or epistemological differences among partner researchers	14.63
Academic tribalism (corporatism)	13.01
Division of scientific work (each one does their part independently)	12.20
Lack of knowledge about their discipline (by those who are not from the area)	11.38
Lack of motivation of researchers to do interdisciplinary research	8.94
Power differences among the participants	8.94

Source: Elaborated by the authors

As evidenced in table 1, in addition to the cognitive and/or epistemological differences between the partner researchers as the most frequent barrier, academic tribalism, the fragmented way of working (each one does their part and then joins the parts), the lack of knowledge about disciplines different from their own, as well as issues related to the motivation for interdisciplinary work and the power differences between the participants stood out. These barriers also match the responses to the other questions such as the statement presented earlier in Figure 1: "when I participate in an interdisciplinary project I prefer to collaborate with researchers with whom I already work or have worked" with 37% neither disagreeing nor agreeing and 30% generally or completely agreeing.

In general, the researchers, when asked about the barriers to working collaboratively, although they claim to have adapted well to remote work (even seeing several advantages in it), still perceive the difficulty of understanding and making themselves understood, especially in the relationship between HSS and STEM areas.

Among the strategies developed, the creation of multi-level co-production spaces in the form of interdisciplinary working groups stands out. This strategy allowed attacking some of the sensitive points identified at the beginning of the pandemic that are directly related to the themes A (engagement, motivation, and dedication), C (coordination and sharing) and E (communication and interaction between teams / in planned spaces), which obtained the highest scores.

These multi-level co-production spaces have allowed for expanded participation of researchers who previously depended on their disciplinary group leaders to participate in technical-scientific debates. This has increased motivation and engagement while dissipating power structures, increasing the sharing of information and knowledge. The formation of the WGs also facilitated knowledge integration processes, which as shown in the results, demands learning beyond specific competencies unknown to most participants.

5. Concluding remarks

The partial results presented on the co-production of transdisciplinary knowledge, point to some initial reflections. The project has a lot of researchers from various disciplines and areas, both in HSS and STEM, which increases the complexity of relations in terms of cognitive and epistemological differences, requiring coordination, communication, and engagement in multiple instances. In addition, it has a diversity of participating companies, different cultures, pandemic context, which required creativity and adaptations to meet the challenge of social distance.

By creating spaces of co-production with shared leadership, in addition to the sharing of information and knowledge, it was possible to advance the integration of knowledge, the improvement of trust relationships, and the dissipation of traditional power structures. Furthermore, the partial analysis of the researchers' perspectives on the understanding, purpose, and practice of inter- and transdisciplinary collaborative actions, demonstrates the unawareness and fear of some of the researchers when it needs to in fact integrate knowledge in collaboration with another discipline. This integration is not something natural, although it is perceived as very important, demanding great cognitive effort. Many testimonials report the initial difficulty of relating at a distance and the need to "reinvent" oneself, and, although they see positives in distance interaction, most miss face-to-face interaction, especially for insight into non-verbal communication, and to "disarm" potential barriers of cognitive or epistemological misunderstanding.

By discussing some divergences and points in common, we present some paths and demonstrate theoretical advances in understanding how coproduction of knowledge is understood, as well as the practical utility in offering co-productive spaces to help navigate this new reality. It is worth mentioning, however, that one of the limitations of this study is that the perception of the participants of the companies has not yet been incorporated to a greater extent, although qualitative data from meetings and gatherings have subsidized the analyses so far. As next steps in the research, it is planned to expand the number of interviews with professionals/workers of the companies, where we intend to explore the perception of the stakeholders, their understanding about it, their motivations, and their engagement in the co-production process. The literature still does little to explore stakeholder engagement and given the field of application of the research it is even less explored (O&G sector).

Moreover, future studies could focus on the identification and analysis of the strategies and mechanisms that facilitate/promote the knowledge co-production in inter and transdisciplinary research projects, as well as on the processes of knowledge integration that permeate the spaces of knowledge co-production.

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Forms of Adaptation of Newcomers in Wikipedia as Online Sharing Knowledge Project

Anna Karczewska
Częstochowa University of Technology, Częstochowa, Poland
anna.karczewska@pcz.pl

Abstract: Wikipedia is one of the largest virtual communities of practice aimed at building and sharing knowledge online. Its ambitious goals require the cooperation of millions of users around the world. The development of the project has slowed down over the last few years, hence the acquisition and retention of new users is becoming more and more challenging. Consequently, properly organized adaptation, and encouragement of newcomers to become a part of the community emerges as a crucial issue for the existence of Wikipedia. This paper presents the results of the quantitative research carried out with the use of the content analysis method on the different language versions of Wikipedia. The issues investigated included the following aspects: the level of advancement of the newcomers' adaptation process, the use of various adaptation tools, forms of welcoming and enhancing newcomers to learn and edit the Wikipedia content, while also their potential effect on the productivity and engagement of users. The results of the research indicate great diversity among the tools used, depending on the language version of the project. Not all the statements directed to the newcomers are encouraging and friendly, as some cultures create more restrictive and punitive content than the others. The latter leaves the newcomer with the responsibility for the process of learning the rules of behaviour of the Wikipedia community. The more advanced the adaptation process is, the more active and productive users are. The conclusions of the research may be of use to different virtual communities of practice and organizations which face the problem of adapting newcomers in the online activity connected with knowledge sharing.

Keywords: adaptation, knowledge sharing, newcomers, organization, Wikipedia.

1. Introduction

Contemporary online knowledge building and sharing projects like Wikipedia resemble a rather disorganized bazaar-like structure instead of a traditional cathedral structure. In the concept of the "cathedral", the decisions are usually taken by central management. The "bazaar" describes an open approach, where the online community is in charge of the whole system (Capiluppi, Michlmayr, 2007, p. 32). A bazaar-like world "behaves in many respects like a free market or an ecology, a collection of selfish agents attempting to maximize utility which in the process produces a self-correcting spontaneous order more elaborate and efficient than any amount of central planning could have achieved" (Raymond, 2001, p. 22). This is most probably the source of the success of Wikipedia and other online open-source projects.

Wikipedia's content can be publicly edited by anyone, which is another reason for its rapid growth. However in the years 2007-2008, the number of users started to decline. Therefore, one of the significant subjects of research became the adaptation and retention of the new users (newcomers). Newcomers can be defined as novice participants who are just starting their activity in the project (Steinmacher et al., 2015 p. 81). The newcomers' adjustment to the new environment has been defined as socialization, or in other words, the process of learning the behaviour and attitudes crucial to playing a role in an organization.

Newcomers in projects such as Wikipedia or open source software often face social or technical barriers that hinder learning and may discourage them from becoming a part of the project (Halfaker et al. 2013). As Choi points out (2010, p. 109), taking into consideration the high turnover rates and lack of input from the majority of users, research on the strategies that support positive relationships between online communities and their members have significant theoretical and practical implications.

The aim of this paper is to identify the forms of adaptation/socialization of the new users (newcomers) of different language versions of Wikipedia and study the relations between the level of advancement of newcomers' adaptation process, as well as the level of activity and engagement of the users in creating the content of Wikipedia. The paper structure includes the analysis of the literature of the subject, methodology of the conducted research, results, discussion on the obtained results, while culminating in the conclusions.

2. Literature review

Retaining users who have started participating in online projects has attracted notable attention among researchers (Lai & Chen, 2014; Galehbakhtiari & Hasangholi Pouryasouri, 2015; Yan, Wang, Chen, & Zhang, 2016). The majority of literature on this subject with relation to Wikipedia originated after 2007, when the decline of the participants was observed. The ways of Wikipedia newcomers' socialization have also been investigated over the last several years (Steinmacher, Wieses, & Gerosa 2012, Steinmacher et al. 2015, Konieczny 2018, Morgan and Halfaker 2018). Every newcomer can edit Wikipedia, albeit (s)he needs to learn basic social and technical aspects of the project before making an appropriate contribution. The "newbies" seek help in Wikipedia forums when in doubt. If they receive not polite answers, they will most probably drop out (Steinmacher, Wieses & Gerosa 2012). Although gaining new participants is crucial to the long-term survival of the community, it can be a source of disagreements in the short-term. As newcomers may more or less unintentionally behave contrary to the code of conduct and therefore impede Wikipedians' activity, it can lower the experienced Wikiedians' motivation to participate. Newcomers may encounter hostility from more experienced users who perceive their mistakes as a danger to the quality of Wikipedia. (Morgan & Halfaker, 2018, p. 1).

Halfaker, Geiger, & Terveen (2014) point out that one of the problematic contradictions raised in the literature of the subject is the one between the retention of Wikipedia newcomers and the content's high quality. New quality control measures in Wikipedia, such as autonomous anti-vandal bots and specialized user interfaces designed to revert destructive edits, have been very effective in minimizing potential harm, yet also very often dissuaded newcomers. Additionally, P. Konieczny (2018, p. 157) indicates that in spite of the fact that among Wikipedia policies there are several points that encourage friendly treatment of all editors, in reality, newcomers often meet with overworked volunteers who spend a long time repairing acts of malicious vandalism. As a result, they do not often have patience to be friendly to users who make mistakes.

One of the studies also found that, among the most researched barriers to the adaptation of newcomers, the most noted are the following: the lack of social interaction with members of the project; not receiving an answer, and the newcomers' small technical experience. What may also constitute a barrier is the fact that newcomers need to take action and search by themselves for the proper knowledge that is required in the project (Steinmacher et al., 2015, pp. 80-83). Thus, the most evidenced barriers are related to socialization, as well as knowledge sharing.

Another part of the literature focuses on the effective tools and techniques facilitating the retention of newcomers. An important issue raised is how to solve the newcomers' problem of finding a suitable task to start with. Encouragement from more experienced Wikipedians for a newcomer to find a relatively easy task to work on, or the tool which would automatically suggest the tasks is recommended. The next solution is to provide a mentor for a newcomer, which may increase the odds of a newcomer staying longer in the project (Canfora et al., 2012, Steinmacher, Wieses, & Gerosa, 2012). Morgan et al. indicated that user-friendly tools, positive interaction with experienced users and safe spaces for newcomers may be promising tools for effective adaptation (Morgan et al., 2013). According to their research results, newcomers invited to the "Teahouse" forum (dedicated to newcomers) were retained at a higher rate than editors who did not receive the invitation (Morgan & Halfalker, 2018, p. 1). It is also advisable to create more spaces dedicated to communication processes. As Jarvenpaa and Keating (2021, p. 10) noticed, cooperation in virtual teams fails due to the lack of trust and the way to increase trust is to create the possibility of free communication.

Choi et al. researched the impact of certain socialization tactics on the newcomers' involvement in online projects. Seven tactics used most often have been distinguished as follows: invitations to join, offers of assistance, welcome messages, positive feedback, requests to work on tasks, constructive criticism, as well as personal-related comments. Although most new users made fewer edits over time, their declines were reduced in the case of those who have been socialized with the afore-mentioned tools. (Choi, 2010, p. 107). Likewise, P. Konieczny (2018) indicates that a major reason for burnout/dropout among volunteers is that of interpersonal conflicts, which shows that good relationships in the online community are a significant factor in users' retention.

One of the most well-known theoretical models of socialization is the one developed by Van Maanen and Schein (1979). Referring to this typology, Jones (1986) assumed that collective, sequential, formal, fixed,

serial, and investiture tactics, so-called "institutionalized socialization", help newcomers to adjust to their new role better, while also prevent their uncertainty. Meta-analytical articles suggest that newcomers experiencing more institutionalized socialization tactics in online projects may have more certainty about their new role, feel more accepted by the community, have a higher level of satisfaction with their activity, and show greater organizational commitment. They are also less likely to leave the project and perform their work more effectively (Saks, Uggerslev, & Fassina 2007; Choi, 2010, p. 108).

Moreover, Chao et al. (1994) claim that newcomers who possess greater knowledge about such project elements as internal group policy, the meaning of jargon or group goals and values tend to have a higher level of involvement and satisfaction with their activity. As Choi et al. indicate (2010), Wikipedia uses more "individualized socialization" techniques in the adaptation of newcomers. The project enables newcomers to edit articles with no training, even though it has numerous policies and recommendations on how users should behave. It is crucial to provide newcomers with the knowledge about community, preferably in an institutionalized way.

In the most recent research, Konieczny (2020) and Jemielniak (2019) related to the afore-mentioned subjects. They raised the issue of encouragement and retention of specialists and experts in Wikipedia in order to protect its content quality. Whereas Yan and Jian's study (2017) confirmed that in accordance with the social exchange theory, receiving answers of high quality positively influenced the future knowledge seeking behaviour of newcomers. Social responses such as answers to the newcomers' questions were found to have a strong positive influence on future knowledge contribution of newcomers.

The socialization and retention of newcomers in Wikipedia and other online open source projects have been studied most extensively in subject-related literature. Yet, the general overview of the adaptation process and tools in different Wikipedia language versions, especially from the cultural perspective, have not received in-depth attention. This paper attempts to fill the knowledge gap in this respect.

3. Methodology

The aim of the presented research was to identify the forms of adaptation of new users of Wikipedia. Other analysed issues were the relations between the level of advancement of the newcomers' adaptation process in different language versions (wikis) and the level of activity and engagement of the users in creating the Wikipedia content. These aspects have been addressed in the cultural context indicated by the chosen Hofstede cultural dimensions. Chosen non-content pages were analysed, while the method of content analysis was adopted. The research was conducted in January and February 2022 and all the statistical calculations were conducted with the use of the Statistica software.

Based on the studied literature, the following hypotheses have been set:
H1: The more advanced the adaptation process is, the more active users there are in Wikipedia.
H2: The more advanced the adaptation process is, the more productive active users there are in Wikipedia.
H3: The adaptation process in Wikipedia depends on certain cultural dimensions of a society:
H3a: the more feminine society is, the more advanced the adaptation process is.
H3b: the more uncertainty society avoids, the more advanced the adaptation process is.
H3c: the more collectively oriented society is, the more advanced the adaptation process is.

In order to measure the variables in hypotheses, chosen indicators have been applied in the research.

1. The indicator of adaptation process advancement was the number of adaptation tools used in a given language version of Wikipedia.
2. The indicator of being an active user is the fact of not only registering the account but also constantly creating the content of Wikipedia.
3. The indicators of productivity were the ratio of the number of articles to the number of active users, and the number of total pages to the number of active users, as well as the number of edits to the number of active users.
4. Femininity-masculinity, uncertainty avoidance and individualism-collectivism indices have been adopted as indicators from G. Hofstede's research (Hofstede, 2007).

The "feminine" culture of a country is characterised by social gender roles overlapping, as well as taking care of relationships and an individual's needs. The "uncertainty avoidance" determines the extent to which the members of a society feel anxious about ambiguous situations and create institutions helping to avoid them. While the level of "individualism-collectivism" of a society is the degree of interdependence a society keeps among its members, in individualist countries people usually look after themselves and their closest family only, whereas in collectivist ones people are loyal to the "in-groups", which take care of their members (Hofstede, 2007).

In the cases of hypotheses 1 and 2, all the language versions of Wikipedia were placed under review (325). In the case of hypothesis 3, the author researched only some language versions (15). The choice of the surveyed versions was limited by the availability of the analysed data, both the Hofstede indexes, as well as automatic Welcome Templates in Wikipedia language versions. Welcome templates are schematic messages prepared to be placed on user pages by any user. Whereas automatic welcome templates are schematic messages placed automatically on the user pages of new registered accounts by bots or scripts. The Village Pump is the public forum for all the users in a given language version. Meanwhile, Teahouse is a parallel public forum dedicated primarily to newcomers. Welcoming committees consist of members welcoming newcomers who have already made constructive edits and help them get started.

The first step of the actual research process started with counting the tools that occur in the adaptation process of newcomers in Wikipedia. The counting was conducted based on interwiki links, which are links leading to the analogical pages in different wikis. In the second step, each language version was checked in terms of the presence of an automatic welcome message for new users. Then, the chosen statistical data characterizing wikis (e.g. number of articles, number of edits, total number of pages) were obtained from the non-content page: https://meta.wikimedia.org/wiki/List_of_Wikipedias. In the third step, Spearman's rho correlations between chosen variables characterizing wikis and the variable "adaptation process advancement" were calculated. In the last step of the research the language versions both included in Hofstede's research, and having automatic welcoming messages were distinguished. The correlations between the elements of the messages offering encouragement, requirements, help, the complexity of the messages and the chosen Hofstede's indices: femininity, uncertainty avoidance and individuality were calculated.

4. Results

To investigate the complexity and advancement of adaptation process designed for newcomers in all the language versions of Wikipedia, the tools used for adaptation have been counted. The results are presented in Table 1.

Table 1: Number and percentage of Wikipedia language versions using particular adaptation tools.

Adaptation tool	Number of Wikipedias	% from 325 Wikipedias
Help page	273	84.8%
Village Pump	244	75.1%
FAQ page	114	35.1%
Introduction page	110	33.8%
Automatic Welcome Template	42	12.9%
Welcome templates category	34	10.5%
Teahouse	26	8.0%
Welcoming Committee	21	6.5%

As indicated in the collected data, two of the adaptation tools exist in the majority of Wikipedia language versions – the Help page (84.8%) and the Village Pump (75.1%). Around one-third of wikis have got frequently asked question pages (FAQ). Likewise, one-third of wiki versions created the Introduction page. What is more, only a small percentage of wikis have prepared automatic welcome message template (12.9%), welcome templates category (10.5%), Teahouse (8%) and a welcoming committee (6.5%).

The welcome templates used by the more experienced users to welcome and get acquainted with newcomers have been counted and analyzed in terms of differences. The exemplary variances of the templates are presented in Fig. 1.

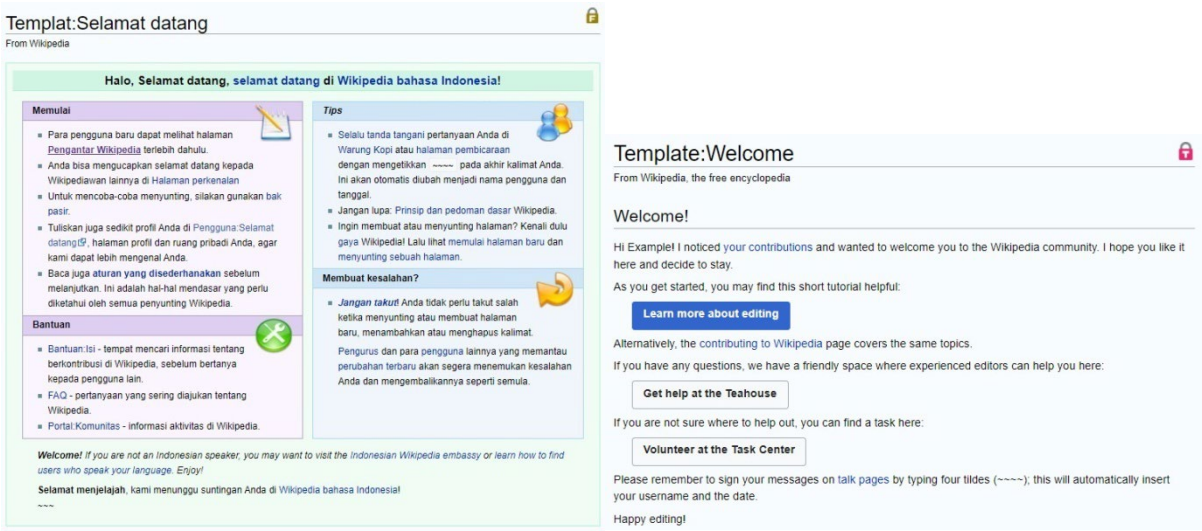


Figure 1: Examples of welcome templates in Indonesian and English Wikipedia

The templates are not the same in all the language versions; they differ in terms of complexity, graphic elements used, a number of links (leading to the aspects of Wikipedians' activity in the project) used. Some are really complex, visually attractive, while encouraging newcomers to edit, whereas some are more simplistic, minimalistic, including only the bare text.

With the aim of verifying H1 and H2, the author examined the correlations between the variable adaptation process advancement (AdaptToolSum) and the chosen variables characterizing Wikipedia language versions referring to the number of active users (ActiveUsersNo), the size of language versions output (ArticlesNo., TotalPagesNo., EditsNo., AdminsNo., RegisteredUsersNo.), and the productivity of active users (ArticlesNo./Act UsersNo., TotalPagesNo./ActiveUsersNo., EditsNo./ActiveUsersNo.). It was assumed that in versions with advanced and complex adaptation processes, the number of active users as well as the productivity of active users would be higher.

Table 2: Correlations between chosen variables characterizing Wikipedia language versions and the variable "adaptation process advancement". N=325, p<0.05.

	Spearman's rank order correlation								
	ArticlesNo.	Total PagesNo.	EditsNo.	AdminsNo.	Registered UsersNo.	Active UsersNo.	Articles No./ Active UsersNo.	Total Pages No./ Active UsersNo.	Edits No./ Active UsersNo.
AdaptTool Sum	0.68	0.71	0.69	0.67	0.68	0.72	0.40	0.51	0.49

There is a statistically significant correlation between the variables measured with Spearman's rho (p<0.5). The results illustrated in Table 2 reveal that in cultures with a higher level of adaptation process advancement, both the number of active users and their productivity are higher. The hypotheses 1 and 2 have been confirmed.

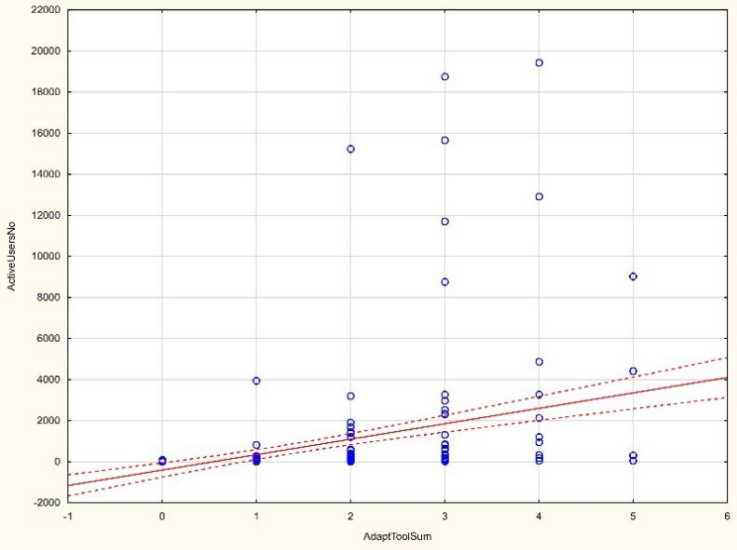


Figure 2:The relation between the variable AdaptToolSum and ActiveUsersNo. N=325.

The scatter plot of data presenting the relationship between the sum of adaptation tools in a given language version and active users number is presented in Fig. 2. It presents how the active users number rises with the rise of the advancement of the adaptation process.

While counting automatic welcome templates, their similarity and complexity were analyzed. The conclusions were the same as in the case of the welcome templates used by experienced users to welcome newcomers (Fig. 1) – they differed in terms of the number of elements (links) included, information provided, visual attractiveness, and graphic elements used. The exemplary variances of the templates are presented in Fig. 4.

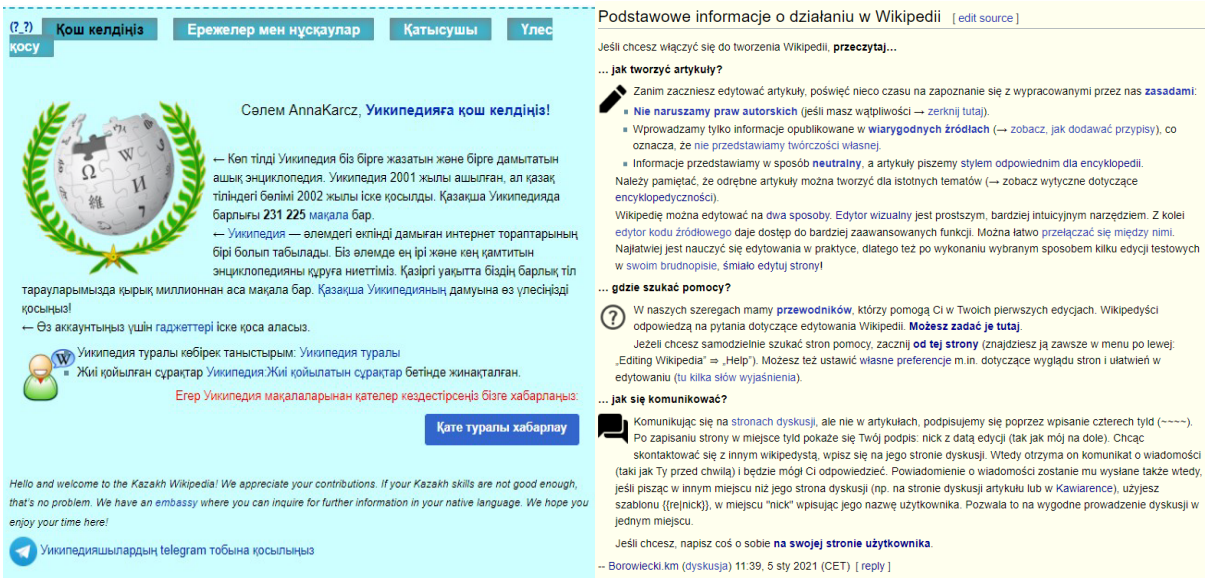


Figure 4: Examples of automatic welcome templates (Kazakh and Polish versions).

To determine if H3, H3a, H3b, and H3c are true, the author calculated correlations between the chosen Hofstede indices – Individualism (IndivIndex), Femininity (MASindex) and Uncertainty avoidance (UncertainIndex) and other chosen variables: the level of *complexity* of automatic welcome message template (measured with the sum of the elements presented – AutomaticWelcomeElemSum), the sum of elements in automatic messages *encouraging* the newcomers (AutomaticWelcomeEncourag), providing *requirements* (AutomaticWelcomeRules&Requir), and *offering help* (AutomaticWelcomeHelp). The calculated results are shown in Table 3.

Table 3: The correlations between the level of complexity of automatic welcoming message, encouragement, requirements and help in the automatic welcoming messages templates and chosen Hofstede indices value. N=15, p<0,05

Variables	Spearman's rank order correlation			
	Automatic Welcome ElemSum	AutomaticWelcome Encourag	AutomaticWelcome Rules&Requir	AutomaticWelcome Help
IndivIndex	0.427496	0.401923	0.535421	0.296029
MASIndex	-0.513542	-0.671635	0.188861	-0.268173
UncertainIndex	-0.103209	0.073999	-0.009443	-0.132124

We may note interesting findings that emerge from the data analysis. Three statistically significant correlations have been revealed. The masculinity index correlates negatively with the complexity of the automatic welcome message template (-0.51), as well as with the encouragement level (-0.67). The individuality index correlates positively with the level of rules and requirements of the automatic welcome message template (0.53). Unexpectedly, the encouragement and offering of help did not correlate significantly with the individualism-collectivism dimension. Only one aspect of the automatic welcome template content correlated with it, albeit the direction of the correlation was contrary to the expectations. As demonstrated by the results, some aspects of Wikipedia content are culturally dependent, but not all and not with every dimension of culture. The hypotheses 3a and 3c have been partly confirmed, while H3b has been rejected.

5. Discussion

Of all the main tools dedicated to the adaptation of newcomers in Wikipedia, only two exist in the majority of its language versions, namely the Help page (84.8%) and the Village Pump (75.1%), while one-third of wikis have got the frequently asked questions page (FAQ) and the Introduction page. Yet, some language versions of FAQ (e.g. Polish) have not been updated after successive changes of user interface (facilitating other ways of communication, other ways of editing pages, new kinds of user rights). This fact may reduce their usefulness to the newcomers. It is worth noting that a very small percentage of wikis use automatic welcome message template (12.9%), welcome templates category (10.5%), Teahouse (forum for newcomers) (8%), or a welcoming committee (6.5%). These tools are underestimated in the majority of Wikipedia language versions. It was proven by Morgan and Halfaker (2018) that retention of newcomers invited to the Wikipedia's "Teahouse" was higher. Hence, it would be advisable to use this tool more widely or invite newcomers to the special section dedicated to them in public forum.

It was found by numerous researchers that the strategies representing institutionalized socialization were negatively related to intentions to quit, while also positively relating to job satisfaction, organizational commitment, and activity performance. Newcomers who experienced institutionalized socialization usually have more certainty about their new role, while feeling more accepted, committed. They are less likely to drop out, and their activity is more effective (Saks, Uggerslev, & Fassina 2007; Choi, 2010, p. 108). The tools described in the presented paper were found to be more individualised than institutionalised. They are individual, random, informal, and variable. However, mentoring may be perceived as institutional socialization, because it is serial (experienced users serve as role models), not disjunctive (no role models). Similarly, a welcoming committee as a permanent body of members dedicated to initiating communication with newcomers, is rather formal, which is more typical for institutional socialization. Development of the tools typical for the institutional socialization in Wikipedia would be recommended.

As Chao et al. (1994) point out, new members who acquire greater knowledge about the internal group policy, the jargon, or group goals and values usually have a higher level of involvement and satisfaction from participating in the project. Not exactly the same, but similar conclusions arise from the presented paper. H1 and H2 were confirmed in the research – in Wikipedia versions with advanced and complex adaptation processes, the number of active users and the productivity of active users would be higher. The number of active users and content amount per active user rises with the growing advancement of the adaptation process.

It was expected that all three Hofstede indices correlate with several aspects of the automatic welcome message template content (H3). Surprisingly, some of the indicators studied appeared to have the opposite direction of correlation than was assumed (the individualism index: 0.535421). The scope of providing requirements is positively correlated with the individuality level in a given culture. After more profound analysis, one can explain

this phenomenon by the fact that more individualistic countries provide the necessary guidelines for the activity mainly in the template, whereas in more collectivist countries the guidelines might be transferred more directly, during interpersonal interactions in forums and discussion pages. Kukowska and Skolik (2021, p. 465) also note that collectivistic cultures are usually high-context ones, therefore not all the rules have to be explicitly indicated and thoroughly explained.

Moreover, it was proven that the more masculine a country is, the narrower the scope of complexity of the welcome template and the less encouragement for participation among newcomers (-0.513542 and -0.671635 respectively). This has confirmed the assumption from H3a, however only partly, as it was not applied to the aspects of the scope of the requirements, and help. This stands at least partly in accordance with the Hofstede's statements (2007) about the countries with higher femininity index, which are characterized by facilitating cooperation, relationships, and satisfying others' needs.

6. Conclusions and limitations

It is essential to create proper collaborative environment for newcomers, and strategies and tactics supporting it. Such adaption tactics as sharing knowledge with newcomers, regular offers of assistance, welcome messages, positive feedback on a newcomer's edits, and other ones, especially of an institutionalized nature, are all recommended to be implemented in online projects such as Wikipedia.

The wide range of possible adaptation tools is not used by the majority of language versions, as only two are applied in over 75% of versions. Initiating communication with new users in the form of automatic welcome template or welcome templates dedicated to the users are appreciated in the minority of versions. There is still a lot that could be improved in this respect. While developing strategies and tactics concerning Wikipedia's adaptation of newcomers, it is significant to take into consideration the cultural differences and different cultural expectations of the users.

It would be recommended to expand the research and confirm some of the results on a wider research population in various cultural contexts. The results may be of use to different virtual communities of practice and organizations which face the problem of adapting newcomers in the online knowledge sharing, or other open-source projects, as well as supporting virtual team management.

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The use of Virtual Learning Environment for Students' Effective Engagement in the Higher Education Institutions Through Knowledge Management and Blended Learning

Nasrullah Khan Khilji
School of Computing and Engineering, University of West London, London, UK
Nasrullah.Khilji@uwl.ac.uk

Abstract: The purpose of this paper is to examine the continuously growing use of Virtual Learning Environment (VLE) for students' effective engagement in Higher Education Institutions (HEIs) through knowledge management (KM) and blended learning (BL). Digital technology has transformed teaching and learning in such a way that VLE became indispensable part of HEIs to effectively engage students through blended learning. COVID-19 pandemic has severely affected organisations worldwide including the HEIs as institutions were compelled to close their campuses in response to lockdowns. The HEIs have responded with greater agility to transform campus teaching into virtual learning. VLE is relentlessly evolving in terms of scope and application while HEIs are renovating themselves in parallel ensuring a practical online platform for digital revolution. In this study, the identified research gap is determined to assess the level of students' engagement in their higher education through KM and blended learning specifically using virtual learning activities. A cross-sectional quantitative methodological approach is employed to assess the use of VLE on students' engagement through KM and blended learning. The students' effective engagement is assessed by employing the research arithmetical analysis method based on five demographic factors including their "age, gender, field of study, ethnicity, and mode of study programme". The collected data is systematically analysed to validate students' cognitive, emotional, and behavioural engagement through KM and blended learning practices. The effective students' engagement through KM and blended learning questionnaire 'KMSEBL'© is industrialized, comprising of five essential demographic factors "age, gender, ethnicity, field of study, and mode of study", containing 12 close-ended substances under three main dimensions to assess students' effective engagement including 'students' cognitive, emotional, and behavioural factors. The data outcome is later evaluated applying the Differential Item Functioning (DIF) analysis, which indicates that students' various groups and sub-groups responding in a different manner in context of elevated substances. The research result approves the role of technology innovation for enhanced students' engagement in higher education through KM and blended learning practices. However, the future research will investigate what specific KM and blended learning activities are essential in engaging students from diverse demographic, geographic, psychographic groups.

Keywords: Virtual Learning Environment, Higher Education Institutions, Knowledge Management, Blended Learning, Students' Engagement

1. Introduction

Technological advancement in education system is ultimately referred to virtual learning environment (VLE), which is increasingly becoming essential component of HEIs (Govindarajan and Srivastava, 2020). The HEIs, as a teaching provision, proposes various courses to prepare students for their careers to add value to the society. This means students, knowledge and technology play crucial roles in achieving education provision in the HEIs (Abass et al., 2021). Knowledge sharing through blended learning is a cause of knowledge management (KM), which is a fundamental element in HEIs that requires an appropriate use of VLEs to circulate knowledge from teaching and research through e-learning (Hargitai et al., 2021). However, the VLE major challenge is how to engage students effectively through blended learning practices. The necessary knowledge management resolutions perform a promising role in the blended learning with the help of technology innovation. The higher education institutions are interestingly developing, adopting, implementing, and practicing blended learning techniques where the influence of knowledge management practices play an important role on students' engagement through blended learning (Galvis, 2018).

The teaching and learning paradigm of education has been severely disrupted during COVID-19 pandemic, and specifically the closure of educational institutions due to lockdown regulations. Campus based teaching sessions in HEIs got cancelled during the lockdown and other teaching arrangements such as blended learning methods are greatly adopted for students' learning, attaining, and assessing (Snelling, 2022). This restructuring in the HEIs presented a sharp growth in the application of web portals whereas academics in higher education institutions have had to swiftly adjust their teaching delivery to the changing environments and to promote blended teaching and guided learning practices for students' learning using different tools such as Microsoft Teams, Collaborate, Zoom, Google Classrooms, and educational software such as Canvas and Moodle (Huang et al., 2020). The blended learning platforms are continuously developed to ensure a better use of the real potential

of digital technology whereas enhancing students' learning experience because of innovative methods (Nair and Munusami, 2020; Hargitai et al., 2021; Al-Omoush et al., 2022).

The HEIs as learning organisations are now required to play an important part in the knowledge-based economy though universities being the centre of excellence are proficient to spread knowledge, skills, and expertise whereas facilitating to prepare top quality graduates for employability and economic growth (Ramirez-Solis et al., 2022). The advancement in technological development plays crucial role in the continuous creation and development of knowledge as an intellectual capital (Aljuboori et al., 2022). At the same time, this is apparent that the universities remain as the hub of expertise or source of knowledge whereas the HEIs mission as well as the fundamental purpose ensures to create, process, store, disseminate, and implement knowledge for the overall vintage of the economic growth of the nation.

In the current global scenario where knowledge driven economy is indispensable, which is supported by technology innovation to set a new paradigm within HEIs for academic, research and enterprise activities through blended learning (Powell and Claxton, 2019). The knowledge based blended learning practices in the higher education seeks to further promote acquisition of soft skills and knowledge sharing by supporting best practices in academic, research, and enterprise activities. This is now becoming obvious that teaching and learning practices in the HEIs are required to be influenced by knowledge management on students' engagement through blended learning in the post COVID-19 era (Castro, 2019).

2. Literature review

The interpretation of blended learning in the higher education spotlights various provocations related to guided learning although this can be sometime classified inappropriately when the narrative lacks precise description in the right context (Armellini, et al., 2021; Bidarra and Rusman, 2017). It is believed that 'blended learning' might be enormously creative teaching method by describing a guided learning techniques as stated by two prominent authors i.e., Garrison and Vaughan (2007). They defined 'blended learning' in their book, *'Blended Learning in Higher Education clearly demonstrates how the blended learning approach embraces the traditional values of face–to–face teaching and integrates the best practices of online learning. This approach has proven to both enhance and expand the effectiveness and efficiency of teaching and learning in higher education across disciplines'* (Garrison and Vaughan, 2007). Despite inconsistent descriptions, a blended learning approach possesses particular abilities to intensify the HEIs' competences precisely (Nair and Manusami, 2020).

2.1 The concept of knowledge management in the HEIs

The use of VLEs for students' engagement through KM and blended learning in HEIs is becoming invaluable for several reasons such as addressing students' learning needs for flexibility, agility, and responsiveness. The core idea behind blended learning is to restructure the teaching and learning practices in the HEIs to get the best out of academic expertise for knowledge sharing (Galvis, 2018). The academic experts who are the knowledge specialists and exist as the centre of excellence specifically for students' engagement to attain learning outcomes effectively. The literature highlights a significant academic contribution in the blended learning application from the perspective of knowledge management though it remains a challenging process (Shahzad et al., 2020). However, the knowledge specialists are anticipated to better scrutinise the restructuring pedagogy excellence while efficiently fostering knowledge driven blended learning, which can enhance students' skills, awareness, and performance through knowledge-based blended learning activities (Azizan et al., 2022). In the technology-oriented approach, Information Technology (IT) is a main driving force for KM and blended learning to enable the creation, distribution, and renovation of knowledge (Williamson et al., 2021).

In the HEIs, KM practices are distinctive sort of information management that aimed for capturing, codifying, creating, communicating, storing, transferring, retrieving, and using of best practices. The fundamental concept of the knowledge-based approach in HEIs is to support staff of the institution to have straightforward access to the codified knowledge, access to the sources of information for solving various academic and administrative problems (Alghail et al., 2021). This encourages the importance of incorporating a knowledge sharing culture in the HEIs to succeed as there is always a risk of losing or forgetting the acquired knowledge. The stream of knowledge sharing needs to be communicated rather than just storing or recording it (Kumar et al., 2022). Viju (2010) presented a general KM framework provides a base for blended learning as shows below in Figure 1.

KM framework is required to continuously disseminate the relevant information to the staff and students at the time when they need it, which can further enhance the efficiency instigating a competitive advantage for HEIs.

In simple words, KM approaches are needed to be designed to support KM processes can be deployed with the expectation that HEIs will have a constructive impact on enhanced performance (Sunalai, 2015). The concept of KM in higher education is the process of creating, disseminating, using, and organising the information and knowledge of any HEIs (Nair and Munusami, 2020). This notion is considered as a multidisciplinary method in accomplishing organisational strategic plan by applying the best use of knowledge (see Figure 1).

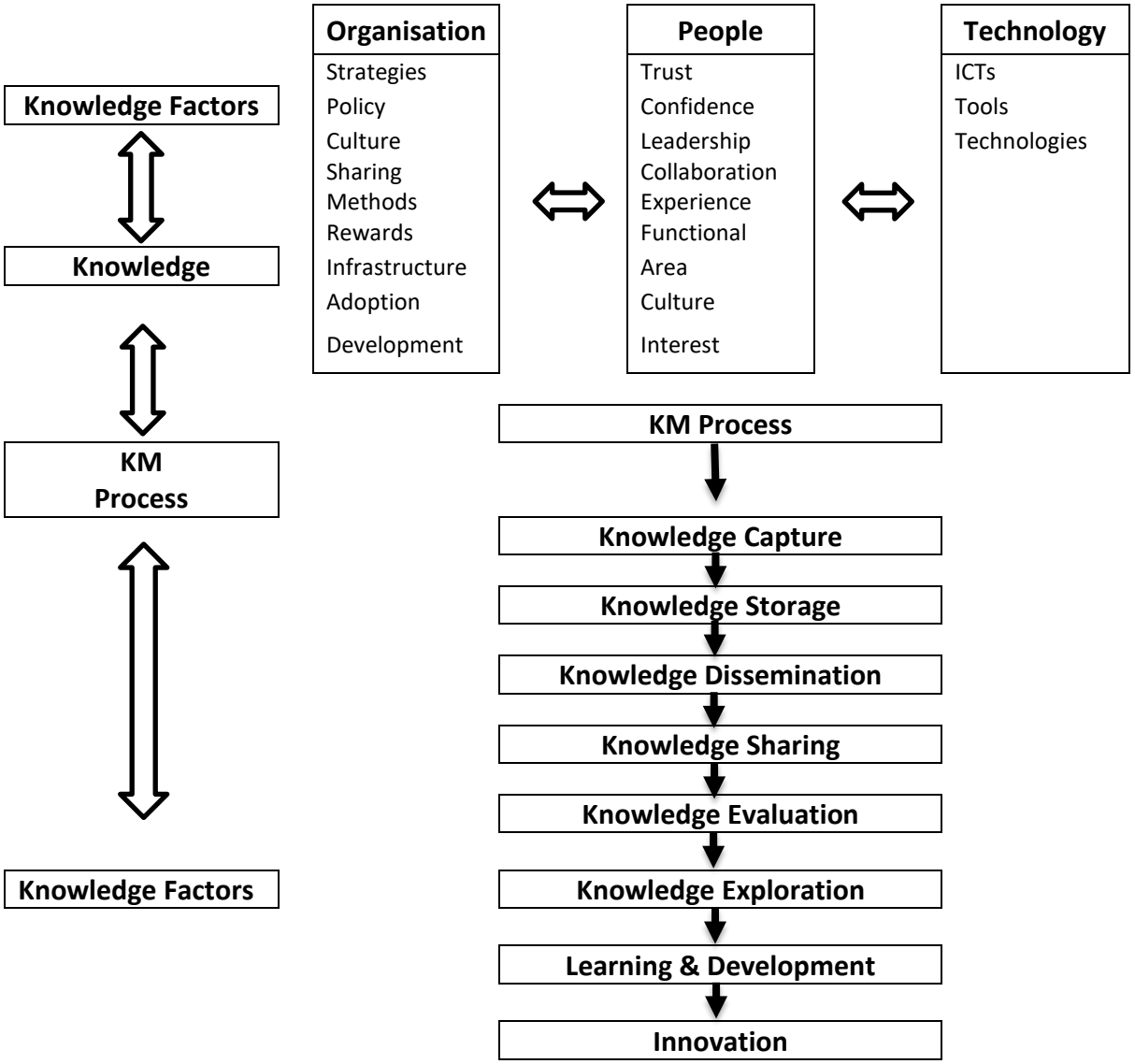


Figure 1: Conceptual Model of KM Framework (Viju, 2010)

2.2 The role of KM in higher education

The HEIs are already playing an essential role in creating, managing, organising, applying, and sharing knowledge to students and academics. This is crucial for the HEIs to remain dynamic and agile in responding to a knowledge-based blended learning being a learning organisation whereas keep playing a viable role based on the knowledge management strategic plan (Zyngier, 2021). The HEIs are comprised of many stakeholders such as academics, admin staff, learners, researchers, enterprises, and academic partners though each of these stakeholders generate and disseminate explicit and tacit knowledge in different dimensions. The utmost goal of HEIs is to keep imparting an explicit and tacit knowledge while making knowledge accessible to many of their internal users through blended learning. This is assumed that the HEIs create and share knowledge with both internal and external stakeholders effectively by transmitting an individual's knowledge with several users by practicing a systematic approach (Finlay et al., 2022).

To bridge the identified gap, this is essential that VLE is deployed to effectively engage students through KM and blended learning as an essential determination to enhance the competitive standing of HEIs while developing

their dexterity for blended learning (Chatterjee at el., 2021). This is equally important that blended learning practices in HEIs progressively support enhanced students' engagement whereas reducing the turnaround timing for academic activities as well as reducing the operations expenses. This means that the HEI achieve the best out of VLE by ensuring an improved academic quality and standard in term of reviewing the curriculum aligned to the students' employability. This identifies how a KM is developed as the fundamental intellectual capacities of academics to provide an excellent learning experience, pedagogy excellence, digital process, and continuous emerging technological advancements (Debaprasad et al., 2022).

2.3 Blended Learning in HEIs

The term blended learning is reviewed broadly in recent literature, emphasizing on the statistical analysis such as meta-analysis that examines the effectiveness of technology employed in KM and blended learning (Castro 2019; Auvinen et al., 2015). The knowledge based blended learning ecosystem covers wide range of practices such as in campus face-to-face interaction, online guided materials, discussion forums, synchronous conversation, announcement, assessments, and feedback. This indicates that the blended learning platforms supported by VLE provide robust students' support while ensuring new prospects for them. Blended learning support students to remain effectively engaged during their studies whereas continuously enriching their learning experience by online facilities (Al-Omoush et al., 2022).

On the other hand, the design of blended learning environment is based on various challenges including integrated flexibility, enhanced interaction, students' learning support and an encouraging students' engagement as described by Chuang et al., (2018). Similarly, the blended learning approach is considered to provide students an opportunity to continuously enhance their skills, knowledge, and performance while developing a positive attitude towards learning outcomes (Gopalan et al., 2018). In similar note, the blended learning provides a teamwork, collaboration, diversity, critical analysis and problem-solving in the course studying activities. However, this is vital that such learning activities could be created in such a way to stimulate interactions among students and their lecturers for enhanced engagement and improved performance (Kopcha et al., 2015).

3. Methodological approach

A cross-sectional quantitative method is used in this research to examine the use of VLE for students' engagement through KM and blended learning. The students' enhanced engagement through KM and blended learning questionnaire is developed 'KMSEBL'© consisting of five essential demographic components whereas comprising 12 close-ended substances under three main dimensions to assess students' effective engagement. The four fundamental questions were about participants' age, gender, ethnicity, field of study, and mode of study although the three dimensions comprised of students' cognitive, emotional, and behavioural engagement. Each selected dimension is clustered with its set of close-ended substances i.e., four items are assigned to emotional engagement(1x4), four items are assigned to analytical engagement (1x4), and four items are assigned to the behavioural engagement (1x4).

The questionnaire survey with 12 close-ended questions within the three underlined dimensions is employed to assess students' engagement in blended learning. The close-ended items appear in a variety of structures, though the questionnaire is clearly defined in an explicit layout for participants. The KMSEBL questionnaire consists of a five-point Likert type scale for all the 12 substances ranging from strongly disagree (1) to strongly agree (5). According to Farrell (2016) the closed-ended questions are often good for surveys, because the researcher gets higher response rates whereas participants do not have to say or type so much. This indicates that a close ended questionnaire can easily be analysed statistically, which is useful to carry out any survey data.

In this study an online questionnaire approach is applied to invite some 300 students specifically at level-6 and level-7 studying various courses in the HEIs in UK. The participants in this study are asked for their consent to voluntarily take part in this study by their free choice. The research ethics is taken in consideration and students could access and complete the questionnaire anonymously and voluntarily. The data is collected through an online survey, after the online questionnaire is distributed among students to be completed by all the participants after their prior consent.

The initially targeted 300 students, and in the end some 251 responses are received. However, there are 23 outlier responses, which is considered as out of scale ranging maximum or minimum ratings only. However, there are 11 misfit responses and after omitting the misfit responses. Finally, 217 responses are processed for

final analysis with 72.22% success rate as shown below in the Table 1. The collected data from successful completed questionnaire is interpreted and inserted into the data analysis spreadsheet for data analysis to generate the research result. The analysed data is further introduced to the Rasch analysis to make available by applying a participants' score scale while expressing the use of VLE for students' engagement through KM and blended learning. The Rasch analysis provided a unique approach of mathematical modeling based upon a rating scale, which is adopted as a common method of research data collection and analysis.

Table 1: Data Collected from Students' Responses (N=217)

Factor	Description	Number	Percentage
Gender	○ Male	*102*	*47%*
	○ Female	*115*	*53%*
Age	○ 24 and below	*65*	*30%*
	○ 25–34 years old	*134*	*62%*
	○ 35 and above	*18*	*8%*
Ethnicity	a) White British	62	29%
	b) Other White	26	12%
	c) Mixed	12	5%
	d) British African-Caribbean	13	6%
	e) British Asian	25	12%
	f) British Chinese	19	9%
	g) Others	60	27%
Field of Study	a) Computing, Engineering & Technology	78	36%
	b) Health, Medicine and Nursing	46	21%
	c) Social Science, Law, and Business	42	19%
	d) Arts, Film, Media, and Music	12	6%
	e) Hotel, Tourism and Hospitality	34	16%
	f) Sports and Education	5	2%
Programme	○ Full Time	202	93%
	○ Part Time	15	7%

3.1 Research analysis model

The role of VLE for students' engagement through KM and blended learning is expressed as a source of judgement, experience, opinion, or attitude in students' engagement effectively. The latent trait theory is applied to understand students' engagement behaviour that's why certain students have a particular trait that could be a reason for their engagement in blended learning (Rajabalee and Santally, 2021). These might be invisible attributes, which could not be easily observed directly. The latent trait theory is applied for such reason to assess students' engagement through KM in blended learning. The 'KMSEBL' questionnaire as an instrument is applied to collect data, then the Rasch measurement model is used for data analysis (Nurulhuda et al., 2018).

The research outcome is applied to further investigate students' engagement through KM and blended learning within the HEIs amassed on age, gender, ethnicity, field of study, and mode of programme applying the expressive data. The descriptive statistics such as the mean, median, standard of deviation, scores, logarithm, value of substances, and value of student. The average calculation is in the structure of logit scale. Therefore, if the value of substance is positive, the student is supposed to be clearly engaged in the blended learning as per the mean. If the logit value is negative, this means student is disengaged in the blended learning. This verified that the higher logit value indicates the higher levels of students' engagement in their HEIs.

3.2 Data validation

The research result is validated by applying the latent trait theory to ensure the reliability of the 'KMSEBL' instrument. A double value consists of both students and substances scoring to use in the rating scale model. The twelve close-ended substances are valued for all successful 217 responses in context of the blended learning. The Rasch model approach is applied to calculate values from responses based on students' demographic dimensions. The substances are initially positioned null, which allowed to gauge the tolerance level for student's engagement in blended learning.

Table 2 below illustrates the 'KMSEBL' instrument as a student's Separation Index (3.36) and the substance's Separation Index (7.62). The value from student's Separation Index and substance's Separation Index provided an evaluation about the 'KMSEBL' reliability. This provided the ability to identify how well the tool illustrated to differentiate among 'student's capabilities' in terms of the latent trait and how extensively the substances are distinguishing between the simple and complicated substances (Hamed and Al-Eideh, 2020; Jeong, 2022). The higher the Separation Index value, the more likely participants respond appropriately to the substances. The 'KMSEBL' tool in this research study illustrates a decent value spread within the grading range of items approving the process fit for purpose as a reliable method by identifying students' engagement in blended learning. The 'KMSEBL' tool provided a satisfactory single measurement (57.3%), with its fundamental variance above the standard of 50% (Li et al., 2021). This clearly demonstrated how to effectively measure students' engagement in the blended learning activities.

Table 2: Summary of Person and Item Separation Index

	Students	**Substances**
Separation	3.36	7.62
Reliability	0.94	0.97
Cronbach's alpha	0.941	
Chi-square (χ2) Raw variance explained by measures	57.3%	

** $p < 0.01$

The calculated values advocated the chi-square (χ2) statistic, which is applied to measure the difference between the examined and anticipated values of the variables. This provided the outfit mean-square statistics for both student and substance close to 1.0, which is endorsed by a substantial level of chi-square score for data reliability model (Boone et al., 2014; Engelhard, 2013). However, the grade ratio analysis in Table 3 below suggests the five-rating scale (strongly agree to strongly disagree). The Likert scale is applied to identify how students easily understand with the upper limit such as grading scale of 1.0 to 5.0 (Li et al., 2021; Jeong, 2022). The calculated values demonstrated that there were no disordered tolerances. This indicated that the average student assessed as per the classification is pushed up monotonically with the rating scale variables, which confirms that the Likert scale classifications are justified and well operating.

Table 3: Rating Scale Model Category Statistics for the Total Sample (N=217)

Category	Frequency	Percentage	Average measure	Outfit MNSQ	Step
1 (SD)	85	1%	-2.73	1.19	NONE
2 (D)	1428	19%	-0.17	1.01	-4.24
3 (A)	4366	59%	+2.01	0.97	-0.21
4 (SA)	1513	20%	+4.89	0.98	+4.47

3.3 Data Outcomes: students' engagement through KM and blended learning

The use of VLE for students' engagement through KM and blended learning in the higher education institutions is indicated as data outcomes. From the data collection and analysis, the students' engagement influenced by KM is assessed. As illustrated in the Table 4, the mean value (logit) as per students score, which is calculated 2.12 logit. This suggested that students are highly engaged in their blended learning activities. The standard deviation is calculated of 2.15 that indicated a wide distribution level. However, as per the mean value (logit) of substance, the mean is calculated 0.03 logit and the standard deviation is 0.82. This verifies a wide distribution of scaling across the logit scale in item complexity level as shown in the Table 4.

Table 4: Summary (Logit) Value of Person and Item

	Students	**Substances**
N	217	12
Measures (logit)		
Mean	2.12	0.03
SD, standard deviation	2.15	0.82
SE, standard error	0.06	0.02
Outfit Mean Square		
Mean	0.97	0.97
SD	0.52	0.23

3.4 Data Variation: Differences in students' engagement in blended learning based on gender, age, ethnicity, field of study, and mode of programme

The collected and analysis of data in this study further indicated that there is variation in terms of students' engagement through blended learning in the HEIs. This is verified by applying the analysis of variation (ANOVA). This clearly illustrates that the ethnicity and field of study got a substantially higher difference at $p < 0.05$ as shown in the following table 6. However, the other factors do not show much high variation in statistical calculation including age, gender, and mode of programme delivery.

Table 5: Students' Blended Learning Engagement Level According to Demographics

Factor	Description	Very Low LVP <-1.25	Low LVP <2.25 ≥1.25	Moderate LVP <3.25 ≥2.25	High LVP <4.25 ≥3.25	Very High LVP > 4.25
Gender	○ Male	*7*	*13*	*36*	*24*	*22*
	○ Female	*4*	*15*	*43*	*32*	*21*
Age	○ 24 and below	*4*	*11*	*15*	*33*	*5*
	○ 25–34 years old	*12*	*20*	*26*	*54*	*22*
	○ 35 and above	*1*	*3*	*4*	*6*	*4*
Ethnicity	○ White British	2	6	14	32	10
	○ Other White	1	1	4	14	6
	○ Mixed	0	1	1	7	3
	○ British African-Caribbean	1	1	4	5	1
	○ British Asian	1	4	6	10	4
	○ British Chinese	1	3	1	12	2
	○ Others	5	9	12	24	10
Field of Study	○ Computing, Engineering & Technology	4	7	9	40	18
	○ Health, Medicine and Nursing	2	5	14	18	7
	○ Social Science, Law, and Business	1	4	7	21	9
	○ Arts, Film, Media, and Music	0	1	2	6	3
	○ Hotel, Tourism and Hospitality	2	6	4	17	5
	○ Sports and Education	1	1	1	2	0
Program	○ Full Time	16	21	32	87	46
	○ Part Time	1	1	3	7	3

Table 5 below classifies students into five levels of blended learning engagement (ranging between very high level to low level of engagement). Using the demographic dimension of students and the logit value of person (LVP), the table below suggested in detail about each classified level of participation. This analysis indicates that the demographic factors such as age, gender and ethnicity were having different effects on students' engagement. For-example, the analysis of students' gender observed 46 out of 102 male students (45%) and 53 out of 115 female students (46%) are found in high and very high level of engagement though blended learning. In the average level engagement, there are 36 male students (35%) and 43 female students (37%); students who were low-level engagement was the least (13% and 17% respectively for male and female students).

Table 6: ANOVA of Students' Demographic Variables

No	Demographic Variable	F-test
1.	Gender	1.988
2.	Age	0.208
3.	Ethnicity	3.349*
4.	Field of Study	2.359
5.	Programme	0.797

note: *$p < 0.05$

3.5 Differential Item Functioning (DIF): Respondents' Demographic Factors in Blended Learning Engagement

The advancing phase of data analysis provided further facts to differentiate between the students based on their chosen five set of factors to better understand their engagement through blended learning. The data analysis

outcomes were evaluated applying the Differential Item Functioning (DIF) analysis, which indicated that students' various subgroups responded in a different way to the elevated substances (Jamalzadeh et al., 2021). These findings further supported the detection of unique commitment of student at various substances from high to low levels. The data result from the DIF analysis illustrates the examined five factors to achieve significant outcome and for comparative analysis. There are ten items out of twelve, which have shown distinct demographic variables in the DIF. The data elements indicated important variation in responses as highlighted on both sides of the scale size > 0.5 logits, t > 2.0 or p < 0.05 as presented in the following Table 7 which indicates the effective engagement of student in their higher education through KM and blended learning practices.

Table 7: Summary of Differential Item Functioning Based on Students' Demographic Variables

Item	Statement	Demographic with DIF
A1	I am motivated to get engaged when performing online tasks	Gender
E3	I give importance to studying together and getting engaged in online learning with my classmates in a group task	Mode of delivery
D3	I feel my classes are more interesting when performing task online with my classmates.	Field of study
C4	I complete and submit assignments on time online	Field of study and Age
B5	I try to do my best to get fully engaged through blended learning group work.	Age
A3	I easily access the guided learning materials from the VLE	Gender
B3	I use reading materials through blended learning using VLE online before attending classes	Age
A2	I am capable to discuss assignments with my classmates using my university's learning management systems	Gender, Filed of Study

4. Conclusion

The outcome of this study reveals the role of VLE for students' effective engagement through KM and blended learning in their higher education attainment. The collected data valuation suggested how certain variations such as gender, age, ethnicity, field of study, and mode of their course delivery could affect the students' engagement. This indicated that support of virtual learning environment further facilitates blended learning practices as per students' motivation, competency, knowledge, behaviour and soft skills aptitude. This study examines how pedagogy excellence is essential to ensue knowledge management supported by agile processes and innovative technology to foster students' high levels engagement through blended learning, which requires good understating and well-planned strategies to be in practice (Roe et al., 2022). However, this study got some limitation on its own; for-example the sample size of participants is quite small as collected data within faculties of the same institution in the same country.

This study is proposing further research in the future studies focusing the concept of blended learning across wider range of HEIs within UK and abroad for comparative analysis. Similarly, this study faced constraint because of only quantitative data without applying the qualitative methods for cross-functional research analysis. In the same context, this is recommended to carry out further research adding qualitative data through open ended substances in the interview format. Moreover, the additional research study will examine how and why VLE is needed for students' engagement through blended practices. The future study will investigate what specific KM and blended learning activities are crucial in engaging students effectively from diverse demographic, geographic, psychographic groups. This will substantially enhance the existing body of knowledge and understanding about various other substantial factors. In conclusion, this is necessary in future research to focus how KM and blended learning are employed within the higher education institution's strategic planning.

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Challenging the IC Theory: Suggestions for Some Ways Forward

Aino Kianto[1] and Sladjana Cabrilo[2]
[1]School of Business and Management, LUT University, Lahti, Finland
[2]I-Shou University, Kaohsiung City, Taiwan
aino.kianto@lut.fi
sladjana@isu.edu.tw

Abstract: Understanding how knowledge and related resources has permeated scholasticism and an intellectual capital (IC)-based view of the firm, and it has gained increasing weight in contemporary management literature. Manifold impacts of IC on organizational performance have been widely evidenced with management mechanisms for various IC dimensions to be found in most established organizations. As research is a strongly path-dependent activity, it seems natural that IC research may lean on classical frameworks and conceptualizations from prior decades. However, this consideration may be problematic, since large-scale changes in companies' operating environments, such as digitalization, a crisis in sustainability, as well as reaction to the COVID-19 pandemic through remote-working initiatives. Consequently, call for new knowledge resources comes into play naturally. In this paper, an argument is made that the normative approaches for conceptualizing IC and its performance relevance must be updated. Further, we suggest that the new post-pandemic world of enterprise calls for novel understandings relevant to IC. To spur new thinking that offers a way forward, a theoretical model is proposed for a revised understanding of IC and its role in organizational viability. Important new issues are examined as related to various IC elements. The paper contributes to IC research by constructing a revised model of IC useful for generating topical research models suitable for development and testing in future theoretical and empirical studies. A set of potential research questions is outlined to guide additional research.

Keywords: Intellectual capital, performance, theory, future, digitalization, remote work

1. Introduction

Worklife as we know it is facing fundamental transformations. The spread of Covid-19 has brought a major challenge to companies that have already been facing globalization, sustainability and environmental uncertainty. Companies not only needed to prevent the spread of Covid-19 through organizational isolation, but they also have to find effective ways to maintain optimal performance. Remote work was found to be a good way to achieve both of these goals during the pandemic (Liu et al, 2021).

Given that there are more than three billion Internet users in the world, along with increasing numbers using digital technologies to work "remotely" (Donnelly and Johns, 2021), the need for workers to adopt skill sets to meet the requirements of digitalization for future jobs (Habraken and Bondarouk, 2017), the rise of crowd-sourcing platforms and co-creative networks for innovation and prosperity, leads to the immediate main inquiry of this paper: "Do we need to redefine knowledge-based resources that contribute to organizational value-added process and consequently to re-conceptualize intellectual capital (IC) framework?"

IC theory, which asserts that organizational 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; 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 organization'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 intellectual capital-based view of the firm, and it is astutely followed by most researchers in this field. Because research is a strongly path-dependent activity, it is natural that IC research leans on classical frameworks and conceptualizations, whereby most IC studies adhere closely to the classical conceptualizations of IC components.

However, this modality may be problematic, since large-scale changes in companies' operating environments and worklife have called for new knowledge resources. Thus, it is necessary to rethink the nature and content of IC along with novel theorizing of IC paradigms. The aim of this paper is to put forward generalized propositions as provocations for both debate and future research impetus, which are likely to shed further light on the revised concept of IC and its performance effects in the digital economy and the post-pandemic work-place.

2. IC-relevant changes in companies' operating environments and the work-place

The work-place is facing large-scale changes due to ecological, political and economic uncertainties. In order to remain competitive in the face of digitalization, diversified work-place arrangements, and the manner of innovation being brought about, organizations require new resources and improved capabilities (Colbert et al, 2016; Habraken and Bondarouk, 2017). In the following, we discuss major changes impacting the nature of IC at present.

2.1 Digitalization

According to Industry 4.0 parameters, digital technologies have increasingly changed the organization 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 organizations (Ludivine, 2017). However, at the same time these present challenges, new technologies are also dramatically changing employment and work features across many fields of work (Cooper and Lu, 2019; Felstead and Henseke, 2017). Digital technology enables the increasing fragmentation of work facilitating complex employment relationships (direct and subcontracted), the growing use of part-time and shift work, and the empowering individualization of employment opportunities, or 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, collaboration occurs across geographical, functional, and hierarchical borders (Lepofsky, 2016) necessitating many aspects of IC to update.

Increasingly, robotization and automation require workers to build digital competencies and to adopt new skill sets needed to work in the new jobs being created (Habraken and Bondarouk, 2017). Furthermore, the rise of crowd-sourcing platforms which are online organizations that organize work by sourcing tasks to their members, independent contractors, so-called gig workers 'hired' on-demand (Nakatsu et al, 2014) has fundamentally changed working relationships.

Proposition 1: Digital skills are an important aspect of human capital in digitalized work-place

Digital-era organizations must not only cope with disruptive technologies and innovation, but adapt their business philosophies and business models, including mindset (organizational and individual), culture, and competencies to a digital way of working (Murakowski and Bick, 2017). Creating an open culture that embraces independent and on-demand workers allows organizations to benefit from external ideas and to engage them in innovation and value creation (Smith, 2020). Digital organizational culture has been found to support digital capabilities and innovation performance (Zhen et al, 2021).

Proposition 2: Open digital culture is an important facet of structural capital in digitalized work-place

2.2 Remote work and gig 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 a traditional fixed places of employment (Felstead and Henseke, 2017). Remote working is not a product of the Covid-19 pandemic, but it has gained momentum and proved its significance as a result of the Covid-19 crisis' catalytic effect (Liu et al, 2021; Donnelly and Johns, 2021). It is evident that remote-work has increased in scope and relevance, and the profile of the remote worker has changed and become diversified (Mahadevan et al, e 2022). What was an exception or evolving concept has suddenly altered the standard during the pandemic crisis. It will very likely remain an important way of working in the future because workers have already experienced the benefits of remote working or working from home.

Established concepts exist in the human resources management literature for flexible work arrangements (Berkery et al, 2017), gig work (McDonnell et al, 2021; Williams et al, 2021; Boons, Stam, and Barkema, 2015), virtual teams (Adamovic, 2018), and digital nomads (Hannonen, 2020). These practices allow for new ways of work outside of traditional organizational boundaries and have been related to the larger phenomenon of 'remote work'. Externalization of employee work has been seen principally as a negative trend from an employment perspective, as work relationships become more fluid, and shorter in duration (Hollister, 2011) and somehow 'less under traditional control' mechanisms. It has been suggested that the restrictions of managerial control under remote work arrangements are compensatory to employees' self-management and displayed leadership skills.

Self-leadership (Manz, 1986; Manz and Sims, 1986) is a process through which people are influenced to achieve the necessary self-direction and self-motivation to behave and perform in desirable ways. Self-leadership is a broader concept of self-influence that encompasses self-control, self-regulation and self-management. It draws upon intrinsic motivation theories (e.g. Deci and Ryan, 1985), social cognitive theory (Bandura, 1986), and positive cognitive psychology (Seligman, 1991) to understand sets of behavioral and cognitive strategies designed to shape individual performance outcomes (Houghton and Neck, 2002; Neck and Houghton, 2006). Self-leadership theory posits that even though external contexts and activities influence behavior, actions are ultimately controlled internally by the individual, which is focused 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). Three distinct but complementary categories of self-leadership influence its eventual outcome: behavior-focused strategies, natural reward strategies, and constructive thought pattern strategies (Prussia et al, 1998). It is argued that in remote work arrangements, self leadership is an important skill for both internal and external human capital, and it should be included in the associated research models.

Proposition 3: Self leadership is an important aspect of human capital in remote work contexts

Furthermore, in today's digital economy, the traditional full-time employed labor force seems to be dwindling, and a growing number of workers, especially highly-skilled professionals, prefer to work as autonomous and independent self-employed, freelance contractors (Vaiman et al, 2011). Contingent work is a form of 'non-standard' employment, which presents the hiring of workers on 'contingency', or on 'fixed-term contracts' (Conelly and Gallagher, 2004). Organizations around the world benefit from contingent work situations by saving on labor and related costs (Smith, 2020), and by becoming more agile and able to respond to rapid-fire change.

Gig work is made up of short-term jobs (gigs) and presents a type of contingent work that typically falls outside the boundaries of an organizational purview. Digital platforms connect gig workers directly with customers and clients (Harris, 2017), and therefore gig workers are rather classified as independent contractors than as employees (McDonnell et al, 2021; Halliday, 2021). In the gig economy, organizations do not hire workers, but rather mediate an exchange between gig workers and customers with all work and requested tasks managed by algorithm (McDonnell et al, 2021). In this new economic system workers are not engaged in 'jobs' and have no long-term connections with a company, but are instead hired on-demand for 'gigs'. This allows for flexible arrangements as independent contractors, working only for a defined time, are able to complete a particular task without the need for connection with an 'employer' (Friedman, 2014).

However, since gig workers have no traditional employment relationships with organizations (Halliday, 2021; Friedman, 2014), managing this workforce may become a considerable challenge. These on-demand, 'hired' workers may feel disconnected to an organization resulting in diminished loyalty to any organization. Therefore, further analysis regarding implications of contingent work on organizational structure, leadership and talent management, organizational culture and trust should be made to facilitate a reexamination of specific organizational theories and models, among others, knowledge-based theory (Grant, 1996) and the overall concept of IC.

Thus, the question remains on how to consider knowledge, skills and experience of workers with zero-hour contracts that do not require a minimum number of working hours by an employer - as a part of an organization's intellectual (human) capital, or not? We argue that no matter of their formal employment status, workers that create value for a company, should be counted as its human capital. However, there have been the opposite views, for example, in financial accounting, an asset is any resource owned or controlled by an economic entity, and following this definition, remote workers that are not fully owned or controlled by a company do not represent its human capital. In any case, it seems important to rethink concepts and theories being affected by externalization of work and other changes in nature of work, including the concept of IC, which is the main aim of this paper.

Proposition 4: Gig work and other contingent work should be acknowledged as an important aspect of human capital

2.3 Open innovation and crowd-sourcing

Recently, open innovation and crowd-sourcing have received much attention in the innovation management literature (Cricelli et al, 2021). There is a successive change occurring in how innovation has been viewed

throughout time. The innovation paradigm has shifted from 'closed innovation' to 'open innovation' or 'networked innovation' models, and subsequently to 'participative innovation', to become an integral characteristic of Open innovation 2.0. (Chesbrough, 2003; Curley and Salmelin, 2018). As innovation has become the most typical performance variable in IC research (Inkinen et al, 2017), this novel 'participatory innovation' paradigm should also entail changes in the IC field.

Open innovation (OI), as introduced by Chesbrough (2003), is an innovational practice that strives to provide a greater knowledge flow allowing innovation to become quicker, easier and more effective through an exchange of ideas by means of collaborative and open network environments (Curley and Salmelin, 2018). It is characterized by shared knowledge, critical resources and capabilities, within and across the boundaries of organizations in order to exploit both, the internal and external knowledge and ideas (Chesbrough, 2003). In open innovation, ideas pass to and from different organizations for purposes of exploitation. Based on bi-direction knowledge flows, two distinct directions in open innovation process have been referred as inbound OI (outside-in processing) and outbound OI (inside-out processing) (Gassmann et al, 2010; Huizingh, 2011). Inbound OI refers to the internal use of external knowledge, from various innovation sources such as partners, customers, universities, and research organizations; and, outbound OI refers to external exploitation of internal knowledge, through the sale of patents, or through direct licensing (Cricelli et al, 2021).

For IC theory, this creates knowledge-based value resources that not only relate to intra-firm resources and capabilities, but also to those over and across organizational boundaries. Thus, the available "external" human, structural and relational capital should be better acknowledged for understanding open innovation practices.

Proposition 5: External IC resources are important for open innovation

Crowd-sourcing, 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). Crowd-sourcing 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 their own experience (Buettner, 2015).

The adoption of OI strategies asks for the reorganization 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 6: Open and entrepreneurial culture is an important facet of structural capital that supports crowdsourcing and use of collective intelligence

3. Consequences for IC theory

3.1 IC components

Considering the global externalization of work, changing employment and work relationships, required skills and workplace mindset, we argue that the IC concept would benefit from updating due to digitalization. The large-scale changes discussed in previous chapter have brought new challenges for IC and addressing them requires expanded knowledge assets.

To retain performance and competitiveness in the changed and digitalized economy, companies must rethink and revise the concept of IC by initiating updated metrics in manage practices. Changes in implementing organizational environment, work relationships, nature of work, job-demand skills, and innovational practices ask for a more 'open approach' to the concept of IC. This means necessitates opening IC management boundaries to the outside and to adequately emphasize the external dimensions of IC (Chen et al, 2015). All previously-mentioned changes redefine the boundary between the firm and its surrounding environment, making the firm more porous and then connecting loosely with other value creators in an open innovation eco-system (Chesbrough, 2003).

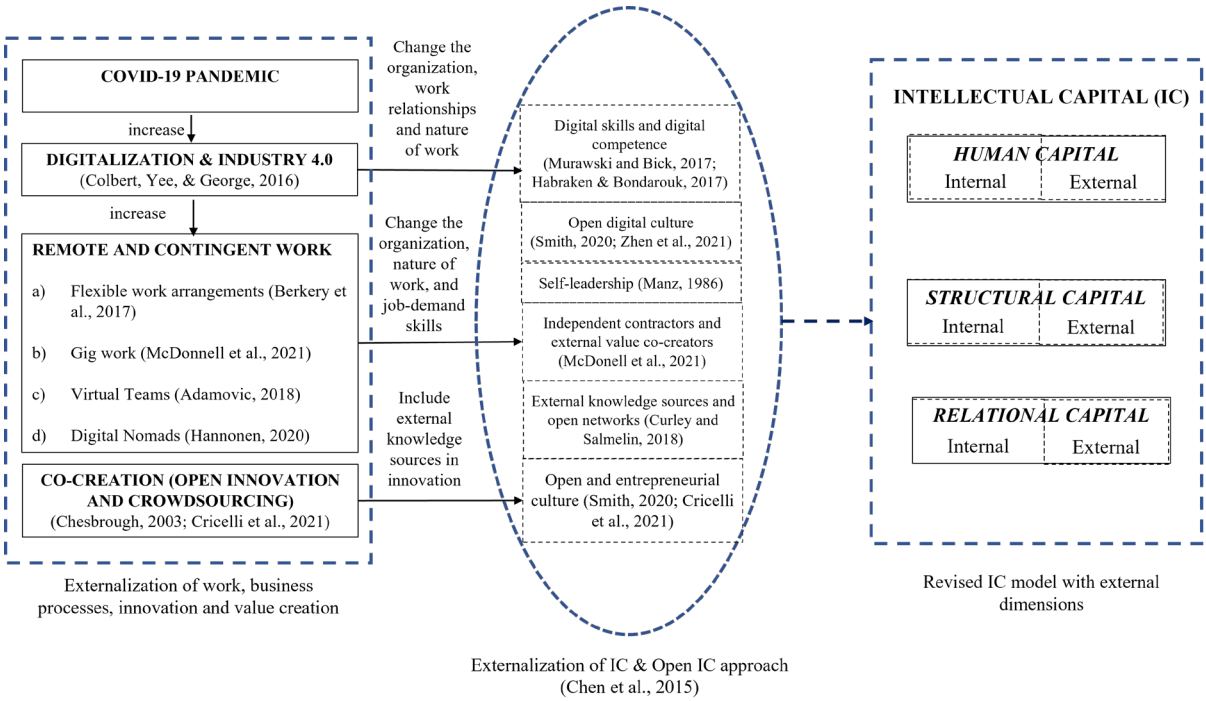


Figure 1: Reconceptualization of intellectual capital

3.1.1 Human capital

As remote/hybrid work forms have become the norm across organizations, the organizational abilities of employees demonstrable outside the office work become increasingly relevant. Accordingly, a crucial new feature of human capital has emerged: digital competence. Digital competence encompasses the knowledge, abilities, skills, and attitudes needed to work in the digital age (Murawski and Bick, 2017). On an individual level, it is an umbrella term covering both the general digital competencies needed for nearly every occupation, and the specific role- or task-related digital competencies differentiated for every occupation. Digital competence can be defined as the ability to adopt and to use new or existing technology to analyze, select and evaluate digital information that solves problems and develops a collaborative framework of knowledge within a specific organizational context (Vieru, 2015).

Furthermore, the increase of gig work means that there is an increasing amount of human intellect working for a firm that may come from outside the realm of its fully employed human resources (McDonnell et al, 2021; Williams et al, 2021). Thus, the inclusion of freelancers in terms of human capital gains in importance. In a remote work context, self-leadership skills are an outstanding aspect of human capital, which impacts the performance of organizational employees, freelancers and other contingent workers alike (Neck and Houghton, 2006).á

3.1.2 Structural capital

Open innovation and related crowd-sourcing activities require an active management of knowledge and information. Crowd-sourcing is an innovative way to organize flexibly using the dispersed skills and ideas of a wide set of actors (e.g., organizational members, customers, suppliers, consultants and gig workers). Capturing value from “the wisdom of crowds” necessitates wider participation, which can be supported by crowd management activities, such as platform design, building a crowd culture, and sharing captured value (Cricelli et al, 2021). Consequently, open and collaborative entrepreneurial culture and its associated activities represent an important new facet of structural capital vis-á-vis open innovation models.

Further, the success of digitalization is dependent on how well an organizational culture already in place supports it. Digital culture is often comprised of a set of shared assumptions and an overall understanding of mutually-held values concerning organizational practices in a uniquely digital context (Zhen et al, 2021). It is known that culture both restricts and guides activity, but it also provides tools for actor’s agentic behaviors.

Digitalization can be significantly leveraged by espousing a culture that encourages risk-taking, supports innovation, and both facilitates and enables wide collaboration. (Grover et al, 2022)

3.1.3 Relational capital

While the conceptualization of relational capital is manifold, ranging from the internally-oriented social capital construct of Subramaniam and Youndt (2015) to the externally-oriented customer capital of Edvinsson and Malone (1995), we think these two variants should be divided once and for all. Instead, we follow Inkinen et al (2017) and suggest splitting relational capital into basic internal and external components, referred to as relationships with intra-organizational and inter-organizational stakeholders (Inkinen et al, 2017). Internal and external relationships create value in different ways, as internal relationships present crucial infrastructure for knowledge exploitation and facilitate process and management innovation; meanwhile, external relationships may become more beneficial in knowledge exploration and therefore better for product/service innovation (Cabrilo et al, 2020).

External relational capital includes relationships with external knowledge and value co-creators, such as traditionally-covered users, suppliers, competitors, universities, and other cooperative partners, along with relationships among newly-added stakeholders, including gig workers, freelancers, virtual teams, and digital nomads. External relational capital is a critically important aspect for successful collaborative innovation to occur (Chen et al, 2015; Chen and Chen, 2008). Open innovation requires entrepreneurial culture, cooperative behavior and a collaborative mindset (Cricelli et al 2021). Of additional importance are innovation intermediaries, who facilitate innovational processes through knowledge transfer, technology exchange, and transfer among organizations and crowds (De Silva et al, 2018).

4. Conclusion

This paper argues that relevance in the face of recent wholesale changes in companies' operating environments, such as with digitalization, maintaining sustainability, facing the COVID-19 pandemic, and related forced relocation to remote work platforms, necessitate an immediate update to general IC theory. This requires novel understandings and viewpoints concerning the nature of IC components, organizational performance dimensions, and moderators in relationship to them.

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 endeavor. Obviously, this short paper is fraught with limitations. Perhaps the most notable one is the selective perspective on the key issues that impact the changes inherent in IC. Other important issues include organizational resilience, risk management, ecological and societal sustainability, and innovative openness.

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Intellectual Capital Statement (ICS): A Case Study from a Hungarian non-profit Joint Venture

Florian Kidschun[1], Fabian Hecklau[1] and Nick Gábor[2]
[1]Fraunhofer IPK, Division Corporate Management, Berlin, Germany
[2]MTA SZTAKI (Institute for Computer Science and Control), Budapest, Hungary
florian.kidschun@ipk.fraunhofer.de
Fabian.hecklau@ipk.fraunhofer.de

Abstract: An Intellectual Capital Statement (ICS) is a strategic management instrument for assessing and developing the Intellectual Capital (IC) of an organization. The ICS shows how IC is linked to corporate goals, business processes and the business success of an organization using indicators to measure these elements. By identifying the causal relationships between the different types of capital, improvement potentials are discovered, which can then be used profitably for the strategic and operational development of the organization. Therewith, the ICS is an essential tool for preserving the competitive edge and keeping business successful in the knowledge-based economy. The workshop-based approach to creating an ICS helps participants to gain new insights into how their own organization operates. It also provides concrete results in the form of prioritized recommendations for action to foster their organization's sustainable development and consistent reporting. Against this background, a case study to outline selected essential steps of the ICS creation for an applied research a non-profit joint venture for computer science and control in Budapest is presented.

Keywords: Intellectual Capital Statement, ICS, Intangible Resources, Case Study

1. Introduction

In an environment characterized by globalization, technologization and increasingly shorter product life cycles, knowledge advantages are the decisive competitive advantage in many areas. To respond to this challenge, innovative companies have started to focus on intellectual capital reporting and to identify and develop their critical intellectual capital, ultimately putting it to good use. The pioneers of intellectual capital reporting showed as early as the 1990s that the targeted recording of intellectual capital opens up additional potential for success. Ordinary balance sheets do not constitute a sufficient instrument for this, as they merely reflect the financial and material past of the organization. Intellectual capital, such as the specialist knowledge, experience and creativity of employees, efficient processes, intellectual property or important relationships with customers and partners, are hardly considered. However, precisely in these elements lies Germany's future potential and opportunities for development as an innovation location.

The great success of companies whose value creation is based primarily on intangible production factors such as knowledge and experience highlights the limits of traditional, financially oriented company valuation. In the search for explanations, experts agree that the success of these companies is largely dependent on their intellectual capital. However, there is little or no reliable data available on these intangible assets in most organizations, which results in uncertainty about investments in the latter. An even more important argument for measuring and valuing intellectual capital is the possibility of making these "soft factors" accessible to systematic management. In many cases, the management of these factors is left to the intuition of individuals. In small and medium-sized organizations, this is usually the "boss" who guides the company's fortunes with his intuition. However, if the companies have reached a certain size or if there has even been a change in management, for example due to a succession plan, this can lead to manifold problems. In these situations, methods and tools for the systematic management of relevant intangible corporate resources are extremely useful.

As a management and communication tool, the intellectual capital statement aims, on the one hand, at the systematic internal control of intangible value drivers. Management and organizational development receive a well-founded decision-making basis for the implementation of development measures (Mertins et al. 2005). In addition, the intellectual capital statement functions as a reporting instrument that can be used for both internal and external communication of the company-specific intangible values (Will et al. 2007).

2. Methodology

The intellectual capital statement constitutes a report on the valued intellectual capital of an organization and on current, completed and planned measures for its development. Intellectual capital refers to all intangible

factors important for business operations and their interconnectedness. The differentiation between three types of intellectual capital has become the standard: Human, structural and relational capital.

The model of the "Intellectual Capital Statement - Made in Germany" of the Intellectual Capital Statement Working Group ("Arbeitskreis Wissensbilanz") consists of three sub-models: the organizational model, a business process model and the control model. Based on a systems theory assumption, the company is embedded in a business environment in the organizational model. Vision, business strategy and business success form the initial situation of the intellectual capital statement model. In the business process model, intellectual capital (human, structural and relational capital) is captured in the context of business processes. In the control model, a control loop is assumed between the status quo of the intellectual capital, the processes, their effects on the results and the strategic goals (Alwert 2006).

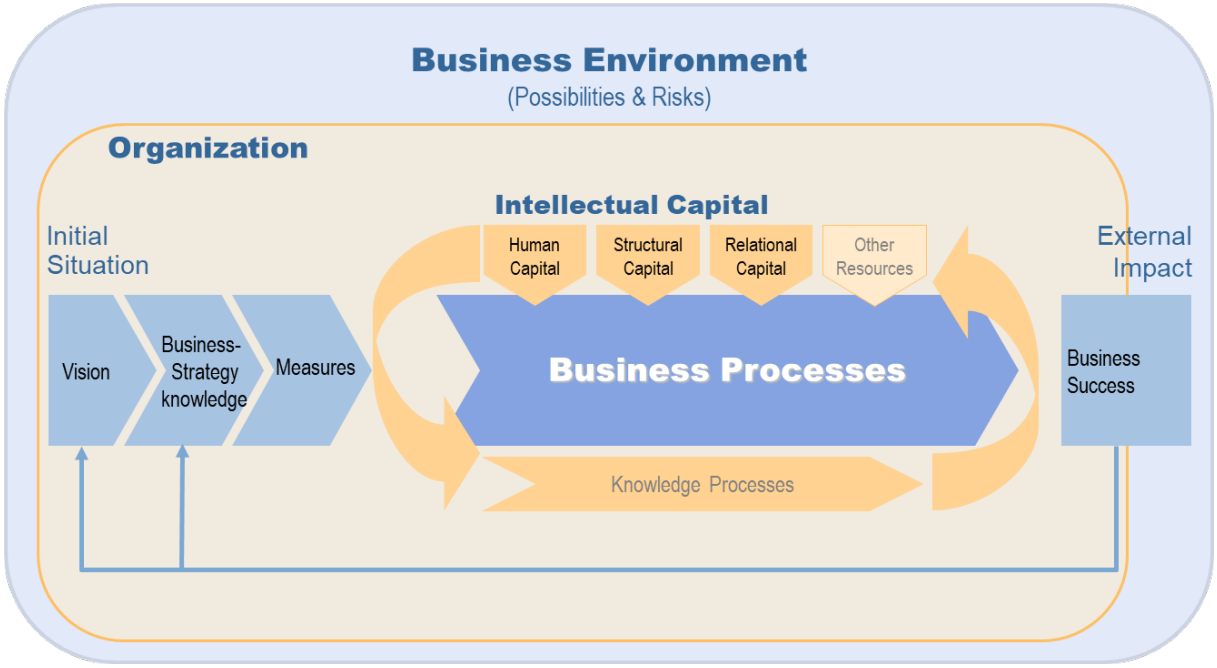


Figure 1: Model of the "Wissensbilanz - Made in Germany" (Alwert et al. 2004)

The method described here was developed by the intellectual capital statement working group initiated by Fraunhofer IPK in the pilot project "Wissensbilanz - Made in Germany" with regard to the requirements of medium-sized companies (first published in Alwert et al. 2004). Based on existing concepts from other European countries (overviews can be found in Mertins et al. 2005; Alwert 2006), a simple, systematic procedure model was implemented and practice-oriented interpretation aids for an efficient management of intellectual capital were tested and optimized. The intellectual capital statement is implemented in the company through a series of workshops with a cross-functional and hierarchy-wide intellectual capital statement team. This procedure ensures a holistic view of intellectual capital in the company (Mertins et al. 2005; Alwert 2006; Alwert et al. 2008). The supporting software "Intellectual Capital Statement Toolbox" (Mertins, Will 2007) breaks down the procedure for intellectual capital reporting into eight simple work steps.

At the beginning, the business model of the reporting company is described. This involves documenting information on the business environment (opportunities and risks) and strategic objectives (step 1), which form the basis for assessing the soft success factors in all further steps. Against the background of the strategic goals and the business success to be aimed for, the performance processes that are decisive for the business success are determined and influencing factors of intellectual capital are identified in the categories of human, structural and relational capital (step 2). The various factors of intellectual capital can be defined individually for each company. The evaluation of the current expression of all influencing factors in comparison with the strategic objectives is carried out with regard to the criteria of quality, quantity and systematics (step 3) on a predefined percentage scale. Qualitative justifications for the individual evaluations are to be discussed and documented in the intellectual capital statement team. This workshop-based self-assessment is substantiated in the next step by determining indicators for measuring intellectual capital in the form of facts and figures (step 4). After assessing and measuring the strengths and weaknesses of intellectual capital, the workshop participants analyze

the impact relationships between intellectual capital, business processes and business success (step 5). Based on the sensitivity analysis according to Vester (2003), this enables statements to be made on the individual influence weight and controllability of individual factors as well as on time lags in the effect of measures. The central result of the evaluation (step 6) is the potential portfolio, in which the evaluation of the factors is presented together with their influence weight. This makes it possible to see at a glance which factors need to be developed due to their high impact on the overall system and their relatively low rating. Once urgent fields of action have been identified, corresponding measures can be defined (step 7). The preceding steps ensure that these measures support the achievement of the strategic goals and have the greatest possible leverage effect. Finally, the intellectual capital statement toolbox enables the creation of the finished intellectual capital statement document at the push of a button (step 8). For communication to selected target groups, such as employees, customers and lenders, the content can be selected, combined in a document and processed further.

3. Implementation of ICS at a Hungarian non-profit Joint Venture

This contribution aims to describe the process of creating an intellectual capital statement (ICS) and selected results of this process for a Hungarian non-profit joint venture. Therefore, the key steps 1-3 of developing an ICS, key issues of the case and their analysis as well as recommendation are outlined. These are based on the results of an on-site workshop with a representative group of the organization (researchers from all service areas and strategic management) conducted in September 2021.

Before the intellectual capital statement was carried out, initial preliminary and informational talks were held with the strategic management of the organization, in which the method of intellectual capital statement was presented. As a basis for the decision on the implementation of the intellectual capital statement the "Fitnesscheck- Wissensbilanz" was carried out. As a result of this quick test, the suitability of the organisation for the implementation of the method was approved. After the official commissioning of the intellectual capital statement by the management, a project plan was agreed upon, which was based on the criteria and milestones of the guidelines (BMWi, 2008) for the preparation of an intellectual capital statement. The individual work steps were fixed in terms of dates with the company management. At the kick-off, the project plan and the method were presented to the employees. The further work steps were carried out by the creator of the intellectual capital statement, the management and the project team. Since the commissioning of an external person for the moderation of the workshops was not possible for economic reasons, this moderation was also carried out by the creator of the intellectual capital statement.

The project team that took part in the workshops consisted, as suggested by the guidelines (BMWi, 2008, p.11), predominantly of active persons from various service areas. Representatives from all parts of the company and from all hierarchical levels were involved as recommended by the AK-Wissensbilanz (BMWA, 2005, p.17), to ensure appropriate "grounding". After the preliminary meeting, a project team was appointed. This consisted of researchers and students from the various service areas as well as the strategic management. The participation of the top management as members of the project team was considered very important, as their knowledge of the process flows as well as their active cultivation of success-critical contacts with the business environment were essential foundations for the effective implementation of the workshop. Since all the people working in the practice see themselves as "experts at eye level" and interdisciplinarity is seen as an important part of the company, the involvement of the top management had an overall positive acceptance by the employees.

In the course of the preliminary discussion, the participants were made aware of the basic criteria for the success of the project as described by Mertins & Alwert et al. (2005) and the AK-Wissensbilanz (BMWA, 2005, p. 13). These are an abolition of the hierarchical principle, consensus orientation, argumentative appreciative forms of discussion as well as transparency on all levels during the entire implementation process.

3.1 Description of Business Model

In the course of the business model work step, a preparatory meeting with the company's management lasted several hours. In this regard, guiding questions of the guideline prepared by the AK Wissensbilanz (BMWi, 2005) were used. For the documentation of the data the software 'WB-Toolbox' was used. The learning program integrated in the software was deployed in order to explain terms and definitions more clearly to the project team. Subsequently, the business model of the Hungarian non-profit joint venture was revealed.[1]

[1] Due to data protection reasons, in this paper only facts and figures that were approved for publication by the top management of the Hungarian non-profit joint venture are incorporated in the business model description.

The joint venture with acknowledged researchers supports companies in creating innovative solutions by conducting R&D work in the industrial environment. Its mission consists in supporting the process of the digital transformation and the implementation of the Industry 4.0 concept with its research, development and consulting services. Its service portfolio covers digitization, big data analytics, robotics, artificial intelligence, with a strong focus on the optimization of production and logistics systems. This includes the newest IT solutions and services for the manufacturing and logistics processes as well as the inter-connected industrial hardware and software systems, called Cyber-Physical Production systems. The joint venture aims to become the most recognized organization for production informatics in Hungary in the short- to mid-term by transferring state-of-the-art scientific results into innovative industrial applications. Therewith, one major and critical challenge is to keep the quality of research results on a sufficient level to subsequently turn them into applicable solutions that are easy to integrate into the customers environment. The organization aims to establish its scientific role within the Hungarian innovation ecosystem as well as international presence, aiming for international customers. Currently, new promising technological fields of actuation have been discovered, and the product portfolio has been diversified according to market demand.

The general value creation model of the non-profit joint venture consists of four levels and several factors per level. The following figure shows the general factors corresponding to the four Levels

- Business Success,
- Customer Value,
- Business Processes and
- Intellectual Capital / Resources (Human / Structural / Relational Capital).

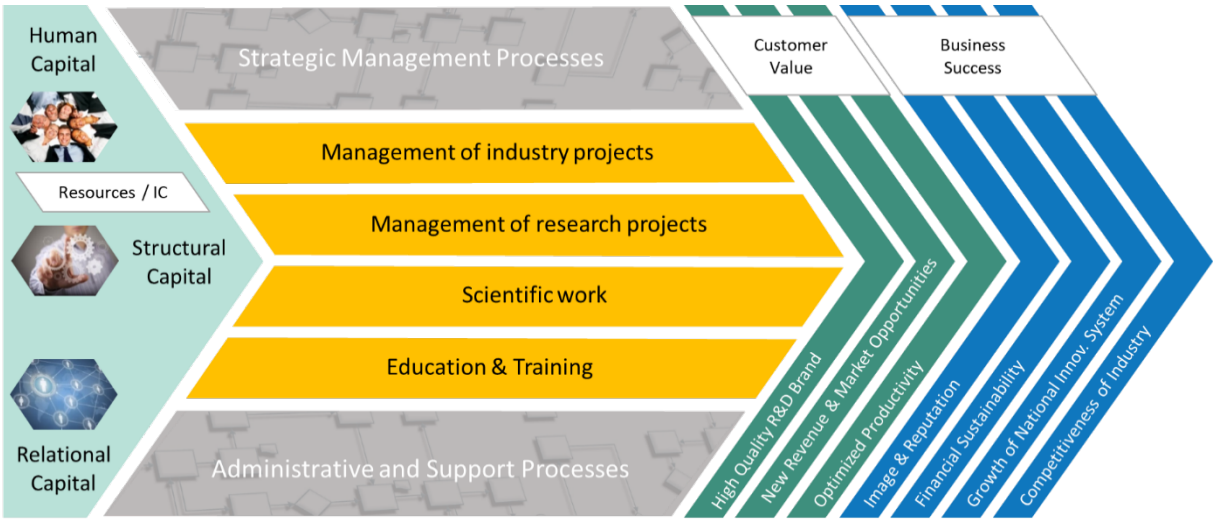


Figure 2: General Value Creation Model of the Hungarian Non-Profit Venture

Business Success is subdivided into the factors Image & Reputation, Financial Sustainability, Growth of the National Innovation System and Competitiveness of the Industry. The Customer Value that the non-profit venture aspires to generate can be sub summarized into High Quality R&D Brand, New Revenue & Market Opportunities and Optimized Productivity. The Process Level is categorized by the Value Adding Core Processes, which are Management of Industry Projects, Management of Research Projects, Scientific Work, Education & Training. The categorization of Resources follows the definition of Intellectual Capital, which is outlined in the following.

3.2 Determination of the influencing factors of the intellectual capital

The Strategic Success Factors are the drivers of the Value Creation Model, i.e. the tangible and intangible resources that are used to execute the defined business processes in order to produce the defined results on the Levels “Customer Value” and “Business Success”. Therefore, they are the basis to identify the relevant gaps. The organisation’s “Resources / Intellectual Capital” are described through the nine Strategic Success Factors that are grouped into the three different Levels: Human Capital, Structural Capital and Relational Capital. The following tables show the definition of each factor by objective level.

Table 1: Human Capital Factors

Objective Level	ID	Factor	Definition
Human Capital	HC 1	Strategic Orientation	The competence of the management staff to set-up, communicate and follow-up on the strategy as well as the knowledge about the strategy among employees and the systematics to set-up and implement strategies.
	HC 2	Professional Competence	The technological and research expertise of the E staff as well as the ability to execute applied R&D and innovation projects and the systematics to build up the necessary competencies.
	HC 3	Communication Competence	Competencies of the staff to communicate and sell its services and products to potential customers as well as the systematics to build up these communication and sales skills.

Table 2: Structural Capital Factors

Objective Level	ID	Factor	Definition
Structural Capital	SC 1	Technology & Knowledge Management	The structures, systems and procedures to acquire, store and disseminate information and knowledge about relevant technological, market related and organizational topics (developments) as well as the systematics to set-up and improve these systems.
	SC 2	Organization & Management	The structures, systems and procedures to manage, run and support the core processes and operations as well as the systematics to develop and improve the organization & management.
	SC 3	Scientific-Technical Equipment	The structures, systems and procedures to select, acquire, install, operate and maintain the facilities and equipment.

Table 3: Relational Capital Factors

Objective level	ID	Factor	Definition
Relational Capital	RC1	Relationship to Industry	The relationships to companies and potential clients in the focus market segments as well as the systematic procedures to build-up, develop and maintain these relationships.
	RC2	Relationship to Science / R&D	The relationships to partners and the scientific community as well as the systematic procedures to build-up, develop and maintain these relationships.
	RC3	Relationship to External Sources	The relationships to external sources of funding and relevant public bodies / agencies / governmental institutions and private sector funding programs as well as the systematic procedures to build-up, develop and maintain these relationships.

3.3 Evaluation of the influencing factors according to the dimensions quantity, quality and systematics (QQS -evaluation).

Through a workshop with the project team, the identification of the factors influencing intellectual capital and the evaluation of these factors according to their characteristics in the dimensions of quality, quantity and systematicity (QQS), as envisaged by the “Arbeitskreis Wissensbilanz” (BMWA, 2005), were carried out. In this regard, the participants were provided with information material on the essential steps and technical terms by e-mail prior to the workshop in order to keep the time for clarification of terms short on the day of the workshop.

Subsequently, the nine factors of the intellectual capital were assessed using the QQS – assessment. This constitutes the basis for a profile of strengths and weaknesses, according to the Arbeitskreis Wissensbilanz (BMWi, 2008). The influencing factors are evaluated according to quantity, quality and systematics. Thereby the project team had a rating scale of 0 - 120 % at its disposal. In this context, the Arbeitskreis Wissensbilanz (BMWi,

2008) recommends evaluating in 30 % steps. According to Bornemann & Reinhardt (2008), the goal of this evaluation system is to be able to clearly distinguish between those factors that already support the strategic goals very well and those that need to be improved. The value of 120% is intended to give participants the opportunity to express that too much of this influencing factor is already present in order to achieve the goal. No use was made of this scoring option in the QQA assessment conducted.

The results of the QQS assessment are presented in the following figure as a QQS portfolio. Simon & Gathen (2002, p. 35) describe portfolio analysis as a portfolio management tool, which intends to show the current status of success-critical potentials and thus allows conclusions to be drawn about strategic development measures. The Arbeitskreis Wissensbilanz (BMWA, 2005, p. 27) describes the QQS portfolio as a form of representation of the previously made percentage assessments in a coordinate cross. While the x-axis represents the quality, the quantity is represented on the y-axis. The percentage estimation of the systematic is represented by the size of the circle area. According to the criteria of the intellectual capital statement working group (BMWA, 2005), those influencing factors that are located in the upper right quadrant are well developed. Small circles, on the other hand, show deficits, because it can be assumed that a weakly developed system to develop the influencing factor leads to a deterioration of this factor in the long term. The interpretation of the created QQS-portfolio of the Hungarian non-profit venture is summarized in the following.

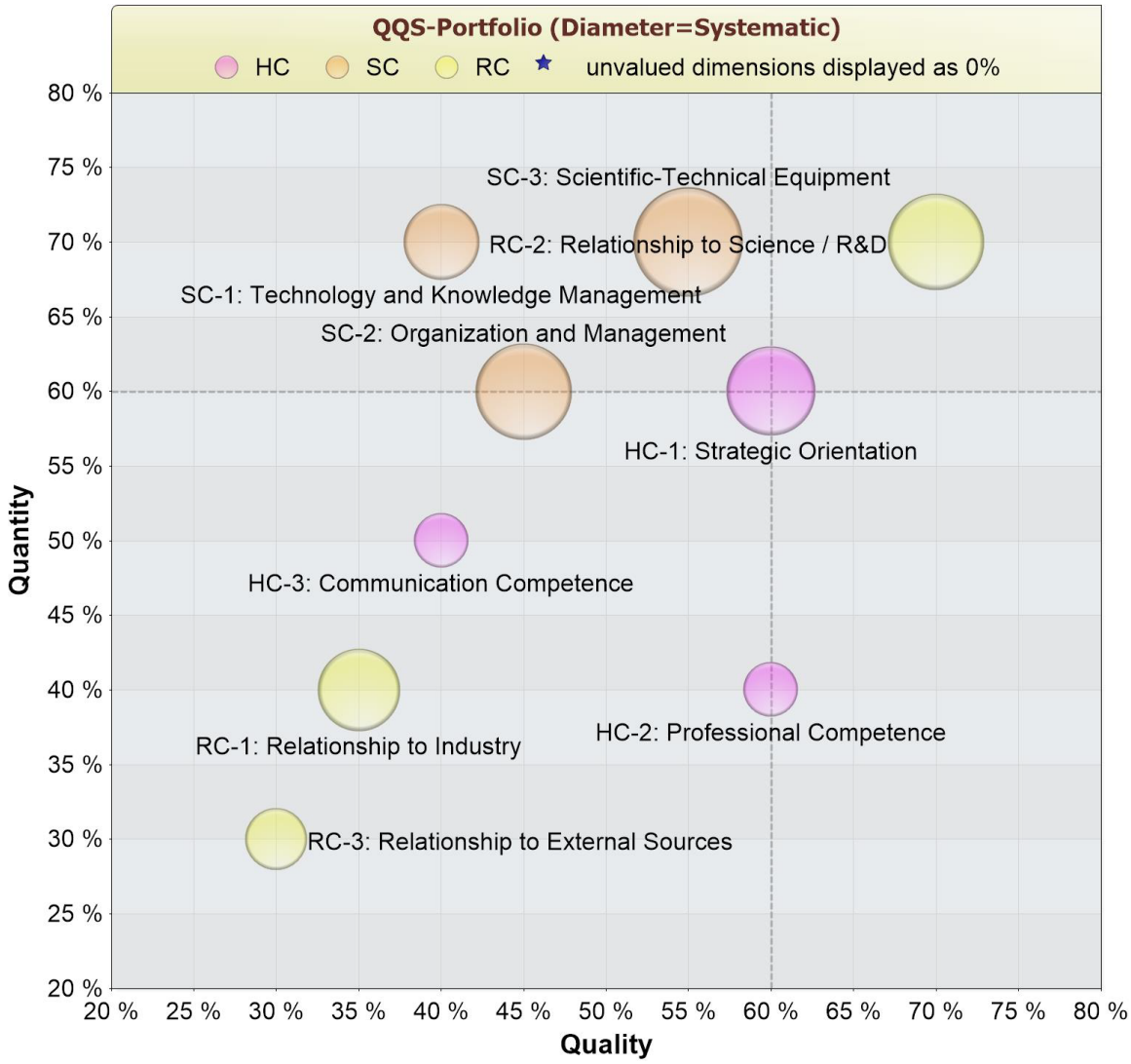


Figure 3: Actual status (strengths and weaknesses) of the Strategic Success Factors of the Hungarian non-profit joint venture (own representation based on BMWI, 2008)

3.4 Human Capital

3.4.1 Strategic Orientation (HC-1)

There is a lack of people carrying out strategic tasks, clearly working towards the vision and mission of the organization. Strategic meetings to support strategic thinking of the workforce are rare, there is no capacity to focus on strategy development, because the employees are loaded with operational tasks. However, the employees possess sufficient strategic competences. A strategy is in existence, but rather implicit - it is not sufficiently communicated. Currently there are no effective ways to communicate and share information. The quality of the strategic objectives is decent, however they need to be refined and revised. There's no clear systematics to further develop the strategy. This underlines the need for annual meetings (refining strategy according to changing requirements, strategic objectives & breaking them down into operational tasks). In addition, it became clear that there is a lack of a comprehensive competitor and market analysis to gain more insights into the concrete market demand for the organization's solutions.

3.4.2 Professional Competence (HC-2)

Current professional competencies are not sufficient to achieve strategic objectives. More professional competencies and technical expertise are needed, especially in the field of IT development. The number of employees is not sufficient in the light of the current size of the organization. In many cases, employees possess the needed competencies, but need to be "convinced" to carry out the respective tasks as well as to attend trainings and learn ("resistance" to changes). Trainings are executed when needed, rather 'on impulse' than systematically. It became clear that new competence profiles are needed for future activities / projects (e.g. Blockchain), which is reflected in a rather low quantity result (40%).

3.4.3 Communication Competence (HC-3)

There are employees with adequate communication competence (e.g. to the customer, supported by using presentations in English) among the team. The amount of communication competence for international funding bodies could be improved. In many cases there is a lack of internal communication competence (e.g. Developer talks to managing director). While the needed language skills are sufficient, there's a lack of communication competence to convince potential clients, negotiate and acquire new projects. No systematics for trainings to improve communication competence are in existence. Trainings are offered from time to time, but more executed on impulse or on demand. On the other hand, a new website, regular newsletter, LinkedIn, Facebook & online ads constitute more systematic communication channels to the customers.

3.5 Structural Capital

3.5.1 Technology and Knowledge Management (SC-1)

Sufficient access to acquire knowledge (e.G. Via scientific journals) is given across the organization. Tools are in existence (e.G. Cloud, internal servers, wiki) to store, share and disseminate knowledge. A kitchen and "playroom" are available to support the exchange of informal information among the team members. Existing tools for acquiring, storing and disseminating knowledge are sufficiently working, however they are not integrated and possible interfaces are not aligned. In some cases, the handling of tools is complicated and hard to understand ('how to use it?'). Individual employees are not giving insights into their gained knowledge (e.g. after sighting papers / articles). To gain insights about projects, there is no standard procedure in place ('where can I find the information I need?). Research and project results are a lot of times not sufficiently documented and communicated, there is a need for regular (mandatory) meetings to share gained knowledge. In some cases, employees leave the organization with their knowledge.

3.5.2 Organization & Management (SC-2)

There is a lack of tools regarding resource planning and project management, however the introduction of new tools could add more complexity and prevent employees from their actual and important tasks. Moreover, there are quality issues with the controlling software in use. The outcome of this software is vague in some cases, actual available numbers and figures are needed (e.g. about project results, budgets, etc.) or can be hard to find. Administrative and support processes need to be clearly defined and systematically developed.

3.5.3 Scientific-Technical Equipment (SC-3)

The overall maintenance for machinery is lacking. Employees are capable and in charge of maintaining basic working equipment, however there are no related standard procedures put into practice. There is a purchasing

department dedicated for the acquisition of new scientific-technical equipment I existence, however a variety of regulations lead to long waiting times even for smaller orders, which have to be checked against the annual procurement plan. An internal Wiki contains valuable information regarding handling of equipment, but is not used sufficiently among the employees. Standard processes to teach new employees, including students on machinery are sufficient.

3.6 Relational Capital

3.6.1 Relationship to Industry (RC-1)

There is a huge lack of valuable relationships to large companies. Lots of contacts (small – and medium-sized companies) are aggregated in a CRM database. However, relationships cannot be turned into actual projects. Moreover, the quantity of people (esp. Sales) to build up and manage relationships to externals are not sufficient. This connected to a lack of systematic communication (e.g. regular calls to the industry). Recent developments are going in the right direction: Newsletters, events, social media, systematic online advertising / marketing (analytics tool) are implemented. Solutions are not systematically matched with industry demands (e.g. collecting ideas to approach potential clients and their problems / demand).

3.6.2 Relationship to Science / R&D (RC-2)

Decent relationships to relevant international R&D organizations and very strong international relationships to universities and other scientific institutions, partners etc. are in existence. However, there are no clearly defined responsibilities and procedures to maintain and support these relationships. Moreover, the relationships are to a certain extent 'unbalanced'. Specific partners and organizations are favored, while others are neglected. In some cases, there is not enough capacity / time to actually create papers and attend conferences to build up and maintain relationships.

3.7 Relationship to External Sources

There are strong and valuable relationships to the European commission and local ministries in existence. There is a systematic approach to maintain the relations to the European commission, e.g. through regular checks of new funding calls, events, meetings etc. However, more capacities (people) are needed to manage and further develop these relationships.

4. Conclusion

In this contribution, the process of implementing an intellectual capital statement within a knowledge-intensive applied research organisation was outlined, focusing on the systematic recording and evaluation of intangible influencing factors of the internal resources. Due to individual definitions of the respective influencing factors, the relevance of the contents in this method can be rated highest. The systematic identification of weaknesses and the detailed analysis of the interdependencies of effects as well as the measures derived from them support the implementation orientation. The workshop-based self-assessment of intellectual capital enabled a high degree of participation in the analysis and the derivation of fields of action. In addition, the representative composition of the workshop team ensured compatibility with the organizational structure and culture. The results can also be easily transferred to existing management systems. However, effective moderation by trained experts is necessary to ensure the quality of the results and, at the same time, a low level of effort. Strategy-oriented monitoring can be derived from the intellectual capital statement, but the procedure does not yet sufficiently support the continuous tracking of measures in intra-year cycles.

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Managing Knowledge Through the Internet of Everything on an Example of Smart Estate

Leszek Kieltyka
Czestochowa University of Technology, Poland
leszek.kieltyka@pcz.pl

Abstract: The paper presents the research pertaining to various forms of communication conducted in so called smart housing estate. The estate has been fitted with various types of equipment (sensors, tags, transducers), whose task is to provide information. The collected information is a source of knowledge that can be further utilised to ensure efficient management of buildings and the possibility of their communication with the environment. The issues presented in the paper pertain to the analysis of major situational phenomena that occur in a smart estate. The main tool of knowledge management constitute digital operations characteristic of the Internet of Everything. The considerations cover, among others, forms of monitoring of the most important areas of the estate, primarily with regard to ensuring the safety of the residents. By utilising smartphones one can acquire knowledge about monitoring own premises (outside and inside), opening hours of individual shops, post offices, chemists, libraries, etc. The knowledge gathered in this way allows for an insight, among others, into current timetables of all means of communication. It also allows for tracking emergencies with a possibility of informing the relevant services in advance. The paper presents the research that has been conducted among the persons that live in a smart estate, as well as persons who intend to dwell in one. The analysed issues included: residents' knowledge about smart home solutions, areas in which residents utilise smart home solutions. managing the collected knowledge so as to introduce energy saving appliances. The paper refers to the advantages of utilising smart communication systems in residential buildings in a smart estate. It presents utilisation of the IoE in communicating with any element of a smart home in a smart estate through internet service based on cloud computing. It also characterizes the most vital elements of smart estate management. In a symbolic manner it presents elements, devices, equipment, objects, which based on the accumulated knowledge can be controlled through application of intelligent communication systems operating based on the concept of the Internet of Everything.

Keywords: knowledge management, Internet of Everything, smart estate, knowledge awareness

1. Introduction

We ourselves decide whether we will be able to enjoy the benefits of communication technology implemented, among others, based on the Internet of Things (objects), Internet of Everything or Industrial Internet of Things. The Internet of Things is a natural consequence of technological development and pursuit to automate processes that do not require human participation, processes that are indispensable for the functioning of the contemporary world, or contribute to relieving human burden.

The currently exposed area where ICT and informatic technologies are being utilised is the Internet of Everything (IoE). This is a term for a network of people, processes, data, and objects connected to the Internet. The Internet of Everything in its present shape has not been an outcome of a genius brainchild. This is an arbitrary set that utilises developing in a longer period of time electronic and digital forms of communication. The IoE makes use of the existing and developing communication technologies, including the technologies of savings and reliability, especially for the operations of gathering, transfer and security of data, which are embedded in the utilised system. It makes use of data collected in Cloud Computing, ICT, software agents technologies, and multiagent systems (Kiełtyka, 2013), technology of semantic networks, multimedia technologies (Kiełtyka, 2020), technology of virtual organisation of actions (Kierzkowski, 2013), etc.

The underlying objective of the consideration pertaining to smart estate is creating smart spaces, including municipal ones, in various areas: transport, products, buildings, energy systems, quality of the environment, health, and other related to everyday life. The foundation for the development of smart spaces is provision of technology that will ensure their implementation, through smart communication in the course of the management process. The set of technologies utilised in the Internet of Everything is based on tools, systems, and sensors that allow communication of a smart estate with the user. Smart spaces accumulate knowledge that is utilised by both teams of professionals and dedicated systems that govern the processes of controlling proper zones of a smart estate. Therefore, knowledge management in this area takes place based on the associative form of the sense of homo sapiens and professionally designed computer systems.

A smart estate is an integration of ever more efficient digital telecommunication networks, omnipresent in smart sensor and markers, and in software (compared to knowledge and cognitive competencies). The stressed "intelligence" cannot exist separated from other systems of an estate. There exists a growing network of overlapping connections to mechanical and electric systems installed in the buildings, systems embedded in household appliances, transport systems, electrical networks, water supply and sewerage systems, and security systems of estate residents. These sets of information constitute knowledge, which is utilised for optimum management of processes undergoing in a smart estate.

The population of smart estates has been growing dynamically in the world. This requires development of an estate system for managing the collected knowledge, which can optimise its development and decrease maintenance costs in the long run. A new problem that requires a detailed analysis is the level of spatial and economic changes of estates resulting from utilisation of advanced technology (Kiełtyka, 2017). Dynamic development and rational use of latest technologies will improve the quality of public services, saving time and money, and ultimately will improve the quality of life in the estate and will allow it to obtain the status of entirely smart one. However, these assumptions are impossible to fulfil without the utilisation and participation of communication systems, where the Internet of Everything plays one of key roles. Communication systems in a smart estate will make possible, among others, managing the accumulated knowledge through:

- introduction of an integrated system of visual monitoring,
- creating an open-access zone of wireless Internet,
- participation of the dwellers in the operation of a smart estate,
- pro-environmental solutions in estate transportation,
- application of multifunctional estate cards for the dwellers,
- management of heating/gas/water network,
- running estate bake/car/trailer rentals,
- introduction of transport systems for traffic management,
- solutions of sustainable public construction,
- creation of Park&Ride zones,
- managing energy networks – smart grid, smart metering,
- promoting car-sharing solutions.

A dynamic development of devices with access to the network through the internet has caused that communication systems can decide based on the collected information about users whether to advise their appliances (fridge, washing machine, radio, central vacuum cleaner, heating, etc), what and how they should do in given time, without the interference of users themselves (Cha, 2016).

2. Role of knowledge in a smart estate

The IoE means that it is necessary to leave the previous practices where the prediction model was built based on collected data, and then applied in operation for as long as it preserved its required qualitative parameters. Tools should ensure smooth integration of new data and incorporating it into analyses. To achieve the sufficient business effect, it is enough to create a forecast or present data in the form of a decision tree, which will constitute a basis for determining objects of knowledge application. A device equipped with sensors sends measuring data to a central system, where it is gathered and analysed. The accumulated in such a way knowledge can be actively used while managing standard processes and occasional phenomena that occur in a smart estate.

Knowledge engineers can interpret the undergoing communication processes and based on them develop analytic models that facilitate, through current and accumulated knowledge, for instance, prediction of failure occurrences, identification of malfunctions in operation of machines, or simply their imperfect use. They work in the area of "knowledge discovery", and outputs of their activities, in the form of created models constitute a starting point for developing automation and intelligence of the system itself (Zhang, 2017). This will allow a solution to react instantly in an event of data occurrence that signals a failure and take appropriate steps, e.g. inform a service team. From the business perspective such a system not only minimises stoppages but also optimises the work of service teams or the amount of ordered spare parts. Significant advantages are also noticeable in the area of developing by companies services and products competitive with the markets they operate on.

In the developing world of interconnected and communicating one with another objects there is space for developing payment platforms by adding another level of possible automation and autonomy in the Internet of Everything. This will ultimately create an opportunity to provide more complex and tailored to the needs of customers financial services, amending, for instance, currently applied credit models. The role of the accumulated in this way knowledge is indispensable for further optimum management of process that undergo in a smart estate.

3. Management tools in smart objects

Platforms of telecommunication networks may offer a possibility of collecting data – also consumer one, for instance, from the smart home area, analysing it and making decisions on its basis. In combination with the possibility to utilise the already existing informatic network this constitutes a comprehensive platform that allows other companies to build IoT services (Singh, 2017). Utilising such a solution decreases the market entry cost related to introduction of a new product or service, and permits to use a mature and rich in functionality platform already from the very beginning of conducting the activity.

An incredibly uncomplicated application of the idea of the Internet of Everything Controlled with one button, simplifies the entire process of ordering goods, and simultaneously guarantees customer loyalty and cyclicity of orders. By equipping selected objects with selective markers, we can provide detailed information about the product directly to customers smartphones, and what follows obtain priceless knowledge about their interests and preferences.

The Internet of Everything is the next step of information revolution. Similarly to the emergence of social media it has impacted the way we organise our lives and significantly modified business models. Achieving greatest business and financial benefits of utilising the Internet of Everything is possible owing to the ability of processing data created in this new world. Business analytics offers techniques and tools that facilitate building of useful knowledge, and modern solutions are effective in making real time decisions based on fast and large streams of data (Cha, 2016). Organisations that would like to incorporate into their business models solutions form the domain of the IoE should not be discouraged by lack of skills or essential technology. The analytics that is supposed to release business values int the Internet of Things has been probably already applied by them. Competencies and tools are identical as the ones applied in Big Data class solutions. As always, also in this case, the key to success in controlling a smart estate will be the ability to find innovative applications in the new space or adapting the experiences observed in other industries.

A smart object needs to be fitted with a device with a sensor, which is capable of collecting specific information from the surroundings, and transmit it further. These can be objects fitted with various types of sensors that monitor: temperature, vibration, humidity, motion, noise, GPS, etc. (Dybowski, 2018). A smartphone or smartwatch can also play the role of a transmitter that sends commands. The difference lies in the fact that data is not downloaded automatically but is a result of user's action (e.g. click, voice command, set time of activation). Examples may include: smart bands monitoring heart rate, a sheet with a motion detector, or a beacon that senses human motion.

Contrary to the commonly accepted name the Internet of Everything (IoE) is actually not the Internet of "everything" but a set of more or less structured data utilised in a particular communication (Bard, 2014). But for the data, which is the basic product for the IoT, its main product would be merely electronic waste. The Internet of Everything is not what is seems to be at first glance. The gigantic anthill of smart-objects and sensors that communicate one with another, with an equal share of homo sapiens, having a closer look it turns out to be primarily the world of radically new data (Kiełtyka, Zygoń, 2018).

4. Examples of IoE utilisation – smart home, estate, city

We need a tool that will be able to receive the transmitted signal, process it and evoke a particular reaction. This can be a smartphone, tablet, smartwatch, or a computer, which will display specific information, but also another thing that will automatically perform a particular action, e.g. unfolding roller blinds integrated with home-automation system, traffic lights adjusted to traffic intensity, or a library book displaying a reminder about the return date.

Currently, one can find on the market a range of technologies that enable transmission of information between two objects, beginning with the most popular ones such as Wi-Fi or Bluetooth, and finishing with NFC or Z-WAVE (utilised, for instance, in building control systems). Thousands of information exchange processes will occur every second in the developed world of the Internet of Everything, and the communication between devices will frequently run multiway – using a greater number of transmitters and receivers, and using the resources of accumulated beforehand knowledge. For instance, in Figure 1 the author presents in a symbolic way elements, devices, equipment, objects that can be controlled and managed with the use of communication systems whose operation is based on the Internet of Everything. A set of smart homes creates a smart estate, which makes use of the forms of formerly accumulated knowledge for governing activities that occur in it, and also uses internet connections handled by Cloud Computing (Sroczan, 2020).

A vital challenge is the issue of privacy felt by end users. What they expect is a widely understood improved security of themselves and their close family, increased control over the possessed appliances and devices, as well as comfort and economy. These benefits can be easily provided by technological solutions for smart management of devices and appliances and energy saving at home.

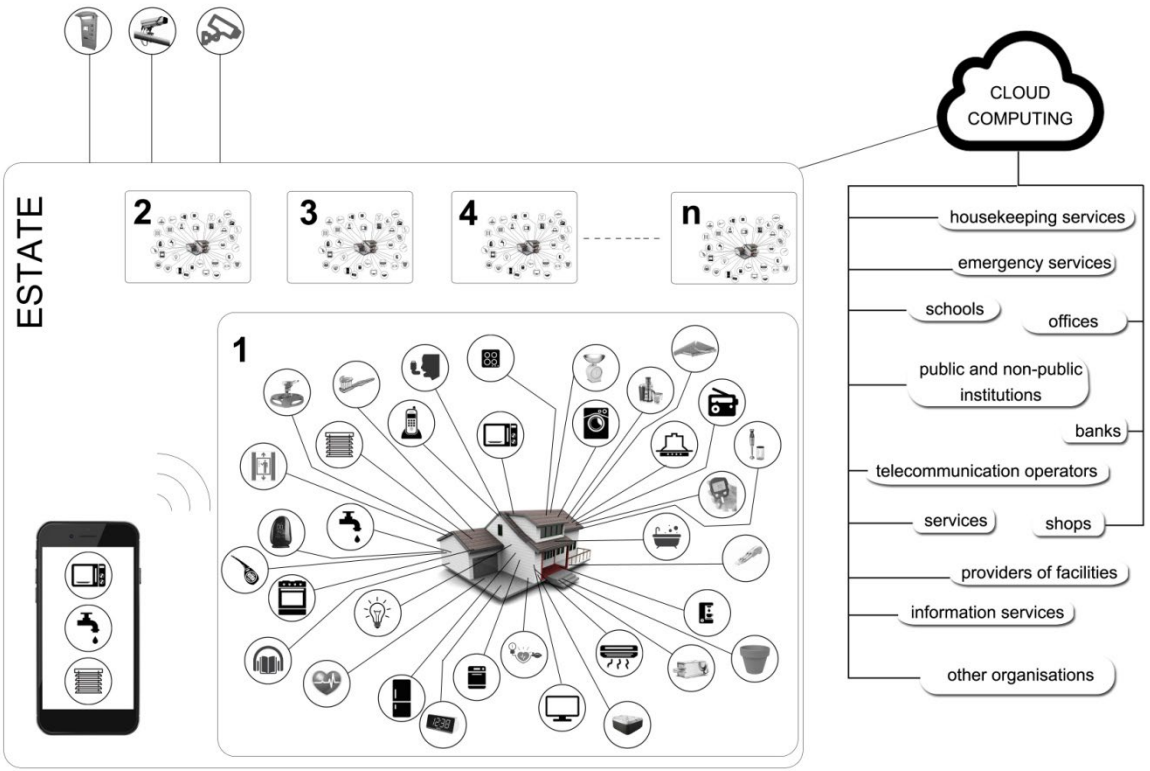


Figure 1: Examples of IoE utilisation for communication of any elements of smart home in a smart estate through a webcam handled by Cloud Computing. Source: Own elaboration.

5. Potential areas of IoE solutions application

Primary areas of implementing the concept of the „Internet of Everything" include (Kokot, 2015):

- Smart environment monitoring – in this scenario a key role plays a vast network of sensors that collect data on temperature, wind, rainfall, level of rivers, etc. (Kiełtyka, 2019). Collecting and real-time processing of this data allows to detect anomalies that may constitute a threat to human life. This activity is the least visible from the customer perspective. It is aimed at anthropogenic environment security and its operations comprise automated systems for ongoing monitoring.
- Smart energy – comprises a series of solutions that allow for management of utilities. It includes monitoring of individual consumption and also the processes of its production and usage. The analysed energy sources include renewable and non-renewable ones, mainly such systems as: solar, wind, thermal and water management.

- Smart metering – concern, among others, automation of the processes on the side of the recipient, instant billings for actually consumed resources, a possibility of changing the tariff, blocking the installation, collecting statistical data related to supplied and consumed energy, ongoing monitoring.
- Smart health – comprises a wide spectre of applications used for health and physical activeness monitoring. It allows for patient security monitoring (both in hospital and at home). It offers, for example, sleep control (through smart mattresses) or teeth control (through smart toothbrushes).
- Smart industry – comprises the area that enters the solutions related to particular industries of the national economy. The possible application areas may include: resource level monitoring (water, liquid fuels, gas), storage facility condition monitoring, machine diagnostics, working conditions or product processing (Jelonek, 2020).
- Smart production – similarly to smart industry it comprises solutions that are entering particular sectors of the economy. The IoT and IoE solutions handle both issues related to agriculture, farming or crops, to production line control, product rotation control in shelves of supermarkets or control in storage facilities and warehouses.
- Smart transport – belongs to key segments that support the economy. It comprises logistic processes support, among others, for the following areas: transport location, controlling transport conditions, conditions of material storage and transport organisation.
- Smart water management – comprises a wide range of issues related to administering and managing environmental resources in the ecosystem, essential for the environment functioning. Thanks to the IoT and IoE it is possible to manage in real time processes of water supplies, starting with the control of its fitness for consumption and manner of storage, through supplies and seal of water supply systems, to monitoring consumption by end users.
- Smart city – a special area for monitoring and organising all the key processes pertaining to functioning of cities, from traffic to public security diagnosing. The area of particular analysis are the levels of: noise, lighting, pollution, parking space load, vibrations or tourist information (Ahlgren, 2016).
- Smart building and its surroundings – consist in smart management of the building and its surrounding. It comprises a whole series of facilities that may be used both at the individual as well as industrial level: property monitoring, movement sensors, smart watering, thermostats, etc. Possible solutions include control of external and internal conditions. Monitoring can also include information on a particular location of threats (e.g. smoke, fire, CO_2).
- Smart flat – covers a whole series of individual expectations, solutions and applications. Most of the expectations are related to household appliances. For instance: fridges (informing about the content, expiry date, need for re-supply), washing machines (enabling energy consumption in lower tariffs), cookers (allowing for remote settings of the oven), humidifiers (ensuring proper air humidity especially for small children). Solutions in this category allow for control of utilities usage (controlling light bulbs, thermostats, air-conditioning) and security (child supervision, cameras, alarms).
- Smart life – comprises a whole range of consumer solutions aimed at convenience and security. They include, for example, shopping support (compliance with habits, monitoring the contents of allergens, expiry date), remote control of equipment to prevent accidents, weather conditions monitoring (temperature, smog, humidity, atmospheric pressure, wind force and rainfall) or personal belongings protection (wallets, jewellery, watches, mobile phones).

The more important abovementioned areas that absorb objects and people that reside in a smart estate utilise the standard forms of managing the knowledge that has been accumulated there.

6. Most essential elements of management system utilised in smart estate buildings

Some of the essential elements that can be applied in smart buildings offered while constructing a smart estate include

- Motion Sensor – a wireless motion sensor that measures light intensity and room temperature. It comes equipped with an embedded accelerator, which detects a change of position or an attempt to open the door or window. The sensor in the Motion Sensor permits to adjust dynamically the operation of lamps to the amount of natural light. It is capable of setting best lighting parameters for the residents and space around the building saving the energy (Barbancho, 2019).
- Door/Window Sensor – a sensor of opened doors, windows, gates with an embedded probe for temperature measurement. It can ideally fit in any interior. Its task is to warn users if windows, garage

gate, doors inside and on the outside of the building, and entrance gate to the estate have been left open. Another feature of the sensor is sending information about approaching change of the weather.

- CO, CO_2 Sensor – very sensitive, certified sensor of carbon monoxide and carbon dioxide that detects even slightly increased amount of carbon oxide, which in the longer perspective can affect the comfort of residents or even the whole estate. It cooperates with other devices of the system and so creates a smart structure of active security.
- Flood Sensor – a sensor that combines several useful functions selected with regard to security and comfort of use. It serves as: flood sensor, temperature sensor, sensor detecting construction deformations in rooms. It is equipped with a light and acoustic alarm, which instantly inform users about incidents. The sensor is fitted with electrovalves that block water influx and minimise the effects of a plumbing failure.
- Heat controller – a sensor for controlling room temperature. The thermostatic head based on room cubature calculates the time it needs to reach the temperature desired by the user. The thermostat can be controlled manually, remotely, with voice or application. The device can operate in accordance with a schedule defined by the user, which can be adjusted to particular rooms (Orłowski, 2020).
- Intercom – a multifunctional and smart device that „sees" and „hears" perfectly. Recording messages makes it similar to the answerphone. Even in the event when user is not . at home Intercom will notify them about being visited at that time. The device with the assistance of the system or user makes it possible, for instance, to let somebody inside the house/flat during the owner's absence.
- Switches – one of the key smart elements of managing home. It proves useful in numerous places and is versatile. It makes it possible to activate and disactivate household appliances, lighting, or power in electrical sockets. Thanks to the function of "power metering" it provides accurate information on energy consumption. It can also turn on the majority of household appliances at any time or automatically turn them off in the event of a failure by cutting off and restoring power in the socket. Devices that work in standby mode influence significantly home budget.
- Roller Shutter – an actuator that enables users to control domestic devices such as electric rollers, canopies, blinds, curtains, recuperation, air-conditioning or gate. Calibration of the module permits vision cameras and gate wings to be precisely placed in the position chosen by user.
- Home Centre Lite – a control room of a smart home, a compact control centre that managers the devices of the FIBARO system with the use of an intuitive application. It offers a possibility of controlling home conveniently thanks to the bespoke application and voice assistants Amazon Alexa, Google Assistant and Apple Siri, and Messenger.

7. Awareness of knowledge utilised in smart estate - research

The Smart Home system controls smart flats and smart buildings. The Smart Housing Estate system comprises communication systems of all the buildings in an estate, and the Smart City system is utilised to control smart cities. These systems based on the knowledge obtained from deployed sensors transmit registered information to a collective database and users of smartphones, tablets or notebooks. Thanks to Smart Housing Estate solutions users and persons managing a smart estate can react instantly should unforeseen situations occur.

To determine the usefulness of the analysed and presented in this paper solutions a survey has been conducted. It reflects the transformations undergoing in the information society (Kierzkowski, 2020). The survey included close-ended questions of single and multiple choice. More than 200 respondents from all age groups filled in the questionnaire in the electronic form. Generally, the questions were aimed at obtaining information about the possibility of applying smart solutions.

The respondents' answers to the question about the areas in which they use smart home solutions have been presented in Figure 2.

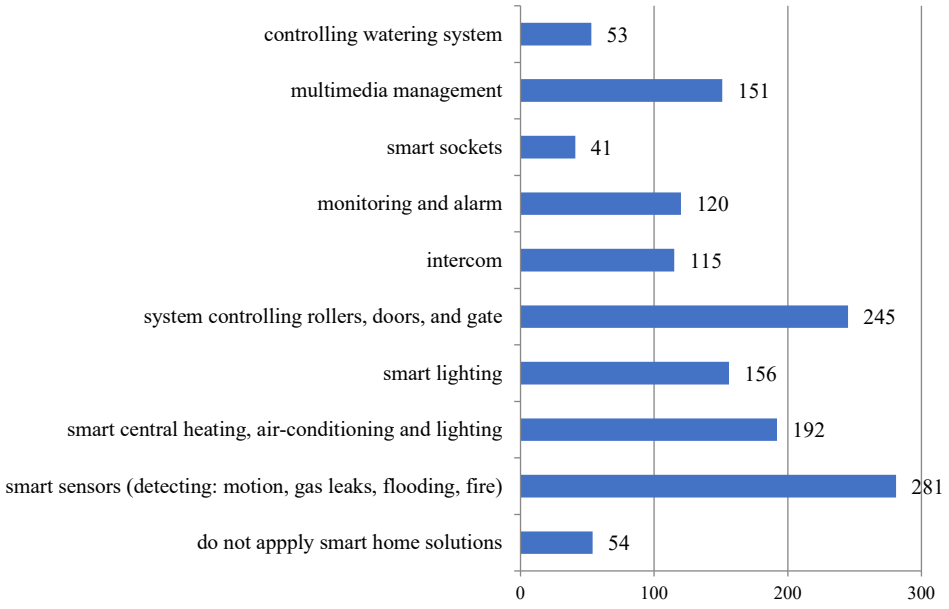


Figure 2: Areas in which respondents use smart home solutions

The great majority of the respondents utilises smart sensors that detect: motion, gas leaks, flooding, fire. Other used sensors include roller control systems for rollers, doors, and gates. The least interest concerns controlling smart electrical sockets.

Another issue presented to the respondents was the question about motivation to purchase a house or flat in a smart estate. Results of the survey have been presented in Figure 3.

The prevailing number of answers indicated improved standard of life, technological possibilities that make everyday life in a house/flat in a smart estate easier, and a willingness to change the hired flat into an own one.

A vital issue was also asking the respondents about the most important functions that in their opinion a smart estate should fulfil. The answers to this question have been presented in Figure 4. The respondents believe that the most important functions that a smart estate should fulfil to its users include: improvement in the quality of life, significant sense of security and convenience of use ensured by implementation of modern ecological solutions.

While analysing the possibilities of managing the knowledge obtained through various types of sensors deployed in a smart estate the respondents were asked to indicate the most important, in their opinion, element of a smart estate that dominates and is the final argument for living in one. The answers related to this issue have been presented in Figure 5. The most frequently indicated in the conducted conversations and the completed survey questionnaires include: efficient security system for the residents and monitoring system of a smart estate. The least attention was paid to the platform of communication with the residents.

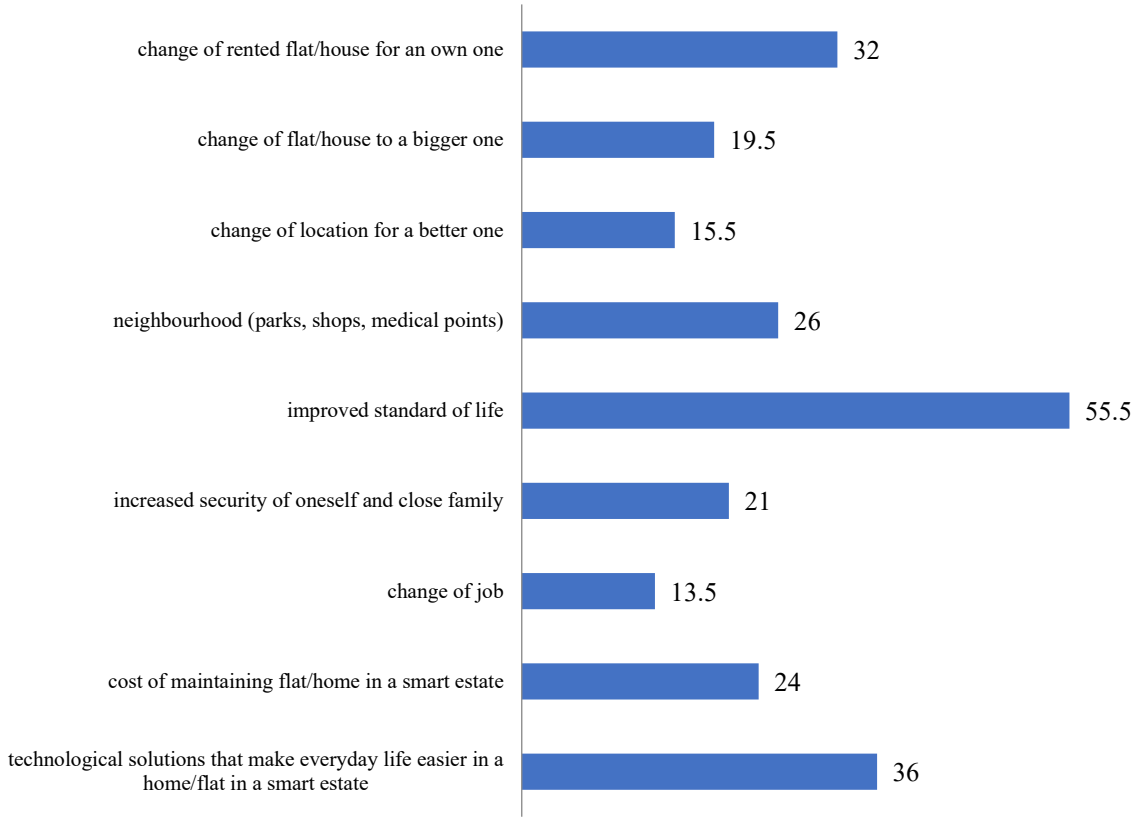


Figure 3: Motives for purchasing a house/flat in a smart estate

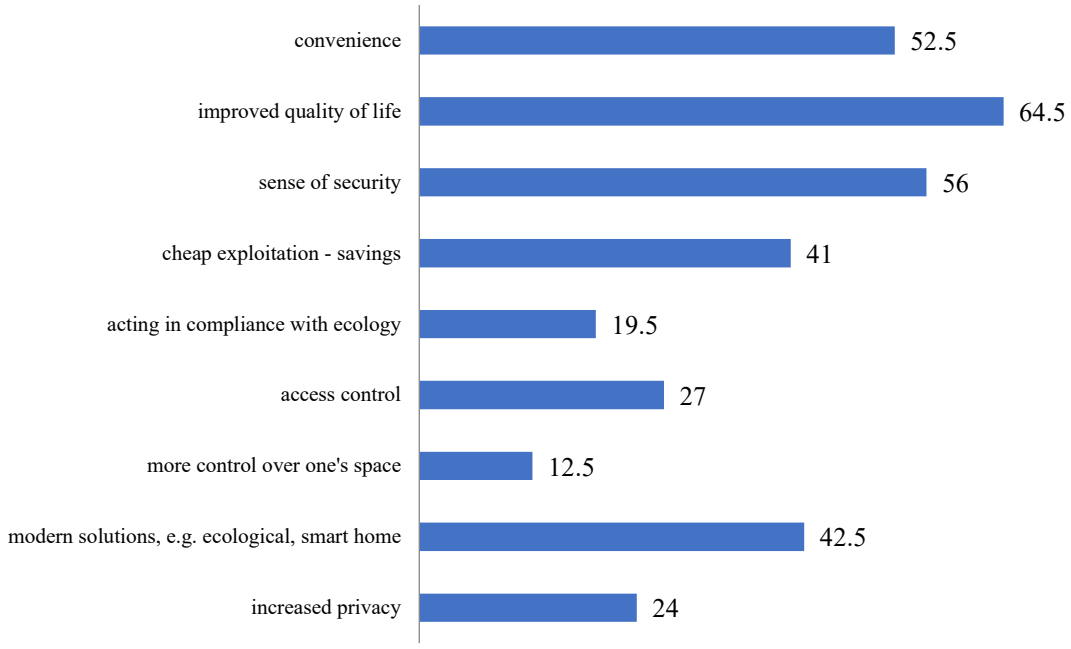


Figure 4: Most important functions of a smart estate

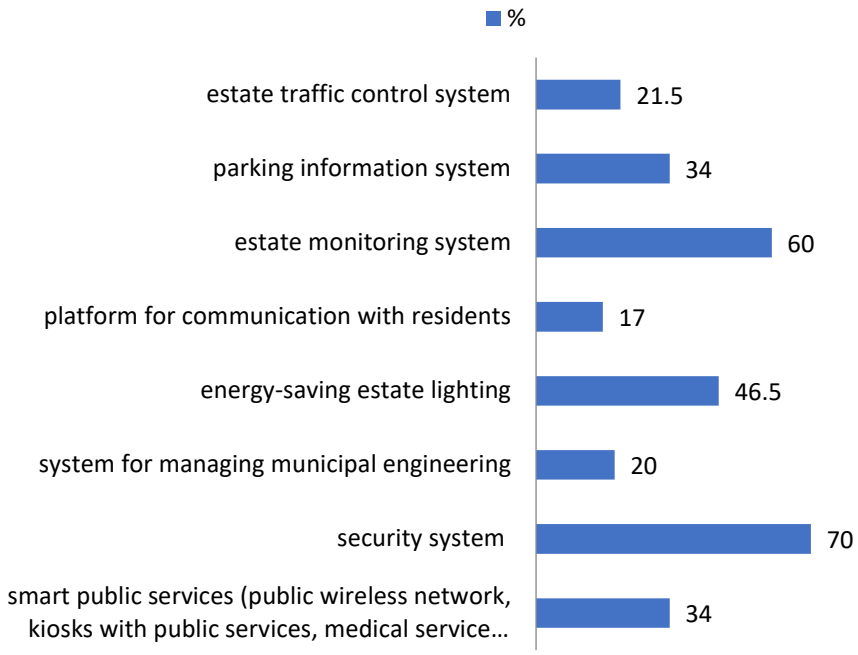


Figure 5: Most important elements of a smart estate indicated by respondents

In an attempt to determine an indispensable knowledge database accumulated in the systems that control a smart estate the author has also analysed further surveys directed at respondents who would intend to live in a smart estate and those already living in one. Apart from the already presented ones, some of the most relevant covered such queries as:

- - What special features should characterise a smart estate,
- - Would you accept an increased cost of purchasing a flat in a smart estate equipped with energy-saving devices (photovoltaics, recuperation, water protection, recycling, etc.)

8. Summary

The conducted research has demonstrated that not only the possible to use knowledge but also the already gathered one is fully utilised by smart communication systems applied in managing a smart estate. Internalisation of the capacities of smart communication systems based on the Internet of Everything ensures proper management of knowledge based on the collected information, which translates into a better management of market offer with regard to customer preferences. Implementation of the concept of a smart estate that utilises smart communication systems is an open and continued task. In the paper the author has presented in a symbolic way elements, devices, objects, equipment that utilise a knowledge database and are controlled with the use of digital communication systems based on ever more frequently applied the Internet of Everything. Potential areas where the capacities of the IoE can be utilised outline the scope and importance of such procedures as: security of anthropogenic environment, statistical visualisation of using available utilities, individual monitoring of health condition of residents living in a smart estate, transport, management of environmental resources in the ecosystem, public security diagnosis, controlling consumption of utilities, weather conditions monitoring or personal property protection. Issues related to utilisation of information communication systems that create a certain knowledge repository while managing processes in a smart estate clarify the explored in the literature on the subject area of application and capabilities of smart communication systems controlled with the use of the concept of the IoT.

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Knowledge Sharing Challenges in Hybrid Knowledge Work: Lessons from Denmark

Kathrin Kirchner, Christine Ipsen and Anders Reenberg Andersen
Technical University of Denmark, Kgs. Lyngby, Denmark
kakir@dtu.dk
chip@dtu.dk
arean@dtu.dk

Abstract: During the COVID-19 pandemic, knowledge workers worked from home (WFH) and had to share knowledge mainly online. Studies show that remote work influence knowledge sharing. Beyond the pandemic, several studies report that companies expect more people to work partly or fully from home or anywhere. Therefore, we investigate how knowledge workers experience working from home (WFH), full or part-time, and how it affects their work and knowledge sharing. We conducted an online survey at six different time points between May 2020 and November 2021, allowing us to analyse different working from home situations for the first time. Our survey included 23 questions covering positive and negative experiences from WFH and demographics. Data was collected from 3406 knowledge workers in Denmark working fully or partly from home. The answers were analysed by fitting proportional odds logistic regressions. During the lockdown around February 2021, when Danish restrictions were high, knowledge workers reported that they could focus less on their work at home than at other points of time when they were allowed back in the office. Furthermore, they missed seeing their colleagues more during the lockdown period than at times when the society was completely open again, as they felt a lack of discussion and creative problem-solving. Despite using software solutions for collaboration and communication, knowledge workers missed opportunities for knowledge sharing when WFH. In general, during the whole period, female respondents reported that they got more time to focus on their work when WFH than males did. Finally, older respondents experienced more time to focus on work than the young respondents did when WFH. The results show the differences in the situation of knowledge workers, whether it is enforced or flexible/voluntary to work from home. Thus, this study contributes to a better understanding of the challenges when knowledge workers WFH, which groups of knowledge workers can gain from WFH regarding efficiency and knowledge sharing needs. Beyond the pandemic, when companies want to offer more flexibility to WFH, this study provides conclusions on which conditions to be aware of to ensure efficient knowledge sharing.

Keywords: Working from home; Hybrid knowledge work; Knowledge sharing; Work efficiency; Longitudinal study

1. Introduction

Knowledge workers are employees with a high educational level, using intellectual and symbolic skills in knowledge work, which results in a high degree of professionalism (Alvesson, 2004). During COVID-19, knowledge workers were forced to work from home (WFH) and experienced the advantages and disadvantages of the home office.

On the one hand, WFH can lead to an improved work-life balance, as workers do not need to commute and have more time for their family, increase work efficiency, and control their working day (Kurland and Bailey, 1999). On the other hand, knowledge workers may miss social interaction, feel tied to their computers, lose meaning in work, or miss essential work tools (Ipsen et al., 2021).

The efficiency and productivity of knowledge workers are crucial factors for organizational innovation, competitiveness, and sustainable development of an organization (Kianto et al., 2019). Changes in efficiency, motivation, and knowledge creation of the employees working at home can thus improve or hamper the productivity of an organization. Additionally, WFH can facilitate cost reductions and use these free resources for productivity-enhancing innovation (OECD, 2020). Therefore, working from home can be a viable option for the future of knowledge work, especially if organizational support is provided (Mattern et al., 2021). However, working fully from home, in unsuitable spaces, with limited office days, might create a productivity problem for companies and lead to fewer innovations and creative ideas (Gorlick, 2020). Thus, companies during COVID-19 were concerned about the work efficiency of their knowledge workers while working from home.

Our paper aims to investigate how knowledge workers experienced working from home (WFH), full or part-time during the pandemic and how it affected their work efficiency and knowledge sharing. Furthermore, we derive conclusions for the post-COVID workplace. We ask the following research questions: How can knowledge workers efficiently work from home? What is the role of distance, i.e., not being able to see colleagues? Can they share knowledge efficiently despite being at home? Are there any differences between people in

demographics, e.g., regarding gender and age? Moreover, how can challenges be mitigated? To answer these questions, we collected data from Danish knowledge workers at six different time points between May 2020 and November 2021. By collecting and analysing longitudinal data, our paper is among the first to cover different WFH situations – from enforced WFH to a reopened society with a free decision to WFH or to be in the office.

2. Literature review

The COVID-19 pandemic and the required physical distancing measures to avoid spreading the virus forced many firms to introduce working from home on a large scale. Throughout the pandemic, studies have repeatedly pointed to a wish for increased use of flexibility and the ability to work from home post-pandemic (Lister, 2020). This may cause a wider adoption of working from home practices after the pandemic, with broader impacts on productivity (OECD, 2020). Decades ago, Drucker pointed out that the rise of productivity in knowledge work is one of the companies' biggest challenges (Drucker, 1991). Furthermore, studies show that knowledge workers get less interrupted (Bailey and Kurland, 2002) and can focus better on their work at home. Furthermore, employees have greater autonomy to decide when and how they work (Kossek and Thompson, 2016), leading to higher productivity. Nevertheless, WFH is less controlled by managers and colleagues, contributing to work avoidance and reduced productivity (Knights and McCabe, 2003).

Essential for productivity and efficiency at work are social relationships with colleagues (Sluss and Ashforth, 2007). The geographic proximity between co-workers influences the building and strengthening of social ties between colleagues, communication, knowledge creation, and innovation (Catalini, 2017). Proximity helps build trust so that colleagues might lose the fear of losing power when sharing their knowledge with others or getting negative evaluations when asking too often for help. Knowledge sharing within an organization is necessary to learn from the experiences of others (Argote and Guo, 2016) which contributes to the productivity of an organization. A study found that when colleagues often meet, they develop a strong relationship that positively influences knowledge sharing. Proximity can minimize the effort of engaging in knowledge sharing and support the creation of social relationships that indirectly influence knowledge sharing (Holdt Christensen and Pedersen, 2018).

Working from home and only connected digital can be more stressful and tiring. It requires higher coordination, more online meetings and can lead to technostress and zoom fatigue (Richter, 2020). Furthermore, the lack of access to relevant and new knowledge causes frustration, stress, repetition of mistakes, and loss of time as the same information has to be retrieved multiple times (Ipsen and Jensen, 2012).

During COVID-19 waves, when schools and day-care were closed, efficient WFH depended on the presence of dependent children, which led to conflicts between work and family needs. However, when children could go back to school and kindergartens, families benefited from WFH with more flexibility, less commuting time, and more family time (Ipsen et al., 2021). In the post-COVID time, the discussion on gender and equity has become current as mothers/women can benefit if fathers work more at home. Then they have more time for family and household or strengthen traditional gender roles, as women's career perspectives might be negatively influenced if they are not as much in the office as men (Arntz et al., 2020).

Young people whose professional careers just started and whose professional self-confidence is yet to be developed, were found in previous studies as especially challenged by WFH (Sándor et al., 2021). They missed the challenges in the work, competition, and team spirit. Participating in the work routines of colleagues and learning from their experience (tacit knowledge exchange) is difficult over distance, and problems with solving tasks are less easily detected. The hunger of young knowledge workers to prove themselves and develop their careers is difficult to satisfy in the home office (Starchos and Schüll, 2021).

Managers might be influenced by WFH differently than employees, as leading over distance is an additional challenge. Managers need to get in touch with their employees and ensure that they get in touch with each other. Smalltalk about an employee's wellbeing is more difficult in an online meeting, and also, on-boarding of new employees or firing employees is more demanding than face-to-face (Kirchner et al., 2021).

Waizenegger et al. (2020) already investigated collaboration between knowledge workers in the phase of enforced working from home. They found that technological affordances allow equal communication

opportunities regardless of physical proximity, but the limitations of enforced working from home can influence the wellbeing of knowledge workers.

3. Data Collection and Method

We developed a survey with 23 questions to collect data, asking about perceived advantages and disadvantages when working from home, using communication tools and demographic information. The complete survey is published in (Ipsen et al., 2020). Most questions used a Likert scale (1 strongly disagree to 5 strongly agree). Demographic questions were of nominal or ordinal nature. We also asked open questions to get more insights into the WFH situation, especially regarding personal experiences while WFH or hybrid.

We collected data online as representative samples in Denmark for six different periods between May 2020 and November 2021 via a Danish market research company. After the first lockdown on 12th March 2020, the society slowly opened again in May 2020, knowledge workers were still working from home, but children were allowed back in school. In November 2020, knowledge workers could partly work from the office. Denmark was back in a second lockdown at the time of the third data collection, February 2021, when schools were closed again, and knowledge workers were advised to work from home. In June 2021, 50% of knowledge workers were allowed back in the office, and 100% in August 2021 (Vendramin et al., 2021). In November 2021, people were back in the office with a COVID-19-passport, showing that they were vaccinated, tested, or recovered from COVID-19. An overview of the characteristics of the different stages of COVID-19 in Denmark is shown in Table 1. By collecting data for all these six time points, we covered different situations of WFH and hybrid work for all knowledge workers.

Table 1: COVID-19 stages in Denmark, adapted and extended from (Vendramin et al., 2021)

Stage	**First Lockdown**	**First opening after lockdown**	**New restrictions**	**Second Lockdown**	**Second opening/ reopening**	**Restrictions again**
Time-line	12th March – April 2020	April 2020 – June 2020	August 2020 – Dec. 2020	December 2020 – February 2021	March 2021- August 2021	November 2021 – February 2022
Data collec-tion round	----	Round 1: May 2020	Round 2: November 2020	Round 3: February 2021	Round 4: June 2021 Round 5: August 2021	Round 6: November 2021
Charac-teristics	Closed businesses, schools,… Public and private sector encouraged to WFH unless critical work function requires presence; Social distancing	Gradual opening Schools opened again in April 2021 Knowledge workers still WFH, some organiza-tions experi-ment with hybrid work models	Allowing of gathering of max. 10 people Knowledge workers returning to work from home offices	Lockdown from 16th December till 7th February Schools closed again Knowledge workers advised to WFH, while service employees sent home with salary compensations	Gradual opening, returning step-by-step to office work June 2021: 50% capacity allowed in offices, COVID-19 pass and masks required August 2021: 100% capaci-ty allowed in offices, COVID-19 passport at events still required	After lifting all restrictions in September 2021, now re-introducing COVID19-passports and masks again Recommended to WFH as much as possible

Initially, a representative sample of the population in Denmark was collected. Our data set for this paper only includes knowledge workers who are not students and have attained an educational level corresponding to a

bachelor's, master's, or doctorate (Ph.D.) degree, resulting in 3406 knowledge workers. Table 2 gives a demographic overview of the collected data from knowledge workers.

Table 2: Demographic overview (N=3406)

Variable	Percent	Variable	Percent
Data collection round		Education	
May 2020	15.0%	Bachelor's degree	48.8%
November 2020	13.4%	Master's degree	47.6%
February 2021	16.6%	Doctorate degree	3.7%
June 2021	19.5%		
August 2021	17.6%		
November 2021	18.0%		
Gender		Age	
Female	51.5%	18 to 30	15.2%
Male	48.5%	31 to 50	42.9%
		51 to 60+	41.9%
Children at home (while WFH)		Manager	
Yes	20.7%	Yes	18.6%
No	79.3%	No	81.4%
Ordered to work from home		Prefer to work from home	
Yes	47.5%	Yes	49.8%
No	52.5%	No	50.2%

The questions were analyzed by fitting proportional odds logistic regressions (POLR) (Cullagh, 1980). A proportional odds model for ordinal logistic regression extends the binary logistics model where the dependent variable has ordered categorical values. It is the most commonly used regression model in the context of ordinal scales (Lall et al., 2002). Dependent variables were "I get time to focus on my work" and "I do not get to see my colleagues as much as I would like to" for the two POLR. As dependent variables, we included the main and interaction effects listed in table 3. While the main effects are single independent variables, interaction effects describe how the effect of an independent variable changes depending on the values of other independent variables. For instance, looking at Gender:Age, there might be differences between younger/older males and females, but gender and age alone would not influence the dependent variable. The quality of regression results was measured with Hosmer-Lemeshow and likelihood-ratio tests (Lemeshow and Hosmer Jr., 1982).

Table 3: Included independent effects into regression analyses

Main effects	Interaction effects
Data collection round	Ordered to work from home:Prefer at home
Ordered to work from home	Gender:Data collection round
Prefer to work from home	Age:Time of observation
Children at home	Manager:Data collection round
Gender	Ordered to work from home:Data collection round
Manager	Ordered to work from home:Children at home
Age	Manager:Gender
	Gender:Age

4. Findings

The Hosmer-Lemeshow test (g=10) accepts all POLR models in the analysis. A likelihood-ratio test accepts the proportional odds assumption in a fair number of cases.

4.1 Influence on efficiency – time to focus

Table 3 shows the results of looking at increased efficiency while working from home, especially on time to focus on work without interruptions. The POLR regression results in Table 4 show that the agreement to be able to focus on work is affected by: (1) The time of data collection, (2) if the respondents replied that they were ordered to WFH, prefer to do so, or both, (3) the respondent gender, and (4) the respondent age.

Table 4: Effect sizes in the regression models for "I get time to focus on my work"

Variables	Beta
November 2020	-0.029
February 2021	-0.246
June 2021	0.090
August 2021	0.306
November 2021	0.402
Prefer to work from home	0.753
Children at home	-0.311
Gender=Female	0.567
Age of 31-50	0.279
Age of 51-60+	0.346

During the lockdown in February 2021, knowledge workers could focus less on their work at home (negative Beta). They could better focus in August and November 2021 (i.e., when society was partly open again). Furthermore, women and people who preferred to WFH (and were not ordered to do so because of COVID-19 restrictions), and people over 30 could better focus at home. Naturally, people working from home with their children under 15 could not focus well. Table 5 shows that the effects of the different variables on "I get time to focus on my work" were all significant.

Table 5: Significant effect in the regression model for "I get time to focus on my work"

Variables	X^2	Df	p-value
Data collection round	41.912	5	.000
Prefer to work from home	121.333	1	.000
Children at home	13.602	1	.000
Gender	79.277	1	.000
Age	13.820	2	.000

Some open answers shed light on the knowledge workers' ability to focus on their work in the home office. A woman (aged 21-30) answered in May 2020: "*This is great because you sit at home without disturbances*." Many other respondents also liked the time of undisturbed work from home, but not all. A female knowledge worker answered in November 2020: "*This is boring. I miss the social aspect of working, and I feel that my productivity is decreasing because of this*."

The use of electronic tools might help to overcome distance. A male knowledge worker (aged 51-60) mentioned in November 2020: *"This works well because via MS Teams, I have a connection to my employees and colleagues, and part of my working tasks can be done from home."* Nevertheless, tools cannot help in all cases of knowledge exchange. A woman (aged 51-60) wrote in August 2021: "*You cannot get into a discussion or quick feedback for ideas or small problems if you are sitting home for a longer time – compared to being in the same room with colleagues.*"

Overall, we can see an inherent dilemma between the possibility to focus and immerse in a task versus the lack of the social element of work and time spent with colleagues, which is connected to knowledge sharing. A female knowledge worker (aged 51-60) summarized in February 2021: "*Some things are more effective, but discussions or creative work is more difficult*."

4.2 Influence on knowledge sharing – meeting colleagues

To gain deeper insights into possibilities for knowledge exchange, we analysed the variable "I do not get to see my colleagues as much as I would like to", which could hinder successful knowledge sharing and collaboration. Table 6 shows that respondents miss their colleagues less as they get closer to November of 2021, and they were voluntarily allowed back in the office. Respondents having children at home (while WFH) feel that they need to see their colleagues more. People over 30 missed their colleagues less than younger knowledge workers.

Table 6: Effect sizes in the regression model for "I do not get to see my colleagues as much as I would like to"

Variables	Beta
November 2020	0.009
February 2021	0.176
June 2021	-0.115
August 2021	-0.230
November 2021	-0.297
Ordered to work from home	0.820
Prefer to work from home	0.035
Children at home	0.192
Age of 31-50	-0.260
Age of 51-60+	-0.310
Ordered to work from home: Prefer to work from home	-0.739
Ordered to work from home: Children at home	-0.312

Table 7 lists whether the effects of the ordinal regression "I do not get to see my colleagues as much as I would like to" are significant. Instead of main effects, some interaction effects have higher Betas and are therefore listed here instead of the main effects.

Table 7: Significant effects in the regression model: "I do not see my colleagues as much as I would like to"

Variables	X^2	Df	p-value
Data collection round	18.124	5	.000
Age	10.706	2	.000
Ordered to work from home: Prefer to work from home	25.575	1	.000
Ordered to work from home: Children at home	3.929	1	.000

WFH can hinder good contact with colleagues and exchanging knowledge with them, as the open answers from our survey reflect. A female journalist reflected: "*It is not easy to keep a good team spirit and help each other when sitting at home. I heard it is even worse for young people. Colleagues are also important in idea development. I also think that many written messages are more difficult to follow – compared to that people just talk together.*"

However, if knowledge workers had certain flexibility, like in August 2021, to work both at home and in the office, the challenges would be minor. A female knowledge worker (aged 31-40) explained:" *I miss the social aspects at the workplace when I work from home. But if this is only one day per week, it does not matter that much.*"

From our longitudinal data throughout the pandemic, we can see that people miss their colleagues and that it influences one's perception of work. As knowledge sharing is central to knowledge work, the lack of accessibility to colleagues may impact knowledge sharing. Therefore, it is essential to investigate whether missing colleagues relate to the interpersonal and social part of work or whether it is work-related and may affect the knowledge-sharing activities.

5. Discussion

Building on positive experiences while working from home, workplaces might offer their employees higher flexibility in answering their requests (Gartner, 2021).

As our results reveal, working from home can improve the efficiency of knowledge workers. They could focus well from home, especially if they were not forced to WFH, but had the flexibility to choose and no children at home while working. As employees would like to have the opportunity to partly WFH after COVID-19, organizations need to consider balancing the higher focus when WFH and the missing opportunities for knowledge sharing based on different factors. As our study showed, can females and knowledge workers over 30 better focus at home, and knowledge workers over 30 miss their colleagues less than young colleagues. This also depends on the concrete tasks – as some tasks connected to discussions and creative work are easier with colleagues face-to-face in the office. Companies could use these findings as the first basis for decision-making on how to organize WFH in the future – based on the demographics and nature of the tasks. Furthermore, elder knowledge workers should not only think about their preferences for WFH, but also consider the needs of their

younger colleagues for knowledge exchange. Our study revealed that young employees could focus less from home and need more opportunities to connect to colleagues and learn from their knowledge.

We also found that knowledge workers miss opportunities for discussions, creative work, and exchange with their colleagues when WFH. In order to overcome distance and establish closer proximity, digital tools were used that allow communicating, having meetings, and collaboration. The lockdown led to using a huge number of tools in the first lockdown. Companies need to put effort into consolidating this tool landscape in the future (Richter, 2020). However, using digital tools is not enough. Planned meetings can be arranged in electronic calendars, and then conducted online. However, spontaneous discussions and idea generation facilitating knowledge exchange are challenging to plan. Knowledge cannot freely flow and be exchanged without personal interactions between knowledge workers. When they were forced to stay home and could not meet colleagues face-to-face, it caused knowledge exchange problems. The positive effects of WFH, the higher efficiency, and the negative sides of less knowledge exchange must be balanced. Efficiency, and thus productivity, is maximized at intermediate levels of WFH (OECD, 2020). This corresponds with the wish of knowledge workers in our study, where the majority would like to keep 1-2 home working days per week.

We found that knowledge workers could concentrate less and missed the exchange with colleagues during lockdown periods while fully WFH. Another study found that team performance is worse when co-workers often WFH, as digital presence cannot compensate for physical presence (van der Lippe and Lippényi, 2020). Working very often from home can lead to social and professional isolation. It is thus essential to acknowledge the social part of work and how it affects knowledge sharing and peoples' motivation and wellbeing in the hybrid-remote work setting.

Video conferencing systems, electronic communities of practice, etc., can help overcome the isolation. Business meetings can have different reasons, e.g., information exchange, decision-making, relationship building, or communicating sentiments. These different meeting types might require different capabilities (hear voices, share screens, see body language, experience co-location) that influence how the meeting should be conducted (Standaert et al., 2021).

Virtual reality could serve as an alternative to video conferencing systems as it can create a more realistic setting for spontaneous collaboration and knowledge exchange. In the role of an avatar, a knowledge worker can freely walk around in the virtual office and meet other avatars (colleagues) for knowledge exchange (Kirchner and Nordin Forsberg, 2021). Augmented reality can be a way of assisting knowledge workers in remote collaboration and training. It allows overlaying the real world with virtual information. By sharing the same augmented environment, employees transfer knowledge. A knowledge worker at the office can then learn to use a tool like a 3D printer with augmented reality, supported by an experienced colleague sitting at home (Chantziaras et al., 2021).

6. Conclusion

In conclusion, knowledge workers experience working in a fully remote or hybrid work setting differently, depending on whether WFH is forced or not. This study contributes to a better understanding of the challenges with hybrid knowledge work, which groups of knowledge workers can gain from WFH regarding efficiency and knowledge sharing needs. Beyond the pandemic, when companies want to offer more flexibility to WFH, this study provides some pointers for which conditions to be aware of to ensure efficient knowledge sharing. Our study is limited as we only collected data from knowledge workers under COVID-19 in Denmark. In the future, we plan to collect more data from different WFH situations after the Corona pandemic.

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Why Knowledge Management for Sustainability needs a Sustainability Mindset

Beate Klingenberg[1] and Helen N. Rothberg[2]
[1]FOM Hochschule für Oekonomie & Management, Mannheim, Germany
[2]Marist College, School of Management, Poughkeepsie, NY, USA
klingenbergb1@gmail.com
hnrothberg@aol.com

Abstract: Although the United Nations (UN) Sustainable Development Goals (SDGs) express urgency for actions, the UN also reports that reaching these goals as planned is very challenging. It has been argued that a mindset paradigm shift is needed and this paper will show that knowledge management (KM) can play an important part in this shift. Knowledge of sustainability is often complex, systemic and hard to capture (tacit), leading to specific challenges in its management. To address these, a three-step process, DCA, had been proposed beginning with defining (D) what knowledge is needed, then collecting (C) and acting (A) upon it. Focusing specifically on the defining step (D) and on tacit knowledge as the most challenging aspects, the paper proposes two improvements: first, to integrate Nonaka et al's SECI model (Socialize, Externalize, Combine, Internalize) that describes how tacit knowledge can be externalized and shared. Secondly, the Sustainability Mindset by Rimanoczy is proposed as framework that aligns values and allows discovery and formulation of tacit sustainability knowledge along its content areas and principles. It is posited that when tacit understanding becomes more tangible, shifts in mindset can occur more readily, and vice versa, that a broadened mindset eases sense-making of tacit knowledge, thus creating a cycle of growth and change for the organization. The Sustainability Mindset Indicator (SMI), a personal development tool is proposed to operationalize the development of the sustainability mindset, and said exploration of tacit knowledge, which combined with tools from the SECI model may offer managers concrete tools to define the knowledge their organizations need on their pathway to change towards sustainability and fulfillment of SDGs.

Keywords: sustainability mindset, tacit knowledge, SECI model, sustainability mindset indicator, knowledge management

1. Introduction

In 2015, the "2030 Agenda" of the United Nations (UN) formulated Sustainable Development Goals (SDGs) (United Nations, 2015). The 2021 SDG report (United Nations, 2021) clearly states that while there has been progress, many SDG goals are not on target, with further setbacks from the COVID-19 pandemic. Furthermore, the 2021 report of the Intergovernmental Panel for Climate Change (IPCC) sounded the alarm for the state of the planet, labeled "code red for humanity" by the BBC (McGrath, 2021). Elkington (1994), the "father" of the triple bottom line (TBL) indicates that the TBL concept – as he envisioned it - has been unsuccessful. He suggests that what is needed now is not a different "accounting" practice but instead a radical intent "to stop us all from overshooting our planetary boundaries" (Elkington, 2018). With the above intents, why haven't sustainability and climate goals been reached?

One can address this question from various lenses. Here we advocate for a shift in leader mindset to facilitate deliberate change management. This idea is not without precedent. Davis-Peccoud, Stone and Tovey (2017) suggest that leaders need a new mindset and clear public commitment to successfully implement sustainability programs. Rimanoczy and Llamazares (2021) discuss a paradigm shift that moves society from the epistemological pillars of mechanism, fragmentation, materialism, determinism, rationalism and competitive individualism to what they call a sustainability mindset. They argue (referencing Meadows (1999) on systems change) that to accomplish change of a system, one needs to address the mindset that is behind it as a mere attempt to fix the symptoms will prevent discovering and addressing systemic causes (Feygina, 2013; Seiffert and Loch, 2005; Waddington and Fennewald, 2018). Rimanoczy posits that mindset shift is a prerequisite for individuals and leaders to break out of an anthropocentric view and develop into champions for the planet (Rimanoczy, 2021a). Ritz (2021) calls a sustainability mindset a requirement for a transformative and connective leadership style, which is needed to address today´s global challenges.

Such changes in paradigms call for broad adjustments across all value chain and societal activities. Frameworks that guide managers through sustainability change exist (Doppelt, 2003; Dunphy, Griffiths and Benn, 2003; Lueneburger and Goleman, 2010). Yet, organizations are challenged by the scope of change and the management of it (Sloan, Klingenberg and Rider, 2013). This is compounded by managers and employees often lacking the needed knowledge and skills to implement them (Soyka, 2012; Klingenberg & Kochanowski, 2015).

Dunphy, Griffiths and Benn (2003) emphasize that leaders need to have relevant knowledge to be sustainability change agents. Lacy, Haines and Hayward (2012) confirm that the dearth of sustainability programs is often due to middle and senior management deficits in skill and knowledge of sustainability concepts, while Haugh and Talwar (2010) even call it "a leap of faith" to assume familiarity with such concepts. Managers need a sustainability road map to success.

Knowledge and intellectual capital management have been recognized as essential strategic pillars for firm success (Gupta & McDaniel, 2002; Snyman & Kruger, 2004; Halawi et al., 2005), for successfully navigating change or as a driver of sustainability (Matos et al., 2017; 2019). However, the role of knowledge and knowledge management (KM) for sustainability is not widely researched (Klingenberg & Rothberg, 2020). Most approaches focus on processes internal to the organization, such as organization-wide dissemination (Mohamad, Stankosky and Mohamad, 2009; Mohamad, Murray and Mohamad, 2010; Iazzolino and Laise, 2016; Iazzolino, Laise and Gabriele, 2017), or knowledge creation, capturing and dissemination (de Marchi and Grandinetti, 2013; Carayannis et al, 2017; Albort-Morant, Leal-Rodríguez and De Marchi, 2018). Meilnschmidt, Foerstl and Kirchoff (2016) on the other hand indicate the importance of identifying and recognizing external knowledge of sustainability concepts, prior to collecting said knowledge, while He at al. (2019) argue that knowledge identification is an essential first step. These observations influenced a three-step process of knowledge management for sustainability, DCA, beginning with defining (D) what knowledge is needed, then collecting (C) and acting (A) upon it (Klingenberg & Rothberg, 2020).

The first step, defining (D), specifically requires understanding what one is looking for. Knowledge about sustainability, however, is difficult to access due to its holistic, systemic, (Benn and Martin (2010), Williams et al, 2017; Klingenberg, Rider and Sloan, 2021) and transdisciplinary character (Schneidewind, 2010). Schneidewind (2010) and Parletow (2016) break it down into three components: system, target and transformative knowledge. System knowledge covers the functionalities and connections of socio-ecological systems. This knowledge develops into transdisciplinary target knowledge that defines sought-after goals as well as transformative knowledge that triggers change processes.

Furthermore, such knowledge is often hard to capture. Benn and Martin (2010) found in their study of a Chinese agricultural sector that many of the sustainable practices exercised by the farmers were based on tacit knowledge. Wilson and Rezgui (2013) describe that sustainability related knowledge in Small- to Medium-sized enterprises (SMEs) in the United Kingdom´s (UKs) construction industry was often tacit. A case study involving the Italian wine industry points to the importance of tacit knowledge of sustainability practices (Klingenberg et al, 2020). Hence, any model for the management of sustainability related knowledge encompasses a challenge well known in knowledge management, namely that of turning tacit into explicit knowledge.

The purpose of this paper is to further develop the "Define (D)" step of the DCA framework by considering the three knowledge types (system, target and transformational) and its partially tacit character. As explained, most research thus far explored processes internal to the organization, represented by "Collect (C)" and "Act (A)" of the DCA model, while the step of defining (D) is less researched, although of high importance and challenging due to the complexity of knowledge that requires defining. Therefore, this paper focuses on "D". Furthermore, tacit knowledge is emphasized, as its counterpart, explicit knowledge, can be defined with more ease. The overall objective is adding tools for managers that want to support the learning and change-capacities of their organizations by providing them with effective knowledge management processes for the most challenging part, the defining of tacit knowledge. It is posited that when tacit understanding becomes more tangible, shifts in mindset can occur more readily, and vice versa, that a broadened mindset eases sense-making of tacit knowledge, thus creating a cycle of growth and change for the organization.

The paper is structured as follows: The next section defines tacit knowledge and the SECI knowledge management process (Nonaka and Takeuchi, 1995), and pairs it with the Sustainability Mindset (Rimanoczy, 2021b). The comparison of assumptions and elements of these two concepts guides the deductive development of a new framework for knowledge management for sustainability, specifically, it is suggested that this pairing can yield common values for managing sustainability related tacit knowledge. In the third section, the Sustainability Mindset Indicator (SMI) is offered as a practical implication, a concrete tool that can accompany leaders and the organization in their transformation towards a sustainability mindset. The final section summarizes the proposed new framework and discusses limitations and future research.

2. Tacit knowledge, its management and the mindset

Nonaka and Takeuchi (1995) define tacit knowledge as knowledge that is difficult to formalize and communicate as it is rooted in perception, human behavior and in the mind. It is individualized, and often difficult to explain, as it can be subconscious (Stenmark, 2001), and thus incommunicable (Polanyi, 1967). Furthermore, it is embedded in cognitive processes, formed by individual culture and values (Daft and Lengel, 1986; Stenmark (2001).

Nonaka and Takeuchi (1995) provide a well-known framework for organizational learning of tacit knowledge: the SECI model. It consists of four steps: socialization (S), externalization (E), combination (C) and internalization (I). Step one, socialization, shares tacit knowledge, for example through sharing experience, face-to-face communication, visits etc. ("originating", tacit to tacit knowledge). Through externalization, this knowledge is made explicit, for example through brainstorming, road mapping, scenario planning ("dialoguing", tacit to explicit knowledge). Explicit knowledge is then combined (systemizing) into scenarios, foresight plans or learning packages (explicit to explicit). During the last step of internalization ("exercising"), the now available body of explicit knowledge is implemented, which converts it into new, tacit knowledge (explicit to tacit). The SECI model is then, according to Nonaka and Takeuchi (1995) a virtuous cycle of empathy to develop a sense for knowledge sharing. It appears to be a suitable model to further develop the defining (D) step to better capture tacit components of system, target or transformational knowledge. As explained in a later section, change towards sustainability, enabled by a mind-set shift, is also driven by empathy (Rimanoczy, 2010), hence the driving force for change and knowledge sharing is the same.

However, the aforementioned attributes of tacit knowledge create various difficulties: as tacit knowledge is embedded in individual culture and values, socializing to share such knowledge may be challenged when values between sharing partners do not align (Haag, Duan and Mathews, 2010). Hence, Elkington´s "radical intent" can only take hold if managers understand what needs to be changed. If sustainability knowledge is difficult to formalize, maybe individualized or even subconscious, and influenced by individual culture and values, then leaders who are not aware of these facets may experience difficulties in communicating clear goals (Davis-Peccoud, Stone and Tovey (2017). As values are routed in personal and societal preferences (Rokeach, 1973), managers first need a framework to guide understanding the context of value and culture. Then tapping into the pools of tacit knowledge to "Define (D)"- what the organization needs to know, develop processes that make this knowledge accessible and allow the development of target and transformational knowledge from system knowledge becomes easier. As Davis-Peccoud, Stone and Tovey (2017) call for a new mindset that is needed to enable business leaders to act towards sustainability, the sustainability mindset (Rimanoczy, 2021b) is proposed as the unifying, managerial framework that aligns unconscious values.

On the surface, the focus of sustainability initiatives is often on visible performance. Rimanoczy (2021a), in adapting the All Quadrants All Levels (AQAL) model (after Wilber, 2005) recognizes this visible, or external side of sustainability, expressed by individuals through behaviors, habits, initiatives and leadership, and for the collective, through regulation, innovations, solutions, programs and institutions. On the internal side, the focus of the sustainability mindset, is the individual´s values, beliefs, purpose, mission and identity, as well as collective assumptions and worldviews (Rimanoczy, 2021a). Kassel and Rimanoczy (2016, p.7) define this mindset as "a way of thinking and being that results from a broad understanding of the ecosystems' manifestations, from social sensitivity, as well as an introspective focus on one´s personal values and higher self and finds its expression in actions for the greater good of the whole" (p.7). This mindset is becoming the common ground to align values across the organization. On the basis of the mindset, managers and employees can understand the contexts of tacit knowledge, create an atmosphere open and responsive to socialization of this knowledge. As empathy is a key prerequisite to lead organizations towards sustainability (Rimanoczy, 2010) and serves as a fundamental value of the sustainability mindset, it then aligns to the driver of the virtuous cycle of the SECI model.

The sustainability mindset is structured into four content areas and twelve principles (SMPs) (Rimanoczy, 2021b). Table 1-4 (modeled after Rimanoczy and Klingenberg, 2021) provide an overview of these, per content area. The tables also indicate proposed levels of tacit knowledge, as well as the knowledge type (system, target and transformational). This creates a tool to operationalize the defining "D" step: managers can explore each content area, and within it, each principle to discover which knowledge of sustainability may be needed or supportive for the aimed at change towards sustainability. It then becomes clear that the mindset is not just the

common value ground, but includes tacit knowledge. In other words, the sustainability mindset is viewed not just as a prerequisite to untap the socialization stage of tacit knowledge sharing, but is by itself a source for knowledge.

Table 1: SMP content area Ecoliteracy

Content Area Ecological Worldview	**Definition (Rimanoczy, 2021b)**	**Tacit Knowledge**	**Knowledge Type**
Ecoliteracy	Understanding of the state of the planet in order to increase awareness of the challenges, the complexity of their interrelation, feelings about them.	Some	System Target Transformational
My Contribution	Identification of how we are contributing to the problems, in order to create chances to act.	Some	System Target Transformational

"Ecoliteracy" encompasses the knowledge about and understanding of the ecological systems of the planet and our social systems. It therefore consists of system knowledge, but this knowledge also generates targets, e.g., where these systems should operate. Similarly, "My contribution" addresses the understanding of how daily actions impact the planet and society, which is system knowledge. This promotes identification of targets for change in habits. Many aspects of this knowledge are explicit; as e.g., natural sciences allow us to describe ecosystems precisely. However, tacit knowledge such as indigenous wisdom, also fall into this content area.

Table 2: SMP content area Systems Thinking

Content Area Systems Perspective	**Definition (Rimanoczy, 2021b)**	**Tacit Knowledge**	**Knowledge Type**
Long-term thinking	Creating positive impact on global sustainability through long-term thinking.		Target Transformational
Both-and-Thinking	Inclusiveness of all stakeholders to create fair and peaceful societies	Yes	Target Transformational
Flow-in Cycles	Recognizing the cyclical character of all natural processes	Yes	System Transformational
Interconnectedness	Understanding the connectedness of individuals and consider diversity	Yes	System

In the content area of Systems Thinking, knowledge of the principle of "Long-term thinking" is explicit, as we can define time frames clearly; however, the other principles in this content area all carry tacit or intuitive knowledge. Thinking in the long-term as well as the inclusiveness that is represented in "Both-And-Thinking" set automatically targets the future. This brings forward transformational knowledge, as it generates ideas about how to reach these targets. Recognizing that all and everything is governed by the cyclical flow presented in nature is by itself system knowledge, but also transformational, once this cyclicality is accepted and one becomes part of the constant flow it generates. Understanding the self as a part of an interconnected system is also system knowledge.

Table 3: SMP Content area Emotional Intelligence

Content Area Emotional Intelligence	**Definition (Rimanoczy, 2021b)**	**Tacit Knowledge**	**Knowledge Type**
Creative Innovation	Acknowledging non-traditional wisdom and using intuitive knowing, non-verbal information, creativity and imagination	Yes	Transformational
Reflection	Reflective practices to ponder implications prior to acting	yes	Target Transformational
Self-Awareness	Exploring personal beliefs, values and assumptions	Yes	Target Transformational

The content area of Emotional Intelligence (which in the context of the Sustainability Mindset is not as all-encompassing as the term is generally used, e.g., by Goleman, 1995), with its principles "Creative Innovation", "Reflection" and "Self-Awareness" reaches into the tacit knowledge everybody carries. The latter two principles

formulate target knowledge of practices and actions, that becomes transformational as a person acts upon them.

Table 4: SMP content area Spiritual Intelligence

Content Area Spiritual Intelligence	**Definition (Rimanoczy, 2021b)**	**Tacit Knowledge**	**Knowledge Type**
Oneness with nature	Understanding that we are a species within species	Yes	System Target Transformational
Purpose	Definition of our purpose as an unconscious compass to help shaping a better world.	yes	Target Transformational
Mindfulness	Enhancing awareness and compassion towards social and environmental actions	Yes	Target Transformational

Spiritual Intelligence is often the result of tacit knowledge, which is reflected specifically in the principle of "Oneness with Nature". This embodies knowledge of the natural system, and generates targets for behavioral patterns and transformational knowledge, for example the development of different approaches towards agriculture and eating habits that better reflect planetary realities. Having an unconscious compass ("Purpose") and being aware of and compassionate about social and environmental actions ("Mindfulness") sets targets and is thus per se transformational, as leaders formulate explicit goals and objectives for their organizations.

These reflections demonstrate the richness of knowledge embedded in the sustainability mindset. It encourages the contemplator to become open-minded and use rational thinking *and* affection to trigger action. If embedded in an organization it furthermore encourages sharing (socialization) of tacit knowledge, thus providing common values and beliefs that enable managers to seek the knowledge needed to move the organization towards sustainability.

3. Practical considerations

The objective of this paper is to provide managers with better tools for knowledge management towards sustainability. While managing explicit knowledge is easier, much of the knowledge for sustainability is tacit. Extending the DCA model to include the SECI model considerations for "D" – Define - can facilitate the task of tapping into said tacit knowledge. Furthermore, the paper argues that the Sustainability Mindset (Rimanoczy, 2021a) can be a guiding framework for managers to identify the needed knowledge. If a mindset change is a prerequisite for aligning internal and external values, how can managers support such a shift throughout the organization? A concrete tool exists in the Sustainability Mindset Indicator (SMI), a personal development tool that supports individuals on their journey towards such a mindset (Rimanoczy and Klingenberg, 2021). Working with the SMI allows individuals and groups to further their knowledge of the different content areas of the sustainability mindset. As explained in the previous section, this should allow discovering tacit (and explicit) knowledge along the dimensions of system, target and transformational knowledge. Paired with, for example, face-to-face exchanges or joint experiences, and followed by, for example, brainstorming or road mapping, an organization can operationalize the socialization and externalization steps of the SECI model, thus feeding the gained knowledge into the "D" (Define) step of the DCA model.

In the past, other tools for mindset shift were developed and should be mentioned: Competencies Assessment of Responsible Leadership (CARL, Muff, Liechti and Dyllick, 2020); SQ21 (21 Competencies for spiritual intelligence, Wigglesworth, 2014, and SCTi-MAP (Leadership maturity levels, Cook-Greuter, 2004). These tools may also be of interest to encourage individual and organizational mindset shifts. Exploring the suitability of their use to generate a similar cycle of exploring, generating and externalizing tacit knowledge for sustainability, goes, however, beyond the scope of this paper.

4. Conclusions, Limitations and Outlook

This paper started with the question why progress towards sustainability appears to be slow, regardless of alarming reports about the health of the planet, and endless calls for action? It recognizes that one of the driving forces of the required change is knowledge and KM. While frameworks for both in the context of sustainability exist, it still seems that they are not sufficient. Given the systemic nature of knowledge about sustainability, and the fact that it itself contains system, target and transformational knowledge, and often tacit knowledge, it is

posited that this could be addressed in the following way: Application of the SECI knowledge management model (Nonaka and Takeuchi, 1995) to help Define (D) what knowledge is needed can facilitate tapping into the pool of tacit knowledge. However, to align underlying value systems and to move from the focus from external aspects of sustainability towards internal ones, a mindset shift is needed. The Sustainability Mindset and its principles (SMPs) as well as the Sustainability Mindset Indicator (SMI) are suggested as a pathway and concrete tool to create joint value systems, to discover tacit knowledge that can then be externalized. The SMPs provide a rich source of knowledge about sustainability, that can unleash organizational change when combined with adequate KM processes.

However, limitations exist. The SMPs and the SMI are established, however, the presented framework of combining them with KM processes is thus far a theoretical, deductively developed framework. Furthermore, other mindset tool mentioned in the previous section where not yet considered. The authors intend on finding organizations willing to engage in trials of the proposed framework to generate empirical guidance.

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Knowledge Management and Corporate Social Responsibility Interactions in Theory and Practice

Patrycja Krawczyk
Czestochowa University of Technology (CUT), Częstochowa, Poland
patrycja.krawczyk@pcz.pl

Abstract: Knowledge management (KM) in the context of corporate social responsibility (CSR) is a new and challenging topic. The possibilities of effectively introducing this process within an organisation and the global trend of its implementation are signals that the topic is worth taking a closer look at. Knowledge management brings the benefits necessary to effectively conduct business. When designed consciously and appropriately, they can increase the effectiveness of business activities and strengthen a company's competitive position. On the other hand, many companies have made the principles of sustainable development a part of their strategy. Knowledge management in the area of CSR is related to important challenges. One of them is a commitment of the board of directors. Particular attention should also be paid to the needs of people in various positions and different company departments. Companies spend huge amounts of money to accumulate knowledge in various forms. However, they cannot turn this knowledge into concrete actions. This article aims to identify common areas of KM and CSR. How the application of both of them will enhance company performance. It utilizes the methods of literature analysis and company reports analysis, as well as own observations. The research was conducted in two stages. Stage 1: literature analysis and synthesis. Stage 2: Analysis of non-financial reports of selected entities. The research question is, how to use knowledge management in the context of CSR. The goal of this article is to show the resonance between knowledge management and corporate social responsibility. The conclusions presented in the article can be valuable for business professionals, small business owners, entrepreneurs, academics, researchers, and business students.

Keywords: knowledge management (KM), corporate social responsibility (CSR), sustainability, non-financial reporting

1. Introduction

Global economic development based on sustainability is only possible through broadly understood knowledge. The term sustainability is the result of understanding the three aspects: social, environmental, and economic, taking into account the costs of current decisions for future generations. Sustainability is a contemporary and current issue recognized by researchers(Al-Ali Mubarak, Gorgenyi-Hegyes and Fekete-Farkas, 2020) and is the main derivative of this concept for business. The communication of an organisation's performance in its economic, social, and environmental dimensions to the concerned parties is the principal function of the CSR (Corporate Social Responsibility) reporting process. In this way, an enterprise demonstrates the effectiveness of its actions in the area of social responsibility management. Thus, the CSR reporting should be part of the process of creating an organisation's strategy, implementation of its action plans (Krištofik, Lament and Musa, 2016). Entrepreneurs should invest in CSR and seek to improve the quality of their relationships with their funders (Mastrangelo, Cruz-Ros and Miquel-Romero, 2019).

Today, knowledge is an elementary component of a company's assets. It is difficult to identify and even more difficult to value. The ability to manage knowledge (KM) becomes critical in today's knowledge economy. The creation and diffusion of knowledge have become increasingly important factors in competitiveness. More and more, knowledge is being regarded as a valuable commodity that is embedded in products (especially high-technology products) and the tacit knowledge of highly mobile employees (Dalkir, 2013).

CSR and KM are two concepts that have gained popularity. These currents have been developing in isolation for many years. Their intersection seems to be an inevitable process. Being socially responsible is something to be proud of. However, simply being socially responsible is not enough, it is also necessary to pass this information on to a wide range of internal and external stakeholders. Many companies understand this and try to emphasize this attribute. This is where the need for information transfer and knowledge management arises. This means that KM should be an indispensable element of the broadly understood CSR. With increasing frequency, articles combining these two issues appear in the literature. This is the beginning of the process of incorporating knowledge management in CSR on a theoretical basis. This trend should also be followed by economic practice.

Knowledge management is increasingly perceived as a prerequisite for proper and rapid economic and social development. When communicating your CSR activities, it is necessary to remember to maintain the principle of substance over form. Such balance can be ensured by implementing knowledge management.

This article aims to define the category of CSR, in relation to a company's balanced development concept which, at least thus far, constitutes a theoretical gap in the literature. The author has tried to define the implementation of CSR with KM. The paper includes an analysis of the literature of the subject and qualitative research based on secondary sources.

2. Systematic Literature Review

The purpose of the literature review is to briefly define the concepts of CSR and KM. Showing the variety of studies on these concepts. Presentation of the publication gap in the area between these two concepts. The communication of an organisation's performance in its economic, social, and environmental dimensions to concerned parties is the principal function of the CSR (Corporate Social Responsibility) reporting process. In this way, an enterprise demonstrates the effectiveness of its activities in the area of social responsibility management. Therefore, CSR reporting should be part of an organisation's process of strategy creation and action plan implementation (Krištofik, Lament and Musa, 2016). Corporate social responsibility requires a company's continued commitment to comply with ethical norms in its operations, while contributing to economic development, as well as improving the quality of life of employees, their families, local communities, and society as a whole. A growing body of literature suggests that an organisation's involvement in CSR policies and practices tends to not only contribute to improving financial outcomes at the organisational level, but also to non-financial outcomes such as the company's reputation in the eyes of its consumers, and its attractiveness to investors by satisfying external stakeholder expectations (Liu, 2018).

The content and goals of CSR may differ depending on the country of origin of the company. The implementation of CSR may depend on the macroeconomic conditions in the country and the existing differences in regional economic development, special economic zones, differences in productivity, regional innovation performance, the effectiveness of labor market policy, and productivity convergence in the regions from which the researched companies come from (Piersiala, 2019b). Implementation of a responsible business and sustainable development strategy has a chance of success when it is supported by the management board and people in managerial positions and finds widespread acceptance among the company's employees of the company. Therefore, the processes and tools of multidimensional knowledge management in the context of CSR should be elements of the strategic vision and mission implementation in companies and constantly accompany other key processes, i.e. internal communication or human resource management.

According to the Global Reporting Initiative, a CSR report can be defined as: “A sustainability report is a report published by a company or organization about the economic, environmental and social impacts caused by its everyday activities. A sustainability report also presents the organization’s values and governance model, and demonstrates the link between its strategy and its commitment to a sustainable global economy.”

The analysis of reports on CSR implementation in enterprises gives ground to conclude that corporate social responsibility has a significant impact on the functioning of a business. For this reason, companies cannot treat the idea of CSR as a passing fashion and associate it only with the need to incur expenses, but rather should see it as a management strategy based on multidimensional relationships with a wide range of stakeholders, and as such consider it an investment and source of innovation (Piersiala, 2019a). Being a socially responsible entity is a sign of prestige. Social reports based on knowledge management can become an essential tool in this process. Such information should thus be an element of knowledge management within an enterprise.

21st-century organisations must be aware of the importance of non-material factors in building a position or creating a competitive advantage. Knowledge as an intangible resource is of great importance in creating the organisation's value (Rosińska-Bukowska, 2020; Bencsik, 2021). Effective knowledge management allows organisations to gain many benefits, such as improving organisational quality or quickly transferring and using the right resources in an appropriate manner (Sagan, 2019).

Knowledge can be divided into two major groups. One of these is formalized and easily transferable knowledge, while the other is defined as latent (tacit) (Poór *et al.*, 2018). Intellectual capital is the value of a company's employee knowledge, skills, business training, or any proprietary information that may provide the company with a competitive advantage. On the other hand, intellectual capital can be divided into human capital and structural capital (Edvinsson and Malone, 1997; Łęgowik-Świącik, 2021).

According to Thomas A. Steward, knowledge resources can be divided into three primary categories: the first is the individual knowledge of employees (their experience, skills, proficiency), the second is knowledge recorded in documentation or databases, and the third is knowledge protected by patents, trademarks, copyrights or trade secrets (Stewart, 1997).

Knowledge is an essential resource for all businesses of the globalisation era (Nonaka and Toyama, 2015; Ding *et al.*, 2017; Abdillah *et al.*, 2018). Knowledge management, as a young field in management sciences, encompasses state-of-the-art methods and techniques to ensure the most effective use of knowledge resources. Over the past decades, knowledge management (KM) has proven itself not simply a trendy movement in research, but a new discipline drawing a growing body of worldwide research. It has been considered a new and influential approach in the science of management. It is KM, a new source of sustainable competitive advantage that makes organisations all over the globe redefine their business strategies (Ngoc-Tan and Gregar, 2018).

The knowledge management system distinguishes three models:

- The Japanese model. This model is based on both tacit and formal knowledge - Nonaka and H. Takeuchi.
- Resource model creted by D. Leonard-Barton. He believed that for a system to function well, there must be a link between five elements, namely: the management system, the knowledge, and skills of employees; experimentation; knowledge transfer; a common solution; the use of new technologies.
- Process model. This model is based on studies and practical experience. This approach distinguishes three knowledge management processes: the knowledge codification process; the knowledge transfer process; the knowledge creation process - T.H. Davenport and L. Prusak.

The topic of knowledge management is taken up by many academics. Skuza and Prusak write about knowledge management in the context of integrated management. Their study presents considerations regarding the possibility of including knowledge management in integrated management systems, treating knowledge as a basic element connecting the system (Skuza and Prusak, 2018). Knowledge management combined with the future of artificial intelligence is shown in an article by Bencisk (Bencsik, 2021). Radziszewska writes about the role of social media in the context of sustainable development. She emphasizes the key role of sustainable development in building a company's long-term strategy (Radziszewska, 2021). She attempts to explain how social media can influence consumer knowledge in the field of environmental protection.

Civilizational changes have resulted in the world economy moving from the industrial era to the era of information and knowledge. Information is of very high importance. The concept that organisations consider social and environmental interests and relationships with other actors at the stage of strategy building has existed for two decades. The great importance of information combined with the concept of CSR resulted in the emergence of non-financial reports (Krawczyk, 2019).

The purpose of this article is to present the characteristics of a learning organisation and offer insight into the idea of CSR, especially in areas linked with the characteristics of a knowledge-based organisation. Considerations have shown that a learning organisation is a space in which the CSR concept can be properly interpreted, appropriated, and implemented. Ethics, in turn, provide sufficient grounds for the implementation of all the principles of social responsibility in an enterprise (Wołoszyn and Ratajczak, 2011). However, there are not many scientific publications combining the subject of KM and CSR. Their compilation is outlined in Table 1.

Table 1: List of publications combining CSR and KM

Author, title, year	**Findings**
L. Preuss, J-R. Córdoba, A knowledge management perspective of corporate social responsibility, 2009	"… paper aims to determine how knowledge management (KM) processes can foster (or impede) progress towards corporate social responsibility (CSR). Distinguishing between two related but analytically distinct approaches to knowledge management, namely an element and a process view, the paper develops a conceptual model of how knowledge management can impact on CSR. Distinguishing between elements of knowledge and processes of managing these allows a more systematic and comprehensive approach to managing knowledge around CSR."
M. Klimczok, A. Tomczyk, CRS - the concept of responsible business in light of knowledge	"... the concept of corporate social responsibility and its importance from the perspective of knowledge management in the company, which is necessary for effective planning and proper functioning of the organisation… Therefore, it seems

Author, title, year	Findings
management in an enterprise, 2013	that the concept of corporate social responsibility cannot be implemented in a company without effective knowledge management."
I. Sztangret, Corporate Social Responsibility Through Knowledge Management on the Example of IT Products' Sector, 2017	"The article identifies and describes the way in which the concept of corporate social responsibility is implemented in the group of selected IT sector entities applied in response to conditions of the environment of functioning. It is perceived through the prism of management of partners' knowledge in the eco-system of relationships of sample enterprises, IT sector leaders and their partners, including customers. The problem gained special significance in the dynamic environment of functioning of enterprises, determined by social, economic and environmental changes."
J. Poór et al., Knowledge management in human resource management, 2018	"Knowledge transfer is strategically important for general sustainability of business, and this contribution aims to provide some insights into one specific area – the complexity of human resource management in foreign-owned subsidiaries… Knowledge management and knowledge transfer play a critical role in HRM at the local level and also between HQ and local subsidiaries."

Source: the authors' compilation based on (Preuss and Córdoba, 2009; Klimczok and Tomczyk, 2013; Sztangret, 2017; Poór *et al.*, 2018)

However, there is a scarcity of management programs on CSR, creating a void in knowledge concerning the implementation of CSR by modern organisations. Knowledge management comprises a range of strategies used by an organisation to identify and enable the adoption of insights to help managers contribute towards personal, professional, and organisational effectiveness (Rao, 2018). The goal of this article is to show the resonance between knowledge management and corporate social responsibility.

3. Research Results

Corporate social responsibility and knowledge management are two trends in the economic space that have been developing in parallel for many years. Their characteristics are compared in Table 2.

Summarizing the compilation contained in table 2, one may conclude that the greatest development of both concepts took place in the 1990s. The definition of KM places much emphasis on the meaning of information transformed into knowledge. In the case of/ CSR, the most important issue is sustainable development. The intended effect of implementing both strategies is improved management of resources in general. CSR places much emphasis on looking into the future of an enterprise and ensuring its long-term development. Both trends focus highly on employee development. They can also be a source of benefits for external stakeholders. Many common tools can be utilized by both strategies. One of these is certainly social media activity. Another important element are reports which, from the perspective of KM are a carrier of knowledge. For CSR, they are an element of marketing. Non-financial reports are essentially a product of these two concepts. It is, therefore, worth studying the inclusion level of knowledge management in Corporate Social Responsibility reports.

Table 2: KM and CSR - comparison of the most important characteristics (components)

	KM	CSR
Inception	Ultimately, the concept of knowledge management is dated back to 1987. This was the date of the first conference in the United States entitled Managing the knowledge assets into the 21st Century. The development of knowledge management took place in the second half of the 1990s and was popularized by the Japanese Ikujiro Nonaka. In 1995, together with Hirotaka Takeuchi, he published The knowledge-creating Company - How Japanese Companies Create the Dynamics of Innovation.	The assumptions of the CSR concept have their origins in the United States as early as the end of the 18th century. The social responsibility of business at that time consisted in personal charity activities conducted by entrepreneurs. The 1950s saw the publication of a work by Howard Bowen – "Social Responsibilities of the Businessman", in which he explained that enterprises should conduct activities following social goals and values because their business activity is directed at ordinary people. An important point was the emergence of new trends and concepts in the 1990s, such as sustainable development or corporate citizenship.
Definition	Knowledge management can be defined as the overall activities aimed at identifying, preserving,	Corporate Social Responsibility (CSR) is a management strategy, according to

	KM	**CSR**
	disseminating, and using the explicit and implicit knowledge of a company's personnel to improve the efficiency and effectiveness of the employees' activities.	which enterprises in their operations voluntarily consider social interests, environmental aspects, and relations with various groups of stakeholders, their employees in particular.
Purpose	Shaping the organisation's knowledge resources and ensuring its efficient flow in individual functional areas of an enterprise.	Being socially responsible means investing in human resources, protecting the environment, relations with the company's environment, and informing providing of these activities, which contributes to increasing the company's competitiveness and shaping the conditions for sustainable social and economic development.
Implementation Effect - benefits	The effects of introducing KM at 3 levels: 1. The enterprise level: - management cost reduction, - increased management efficiency, - increased creativity, - development of the enterprise, 2. The employee level: - increased competencies and work productivity, - self-realisation, - development/growth, - increased competitiveness of employees in the labour market. 3. The level of benefits for both partners and competitors includes: - ideas for new products and services - information exchange, - understanding the customer's needs.	The effects of introducing CSR at 4 levels: 1. The enterprise level: - higher current liquidity; - better use of fixed assets and human capital; - better sales profitability; - more investments per 1 employee. 2. The employee level: - timely payment of remuneration; - high work culture and work safety; - continued occupational development thanks to training availability; - additional medical care; - high-quality social benefits; - equal opportunities for women and men in terms of positions and wages. 3. Benefits for the community: - higher level of culture and work safety; - reduction of the negative impact of businesses on the environment; - implementation of social goals unattainable without support from business. 4. Environmental benefits: - conduct following best practices; - rational management of natural resources and waste; - engagement of business partners in the chain of environmental responsibility and initiation of joint pro-ecological actions; - popularization of pro-ecological ideas.
Tools	Open knowledge management tools: - Project reports - Post-project analysis with the person in charge of the given area of knowledge. - Knowledge mapping - Practitioner groups - Transfer of best business practices - Knowledge fairs - Competence management (regular assessment and competence development planning of individual employees) - Master-apprentice (mentoring) programs - Knowledge sharing technologies (e.g. groupware) - Shared databases	- Social campaigns, including those conducted via new social media - Socially involved marketing (Cause-Related Marketing, CRM, social marketing) - Ethics programs for employees - Employee volunteer work - Eco-labelling and social labelling - Social reports - Socially responsible investment (SRI) - Sustainable supply chain management - Investments in ecology - Corporate governance

	KM	CSR
	- Knowledge brokers (organisation members responsible for a specific area of knowledge) - Social software (wikis, blogs, etc.) Classified knowledge management tools: - knowledge map, - e-learning, - blog, - social media, - internal practitioner networks (trade blogs), - video conferences, - newsletters, - corporation websites,	

Source: own study.

The database for this study is CSRinfo, which is the Polish GRI Data Partner and collects report data for the Global Reporting Initiative. It services the Polish region in order to facilitate access to non-financial reports and promote this form of reporting. CSRinfo handles consulting, training, and education in the area of responsible business and sustainability standards. Reports contained in the database are prepared according to various standards (GRI, SIN, other), some of them are published in PDF format, while some are online - these are integrated or non-integrated reports from various industries.

The qualitative study encompassed 35 reports published in 2020. The reports have been analysed in terms of their references to Knowledge Management. The study sample features reports of entities from various sectors, including banking, insurance, petroleum industry, retail including e-commerce, food industry, media, electromechanical industry, services, and others, construction, chemical industry, metal products industry, information technology, power industry, wholesale, automotive industry, transport and logistics, building material industry, finance, and others. Some of the reports are integrated, while others concern only CSR.

Based on the collected data, it can be concluded that only one entity's report includes references strictly to knowledge management. In the vast majority of reports - 28 - indirectly mention knowledge management practices. These are usually statements concerning knowledge sharing. As many as six entities did not refer to knowledge in any way. Table 3 shows select ways in which entities refer to knowledge management.

Table 3: Qualitative study results

Integrated report of the Orlen group for the year 2019	- Projects are conducted with the purpose of organisational development based on knowledge, unleashing the internal potential, and sharing feedback. In 2019 the company continued its internal employee innovation activation program which motivates employees to submit initiatives and enables identifying solutions with a high innovativeness level, incl. the ORLEN Insight knowledge-sharing platform… - Thanks to such actions, employees know how to behave in a dangerous situation. - Culture of innovation: motivating employees to create innovative technical and technological solutions through implementation of - internal projects and intranet platforms for innovation processes stimulation and knowledge management.
PZU annual report 2019	The knowledge and experience of the PZU Group's employees constitute the company's great potential. Understanding its significance to society and the economy, PZU has introduced new knowledge-sharing standards. Participation in various events, conferences, and symposiums, and activity towards the development of business, science, new technologies, and financial education allow - in consideration of the common good - to share a part of its expert knowledge with employees and the company.
Towards fashionable sustainability. LPP S.A Integrated Report for the year 2019/20	We provide intense training to our employees and promote sharing knowledge, which is why we often speak at industry events or conduct workshops.
Kompania Piwowarska sustainability report for the calendar year 2019	The people employed at our company eagerly share their time, skills, and knowledge with those in need, and we provide financial and organisational support to such activities.

"Apator Bliżej". Report on non-financial information of the Apator Group for 2019	The newly defined goals in the perspective of 2023 are:… efficient exchange of information and knowledge within the Group.
CIECH Group non-financial report for the year 2019	In 2019 the CIECH Group once again received the Highest Quality HR Certificate awarded by the Polish Human Resource Management Association. The award was received in the category of employee development for the implementation and execution of the Production Worker Competency Assessment and Skill Development Program. The Program aims to build a culture of knowledge sharing within the organisation, recognize potential among employees and their development in a coaching role, as well as expand the internal training portfolio.
Intercars Group Sustainability Report for 2019	Knowledge, an innovative perspective on the future, and many years of experience are practices that we constantly improve, but which we are also happy to share, actively participating in the work of industry associations.
Biedronka - Jeronimo Martins Polska S.A. - Sustainability report for 2018-2019 – responsible every day	We share our knowledge concerning customer needs with our partners and we know that they appreciate it, drawing ideas for development from it.
Make Your Space Responsible - Nowy Styl Group Sustainability Report 2018-2019	In the special "Knowledge" tab, in addition to numerous articles, you can find our reports referring to the current market needs, case studies, and the company's "UPstream" magazine. We share knowledge not just on the Internet.

Source: owend elaboration based on CSRinfo Date Base.

The results of qualitative research show that in economic practice, few entities refer to knowledge management in their sustainability reports. Simultaneous implementation of the assumptions of sustainability and knowledge management in a company's strategy can provide the entity with many benefits.

4. Conclusion and future work

Corporate social responsibility and knowledge management are two trends in the economic space that have been developing in parallel for some time now. Recent years have given rise to the academic discourse on the interpenetration of these two issues. This was shown in the literature review. Furthermore, economic practice is beginning to notice the relevance of implementing both solutions in parallel. Consideration should be given to how these techniques can be implemented to maximise their mutual permeation.

There is an extensive gap between the key elements of Knowledge Management and CSR. The current role of knowledge management in sustainable development is rather minimal. The ways to fully utilise the potential of knowledge management claimed by academic research are still to be discovered. For this purpose, future research is needed, focusing on practical aspects of knowledge management applications.

This study was conducted based on reports published by CSRInfo. The materials presented through them have a high level of credibility (CSRInfo is a local partner for the Global Reporting Initiative), however, it is a database of reports encompassing one country. Further research should be expanded to include a comparative analysis of reports from other countries. This issue is an area for further research into the interactions between corporate social responsibility and knowledge management.

Enterprises that see the importance of CSR values have quickly noticed that the fact of being socially responsible should be presented. CSR should be an element of knowledge management within an enterprise. Knowledge that should be presented inside and outside the organisation. Knowledge that builds the image of a socially responsible company ensuring its long-term development. Transparency of company knowledge promotes sustainable development.

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Remote Negotiations during the COVID-19 Pandemic and Its Impact on Interorganisational Relations of Small and Medium-Sized Enterprises

Joanna Krzywda
Czestochowa University of Technology, Czestochowa, Poland
joanna.krzywda@pcz.pl

Abstract: Theoretical considerations show that negotiation is a very important element of interorganisational relations. According to the relationship model by P. S. Ring and A. H. van de Ven (1994), which is still valid today, negotiation is, besides the formation of commitments and their implementation, one of the 3 stages in the formation of interorganisational relationships. Efforts at the negotiation stage are often necessary to provide participants with an opportunity to assess the uncertainty involved in the transaction, the nature and substance of each participant's roles, the trust that can be placed in the other party, the rights and responsibilities of the participants in the transaction and the possible efficiency and equality of outcomes. This paper will attempt to answer the question of how the pandemic has changed the way business negotiations and talks are conducted and what impact this has on business relationships. To this end, with reference to the aforementioned business relationship model, research questions were formulated, the core of which was to reveal how remote negotiations affect the trust in the relationship and how the fact that remote negotiations affects the dynamics of the relationship, compared to face2face negotiations. The answers to the questions posed in this way were obtained by conducting a survey of Polish managers who are involved in negotiation on a daily basis and who have shifted their activities to online platforms during the pandemic.

Keywords: negotiations, remote negotiations, interorganisational relationships, trust

1. Introduction

According to the opinion of business theorists and also business practitioners, interorganisational relationships (IORs) are a key resource of the enterprise. Giving those relationships such a great importance is based on the assumption that the stronger they are, the better the company performs compared to its market competitors (Małys, 2014). From a theoretical and practical perspectives, it becomes important to understand and monitor the quality of these relationships (Jiang et al 2016). Many companies are aware of this fact. There are efforts to strengthen cooperation between business partners and move from a transactional model through a relational model to a strategic partnership model, yet there are also many failed relationships. However, no matter what relationships are formed between businesses, establishing and sustaining them cannot do without negotiation. Negotiation is a key interaction in every business project - and every business relationship - is negotiation-related. Thus, it becomes apparent that negotiation is fundamental to the relationship. Consequently, if one assumes this to be the case, then it is important what factors influence negotiation. Recently, in the wake of the COVID-19 pandemic, one factor has become particularly important - the need to have many discussions online. This form of business conversation has of course been known for some time, but in connection with the pandemic such conversations have become increasingly commonplace. Thus, the question can be asked as to how this has affected negotiations and business relationships. This paper addresses this very question.

2. Literature review

In the literature, research on IORs and negotiation has a long and rich history. Contributions in a whole spectrum of literature on the subjects related to relationships are very rich and multi-threaded. One of these threads is the role of negotiation in building relationships and the connections between relationships and negotiations. It is worth noting here a non-academic strand of literature which clearly points to trends and tendencies that can be expected in relationships on the basis of textbooks and handbooks that have always been present on the market. First of all, we should of course mention Getting to Yes (Fisher, Ury, Patton, 1981), which is a fundamental work on relationships, or rather on building them through negotiation. It is a guide to negotiating whose motto is good, long-lasting relationships. Together with the continuation of Getting to Yes, the book Getting to We (Nyden, Vitasek, Frydlinger, 2013), but also books such as Negotiating the Nonnegotiable (Shapiro, 2016) give us a picture of the contemporary perception of relationships shaped by negotiation.

The issue of negotiation itself is, needless to say, examined in a number of ways. Many works thematise the factors that influence negotiation. Among the factors that affect negotiators' behaviours and choices, BATNA,

or best alternative to a negotiated agreement, is considered most often (Fisher, Ury, Patton, 1981). There are well known studies 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 that shape negotiators' attitudes include the history of relationships linking negotiation counterparts (Thomas et al. 2015, Patton et. al. 2010; Pinkley et al., 2019), 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 prioritise 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 can 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 expectancies 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). A new factor that influences negotiation is the new technologies, which recently, in times of pandemic, has been particularly evident. This factor and its impact on negotiations, and thus on relationships has not yet been very well recognised and described. This question is particularly relevant in the context of the COVID-19 pandemic, which caused negotiations to move online and become remote negotiations. Hence, we can speak of a certain research gap and a research problem, which is actually the main question in this paper: how does the fact that negotiations take place on a remote basis affect relationships?

3. Conceptual framework and methodology

In order to answer the question posed in this paper, it is assumed that relationships and negotiations remain in a certain arrangement in relation to each other, which is best illustrated by the model of relationships seen as a process. The model of a relationship in terms of a process, or rather a cyclically repeated sequence of events, is presented in the fundamental work of P. Ring and A. van de Ven. This work is an important contribution to the study of relationships, because it presents a model of the relationship that takes into account its entire 'life', which has its beginning, consists of phases, and may end, (Ring, Ven, 1994). Since this model very well explicates the role of negotiation in relationships, it is worth adopting the approach presented here as a starting point in considering the role of negotiation in relationship management. It also seems that despite the passage of time this model has not lost its relevance. A diagram of this model is shown in the figure below.

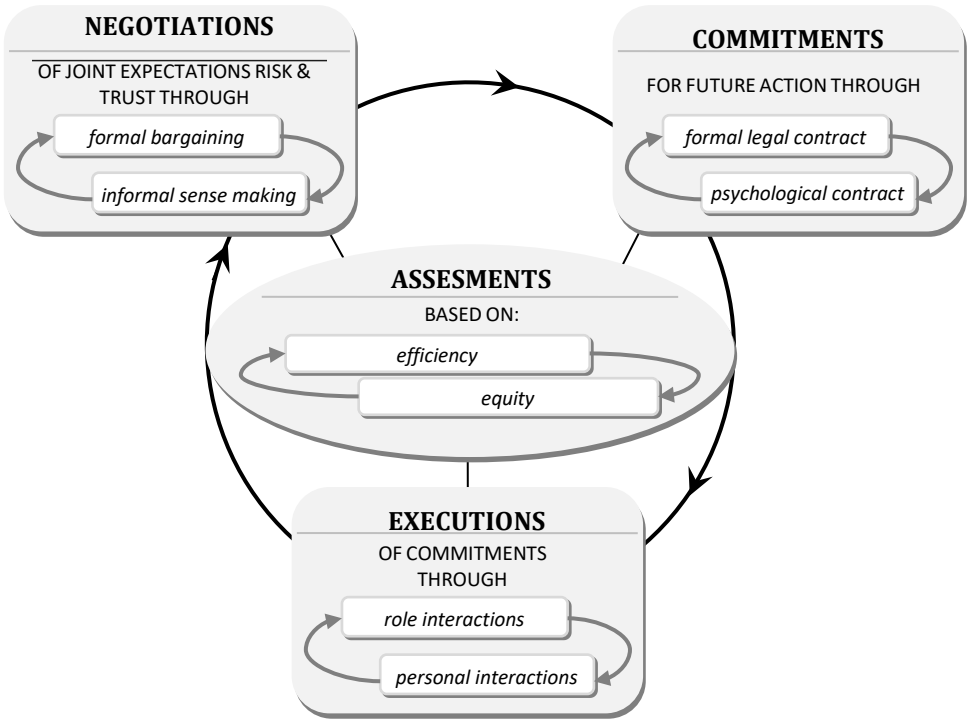


Figure 1: Process Framework of the Development of Cooperative IORs

Source: P. S. Ring, A. H. van de Ven (1994) “Developmental process of cooperative interorganizational relationship”, *Academy of Management Review*, Vol 19, No. 1, pp 90 – 118.

In the cyclical model, IORs emerge, develop, or weaken as a consequence of individual actions and decisions of particular persons. There are three ways that have been identified in which the actions of individuals affect IORs:

- defining the degree of uncertainty that exists in a given relationship,
- defining the degree to which trust can be relied upon in a given relationship,
- clarifying outcome expectations with respect to the effectiveness and equality of the exchange.

The diagram depicts the evolution of a cooperative IOR as an iterative sequence of three stages: negotiation, making a commitment, and delivering on a commitment made. In practice, these stages overlap and their duration varies depending on the level of uncertainty about the issue at hand and the trust between the parties, as well as the evaluation of the outcome according to the criteria of equality and effectiveness of the exchange.

Understanding the role of negotiation in shaping relationships is facilitated by analyzing another model, by S. Thomas, K. B. Manrodt, J. K. Eastman (Thomas, Manrodt, Eastman, 2015). Taking a broader perspective, the authors of the model assumed that the relationship between suppliers and buyers is a key element in the practice of supply chain management. The model also assumes that there are two main negotiation strategies: a cooperative strategy and a competitive strategy. Individual '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 buyer and seller is built over a series of transactions.

Based on these two models, it was assumed that the way one negotiates influences the relationship. It was assumed that the form of negotiation - remote or traditional face to face (f2f) - influences the elements of negotiation highlighted in the model. Accordingly, the following research hypotheses were posed:

1. Hypothesis: uncertainty and risk are higher in remote negotiations and trust is difficult to build.
2. Hypothesis: Formal negotiation prevails in remote negotiation.
3. Hypothesis: Remote meetings make it more difficult to reach agreement and make commitments.
4. Hypothesis: Efficiency of negotiation and equity of negotiation outcome do not depend on the form of negotiation.

The research tool was an anonymous survey conducted among entrepreneurs or people employed in small and medium-sized enterprises from the Silesian Voivodeship in Poland who declared experience in remote negotiations. The survey consisted of 25 questions, in which the respondents were asked directly about the researched phenomena and asked to evaluate them using a semantic scale. Due to the object of the research being relationships and negotiations, it was felt that the interpretation of the survey results should be qualitative in nature. The questions in the survey were constructed in such a way so as to obtain verification of the hypotheses posed at the beginning of the study. Some of the respondents shared their opinions on some of the themes raised in the survey, which was taken into account in the interpretation of the results.

4. Results

There were 64 respondents who provided their answers. Given the commonness and popularity of negotiation, it should be noted that this is not a large number. Therefore, already at this point it should be stated that in order to confirm the results of the survey, it would be necessary to extend it with a larger number of respondents and a different research method (e.g. interviews). Thus, the survey may be treated as preliminary research.

All were employees or owners of small and medium-sized enterprises located in southern Poland, representing such industries as insurance, construction, metal waste processing, packaging, services and others. The respondents participating in the survey were managers, executives, and owners. The majority of respondents (51.5%) assessed their experience in remote conversations as medium, 20.3% had little experience in their opinion, the remaining respondents described their experience as extensive. The majority of the surveyed people - almost 80% - declared that they preferred traditional f2f talks. For almost all of the remaining respondents it was irrelevant in which form they conducted negotiations. It is also significant that nearly 93.75% of the respondents felt that remote negotiation was for some reason "more difficult" than traditional negotiation.

4.1 Uncertainty, risk and trust

The respondents were divided on the issues of uncertainty in remote and traditional negotiations. 40.6% believed that uncertainty in remote negotiation was slightly smaller than in f2f negotiation while the same percentage believed that it was the same in both types of negotiations. Only 12.5% of the respondents felt that uncertainty in remote negotiation was a little greater or much greater than in the traditional format. None of the respondents felt that uncertainty in remote discussions was much smaller than in f2f negotiations.

60.9% thought that risk in remote negotiation and in-person negotiation was the same while 39% said that risk in remote negotiation was higher or much higher.

Most of the respondents felt that when compared to f2f negotiation, in remote negotiation it was more difficult (59.37%) or a lot more difficult (18.75%) to build trust. The remaining respondents were of the opinion that trust was built the same way in remote negotiations (21.87%).

4.2 Formal and informal negotiations

Informal elements of talks, such as extra gestures, informal eye contact, or passing an item, are not part of remote negotiations. 67.18% of the respondents felt that it was of great importance to them during negotiation. 20.3% felt it was of moderate importance to negotiations and the others felt it was only of minor importance. Almost all (93.75%) of the respondents felt that it was more difficult in remote talks than in f2f talks to establish more informal friendships or deepen existing ones.

4.3 Understanding, making commitments and delivering on them

When asked how the fact that the meeting has a remote format affects the ability to reach an agreement, 68.75% of the respondents reported it to be a hindering factor, with the remainder stating that it did not affect reaching agreement. None of the respondents thought that remote meeting facilitated understanding and reaching an agreement. The survey also asked about making commitments. 53.12% of the respondents believed that remote negotiations did not affect making commitments, while the remaining 46.87% believed that this factor hampered that. However, if an agreement was to be reached, according to the majority of respondents (76.56%), the fact that commitments were made during remote negotiations had no impact on delivering on them, and it was only 21.87% who believed that it hindered implementation of the commitments made.

4.4 Effectiveness of negotiation and fairness of its results

In the evaluation of effectiveness, 53.12% of the respondents said that remote negotiation had the same effectiveness as f2f negotiation, while the others said that the effectiveness was lower. In addition, the respondents were asked to rate the "fairness" of the results of remote negotiation compared to that of in-person negotiation. Almost all respondents (63 people) felt that the fairness of the negotiation outcome did not depend on the form in which negotiation talks were held.

5. Discussion

The obtained results made it possible to verify the hypotheses that had been set, which were confirmed partly or in full.

5.1 Hypothesis: uncertainty and risk are higher in remote negotiations and trust is difficult to build

In the study, hypothesis 1 was partly confirmed. First of all, all three factors affecting negotiations and resulting from the form in which they are conducted should be considered separately.

Table 1: Uncertainty, risk, building trust in remote and f2f negotiations

factor/type of negotiation	remote	f2f
uncertainty	same or slightly smaller	higher
risk	same or slightly higher	smaller
building trust	more difficult	easier

Source: Author's own compilation based on the conducted survey

Uncertainty associated with a transaction is slightly smaller or the same in remote negotiation as in f2f negotiation. Risk, on the other hand, is perceived to be the same or slightly higher. This means that these two categories, distinguished in the Management Sciences, are also distinguished by practitioners and at the same time evaluated differently in the case of remote negotiation. Although the questions included in the survey did

not explore the role of these two factors in negotiation, it can be assumed that the respondents answered based on their intuitive understanding of uncertainty and risk. The same or slightly smaller uncertainty may arise from spatial factors, such as the fact that you cannot see your negotiating partner's posture and that everyone is in a different location. In general, these factors were identified by the respondents as those that hinder "a little" or "a lot", but on the other hand, you yourself can profit from this situation. However, the remote form of negotiation makes informal sense making particularly difficult. This seems to be why respondents felt that the risks in remote negotiation were the same or higher than in traditional negotiation, and that building trust was more difficult. If we go back to the Ring and Ven's model (Ring and Ven, 1994), the stage of remote negotiation when expectations are formed, risks are assessed, and trust is built may proceed with difficulty or result in lower levels of trust and higher risk assessment. Different types of interference may also occur. In the unstructured interviews used for the survey, for example, one respondent stated that trust was built the same way as in f2f negotiations, but it just took more time. Trust is a key factor in negotiations that improves the efficiency of the relationships (Connelly, Crook, & Combs, 2015). Some of the respondents in additional interviews emphasized its fundamental importance to the relationship and that the difficulty in remote negotiations involves more difficulty in building trust here, which is their main drawback.

5.2 Hypothesis: Formal negotiation prevails in remote negotiation

At the stage of making commitments (see Ring and Ven model, 1994), the parties reach an agreement about their commitments and roles in their future activities. At this point, the terms and structures of future relationships crystallise and are expressed in the form of formal contracts and in the form of arrangements that do not take a formalised shape, which are known as informal psychological contracts (Ring and Ven, 1994). The informal elements of the talks are not insignificant, and here the respondents unanimously noted that informal contracts are very difficult to establish or maintain. Informal psychological contracts are often unwritten and non-verbalized mutual shared expectations and assumptions about the outcome. Remote negotiation makes it difficult for the parties to enter into these types of contracts. The nature of remote talks deprives contacts of the opportunity of their being expanded by an informal element and moving from a role-based interaction to a personal interaction. Many of the respondents expressed outside the survey that remote talks were missing the opportunity to, for example, continue a conversation in a restaurant, and many respondents complained about not being able to meet, for example, at trade shows or to travel and meet people in general. More than 80% of the respondents stated that it was easier to understand the other party in traditional negotiations, and 85.93% believed that it was easier to have a friendly atmosphere in traditional negotiations. This situation proves the common knowledge regarding people's social needs, which is manifested in remote negotiation as well. Of course, this does not mean that psychological contracts are not formed in remote negotiation; however, it is clear that participants have limited opportunities here and they actually regret that. When asked if all topics and issues can be discussed remotely, the majority (54,68%) answered that there are some subjects that could only be discussed in traditional negotiation, the others said that any subject could be discussed both in remote and traditional settings. Therefore, remote negotiation is dominated by formal agreements that are in the nature of formal commitments, not necessarily made in writing. Thus, hypothesis 2 was confirmed in the study based on the survey.

5.3 Hypothesis: Remote meeting makes it difficult to reach agreements and make commitments.

Similar to hypothesis 1, all the three factors comprising a possibility of reaching an agreement, making commitments, and delivering on them need to be considered separately.

Table 2: Ability to reach agreement, making commitments and delivering on commitments in remote and f2f negotiations

factor/type of negotiation	remote	f2f
ability to reach agreement	difficult or same	easier
making commitments	difficult or same	easier
delivering on commitments	same or slightly more difficult	same or easier

Source: Author's own compilation based on the conducted survey

In the last phase, the parties implement undertaken commitments. They give instructions to their subordinates, obtain resources needed to perform the tasks resulting from their commitments, and make the agreed payments, i.e. they do everything that is necessary to execute a contract. In this way - in a model case scenario - they close the relationship cycle, only to return to the negotiation stage where they will negotiate the terms of the next transaction or sequence of transactions. The respondents believe that all three factors comprising this

element of the relationship are hampered by the remote form of negotiation. If obstacles arise at this stage and commitments made are not fulfilled, a weakening or even loss of trust occurs. This stage takes place partly at the negotiation table and partly outside that situation. In fact, it is difficult to separate negotiations from the relationship, since almost every stage of the relationship involves interaction and communication, both of which may bear the characteristics of negotiations. If they take place remotely, the survey finds that all three key factors at this stage have a negative impact on the relationship. The majority of respondents (82.81%) also reported that in traditional negotiations it was easier to persuade the other party to make concessions, which may also be related to the possibility of reaching an agreement. It also appears that the same negotiation techniques can be used here as in f2f negotiation (70.3%), but they need to be modified or only a few techniques can be used. Perhaps this is the reason for the respondents' impression that reaching an agreement in remote negotiations is difficult or the same, as is making commitments.

5.4 Hypothesis: Efficiency of negotiation and equity of negotiation outcome do not depend on the form of negotiation

This hypothesis was only partially confirmed by the study based on the conducted survey. The effectiveness of remote negotiation is considered to be equal or slightly lower than that of f2f negotiation. The lower effectiveness of remote negotiations most certainly results from the fact that effectiveness is one of the criteria for evaluating negotiations, and these in turn are evaluated through the lens of trust, agreement, etc., which, after all, were rated lower than in traditional negotiations. On the other hand, almost all respondents believed that the "equity" of the outcome of the negotiation does not depend on its form. This is important because both of these characteristics are the basis for evaluating relationships. Although the survey asked about the outcome of the negotiation and not the relationship, conversations with some respondents suggest that most of them identify negotiation with relationship. Lower effectiveness of negotiation may be related to the overall impression or lack of satisfaction with remote negotiations. To remind, almost 80% of the respondents said that they preferred traditional f2f discussions, and 93.75% reported that remote negotiations were more difficult.

However, very significant is the result on the perception of equity of the outcome, which is very much in favour of remote negotiation. It is actually crucial for considering relationships based on remote negotiation. This is because based on the outcome, partners re-evaluate their relationship and revise their trust level and risk assessment. If they find the outcome fair, they are also likely to be willing to invest more trust in the next cycle of the relationship. This was partially confirmed in the survey, i.e. when asked if it was possible to maintain a business relationship relying primarily on remote negotiation, 75% of the respondents thought it was rather possible. The remainder thought it was rather impossible or definitely impossible. When asked to what extent the fact that negotiations are conducted remotely can affect the business relationship, 53.12% said it had no effect on the business relationship, 32.81% said it hurt the business relationship slightly, and 12.5% said it hurt the business relationship considerably. However, such a result may be indicative of how much respondents identify negotiations that they are not satisfied with because they are remote with the relationship as such.

6. Conclusions

Remote talks were considered "more difficult" by the respondents in one of the first questions of the survey, and most of them stated they preferred traditional negotiations. The findings from the responses to the remaining questions confirmed this thesis. Almost all elements of the relationship are more difficult to form on the remote basis. In remote negotiation, the risks are the same or slightly higher and trust is harder to build. It is more difficult or the same to reach an agreement, to make commitments and to deliver on them. Physical distance is seen as a disadvantage, which prevents transition to more informal relationships and personal interactions to replace role interactions. Only uncertainty is smaller or the same here as in traditional negotiation. It would seem, therefore, that the remote form of negotiation is detrimental to the relationship, i.e. it causes it to weaken. However, it turns out that in evaluating a negotiation its form does not matter very much. This is very important, because depending on how the outcome of the negotiation is perceived, other factors come into play. If the outcome is perceived as fair, more trust comes into the relationship. In general, the greater the reliance on trust, the lower the transaction costs (time and effort) required during the negotiation to reach an agreement and ensure cooperation. Over the course of a relationship in which negotiations take place via remote talks, it may therefore occur over time that satisfaction with the outcome will increase trust, which in turn will result in agreement being reached more easily. In conclusion, it must be stated that with a fair outcome, and this is how the outcome of the negotiation is perceived, the form of the negotiation is not of significant importance, although remote negotiation requires overcoming greater difficulties.

This study has had its limitations. First of all, it turned out that many respondents were willing to share their thoughts and comments on remote negotiation. This suggests the prospect of expanding future research to include interviews as another research method, which is also used in relationship and negotiation research. In this way, the triangulation of the survey and the validation of its results should be sought. Furthermore, 64 respondents answered the questionnaire. As noted earlier, given the scale of the phenomenon and the commonness of negotiation in general, this is a relatively small number, which means that the survey should be extended in the future. It should also be noted that the survey was conducted among respondents from Poland. However, Polish people seem to have a specific way of approaching technology, which may be different in any other country. Also, the perspective of small and medium enterprises was taken into account and analysed, while perhaps the perspective of large companies would prove different.

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Relationship Between Self-Efficacy, Trust, and Knowledge Sharing Among IT Industry Employees Working Remotely

Ewelina Krzyżowska
Department of Applied Sociology and Human Resources Management, University of Technology, Częstochowa, Poland
ewelina.krzyzowska@pcz.pl

Abstract: The COVID-19 pandemic has had an impact on socio-economic changes, including changes in the working environment. Remote working started to become widely applied. Consequently, there has been a growth in the level of interest in the organization of this form of work and the search for effective solutions that support labour efficiency in these particular conditions. One of the aspects that is gaining in significance in terms of working conditions that reduce direct face to face communication between employees is that of knowledge sharing. The aim of the paper was to analyse the dependencies between the chosen individual psychological variables and knowledge sharing in conditions of remote working. Emphasis was placed on the analysis of the relation between such variables as: self-efficacy and the level of interpersonal trust, while also knowledge sharing behaviour among the employees of the IT sector working remotely. A cross-sectional study model was applied. The study included 112 employees from the IT industry who worked remotely at the time of conducting the research. The following tools were used in the analysis: *Generalized Self-Efficacy Scale* (GSES) by Schwarzer, Jerusalem, Juczyński, a questionnaire entitled *Faith in a Person* by Hybiak, while also a self-designed survey. In the analysis, a strong positive correlation between self–efficacy and knowledge sharing and a moderate positive correlation between trust and knowledge sharing was noted among the employees of the IT sector. 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. It is possible to state that the employees of the IT sector, who are characterized by a high level of self–efficacy, while also more prone to trust others, display a greater willingness to share knowledge with other employees. Familiarity with the relations between knowledge sharing and the psychological variables may be useful, particularly for IT managers.

Keywords: knowledge sharing behaviour, self-efficacy, trust

1. Introduction

The direct consequences of the COVID-19 pandemic forced changes in the social and economic spheres, including the area of professional functioning. The resulting real threat to health and life itself required adapting working conditions to the changed reality to ensure appropriate safety levels for employees. Remote working has become a recommended and widespread form of earning a living. When compared to the pre-pandemic period, its use has increased, with fewer than 1 in 20 employees reporting working from home regularly in 2018 and less than 1 in 10 working this way occasionally (Sostero et al., 2020). By contrast, in the 'Living, working and COVID-19' survey conducted by Eurofound in April 2020, over one-third (39%) of European Union Member States employees indicated that they were working from home because of the pandemic (Eurofound, 2020). By July 2020, this figure had risen to 48% (34% working exclusively from home and 14% working hybrid). The spread of remote working has also raised issues regarding this form of earning a living. Topics such as working time flexibility, coordination of remote work, or adequate work efficiency evaluation have become more prominent. A problem related to the limitation of direct communication between remote workers is also the problem of effective knowledge sharing (KS). KS is one of the critical elements of knowledge management and thus a central topic in management research (Serenko, Bontis, 2004). KS is the transfer of knowledge among individuals in organizations to help others and collaborate with others to solve problems, develop new ideas, or implement policies or procedures (Wang, Noe, 2010). It is a confirmed fact that good organization of KS among employees leads to many benefits for an organization such as, among others: building innovation, developing new ideas, building competencies, responding to problems more quickly, understanding customer needs, while also reducing operational costs of the organization (Mohajan, 2019). Therefore, it is evident that the proper implementation of KS is of momentous importance for organizational performance. Considering the aforesaid significance, the paper attempts to answer whether psychological variables are related to KS readiness in terms of remote working settings. The focus was on analysing the relationship between KS and two selected variables: self-efficacy (SE) and trust in a group of IT employees. Learning about these relationships seems particularly important in the conditions of the COVID-19 pandemic, in which remote work has become the most recommended form of earning a living.

2. Literature review

2.1 Determinants of knowledge sharing

The literature highlights various determinants of KS. They can be described in three categories: technological factors, organizational factors, and individual factors (Paroutis, Al Saleh, 2009). The focus of this article is on the category of individual psychological factors, which includes several personal characteristics that can significantly affect the readiness for KS in the working environment, such as personality traits, resources and skills. Research confirms the relationship between KS and individual personality dimensions distinguished according to the *Big Five* model. Some studies indicate that KS readiness actually correlate positively, especially with the dimensions of Extraversion (Anwar, 2017; Chrapek, 2021; Lotfi et al., 2016; Maliszewska et al., 2010; Nishanthi, Munasinghe, 2020; Teh et al., 2011), Conscientiousness (Anwar, 2017; Chrapek, 2021; Gupta, 2008; Lotfi et al., 2016; Matzler et al., 2008; Nishanthi, Munasinghe, 2020) or Openness to experience (Cabrera et al,. 2006; Chrapek, 2021; Lotfi et al., 2016; Maliszewska et al., 2010; Matzler et al., 2008; Nishanthi, Munasinghe, 2020). Another individual psychological trait that may influence KS readiness is related to altruism – the enjoyment of helping others (Yiu, Law, 2012). Research indicates that employees are intrinsically motivated by relative altruism to KS because engaging in intellectual pursuits and solving problems is challenging or pleasurable, and they enjoy helping others (Lin, 2007). Among other individual factors, it is also worth pointing out the sense of competition that individuals perceive, a variable that may negatively correlate with motivation for KS, but research in this area is not consistent (Connelly et al., 2014; Jeon, Lee, 2020; Yang, Maxwell, 2011).

2.2 Self-efficacy and trust versus knowledge sharing

SE is a characteristic identified in subject-related literature that strongly influences KS (Shehab et al., 2018; Olowodunoye, 2015; Yiu, Law, 2012). SE is defined as "the belief in one's capabilities to organize and execute courses of actions required to manage prospective situations" (Hsu et al., 2007). Many authors identify SE as an essential element in sharing knowledge (Bock, Kim, 2002; Kaewchur, Phusavat, 2016; Othman, Skaik, 2014). Bock and Kim (2002) propose considering SE as a significant factor that is a source of motivation for KS. These researchers showed that employees' individual evaluation of their personal contribution to organizational performance positively influences KS activity. Similarly, a study by Fathi et al. (2011) in a manufacturing company in Malaysia confirmed that SE affects intentions towards KS. Empirical evidence also indicates that SE may predict KS (Bilginoglu, Yozgat, 2018; Boonmee, 2011; Olowodunoye, 2015; Othman, Skaik, 2014). Notably, the relationship between SE and KS has also been demonstrated in virtual communities (Hsu et al., 2007; Huang et al., 2015).

Another essential factor that determines readiness for KS is that of trust. Trust is a variable referred to in literature as a critical facilitator of KS (Zhang, 2014). It is indicated that the attitude of trust significantly reduces the distance between co-workers (Davidavičiene et al., 2020; Hung, et al., 2015; Shehab et al., 2018). When collaborators trust their partners, the social ties are strong, and the contribution to KS is increased (Navimipour, Charband, 2016). Wang et al. (2012), by availing of data from the top firms in high-tech industries, confirmed that trust positively influences KS. Holste and Fields (2010), in a study involving 202 professionals and managers, showed a positive relationship between the so-called affect-based trust with a willingness to KS compared to cognition-based trust, which was more significant for the willingness to use tacit knowledge. Similar findings were obtained by Huang et al. (2011) in a study involving 204 employees from Chinese organizations, who showed that affect-based trust explained significant variations in KS. The importance of trust in the context of KS has also been tested in online settings (Ridings et al., 2002; Paroutis, Al Saleh, 2009). The study of Ridings et al. (2002) confirmed that trust in others' ability, benevolence, and integrity correlates with the willingness to give and receive information from virtual community members.

3. Research background

The literature review presented confirms the association of KS with various psychological variables, among which SE and trust can be considered to be one of the most important. Both of these variables were taken into account in this study. SE is a construct that grew out of Bandura's social-cognitive theory, which points to the importance of the interaction between individual, environmental and behavioural factors (Bandura 1997; Bandura 2006). Bandura emphasises that this concerns the self-efficacy mechanisms. The most central and dominant beliefs of people relate to their own efficacy in controlling their own functioning and the events they experience. Therefore, SE influences motivation regarding what people feel, think, behave, and what decisions they make. Since SE stands for a person's belief in their ability to perform a specific task, therefore with regard

to KS, efficacy perceptions refer to a person's view regarding the value of knowledge (Cabrera, Cabrera, 2005). It may be assumed that if individuals believe that the knowledge they have will be valuable and helpful to others, they will be more likely to make an effort to share this knowledge with others. In turn, the trust factor seems particularly important with regard to KS, as it is treated as a particular exchange of resources. Referring to the Social Exchange Theory, individuals regulate interactions with others based on a balance of costs and benefits (Blau, 2006). An individual may engage in an interchange according to the expectation of reciprocity in the future, an expectation regulated by trust (Cabrera, Cabrera, 2005). This is important because, as Szczepański et al. (2014) point out, any act of social exchange must be accompanied by trust, and its absence can lead to the abandonment of the exchange process. This seems particularly relevant in a remote working situation where face to face communication is limited. Given the above arguments, the following hypotheses were adopted:

H1. There is a positive relationship between SE and KS in a group of IT employees working remotely.
H2. There is a positive relationship between interpersonal trust level and KS in a group of IT employees working remotely.

The lack of similar empirical works justifies learning about the presented relationships among IT employees working remotely. The author is aware of what would be conducted with the participation of such a group of respondents. Therefore, the results will constitute an essential supplement to the research gap in this respect.

4. Methodology

4.1 Participants

The survey was conducted among employees of an IT company based in central Poland. The selection criterion for the study was the condition of remote working as the dominant form of work at the time of the study. Out of the employees who met the selection criteria, 131 people agreed to participate in the study. The surveyed employees received survey sheets in a sealed envelope and handed the completed sheets to the person designated to cooperate in the study. The final study group consisted of 112 people (19 people did not return the completed questionnaires): 39 women and 73 men aged between 26 and 47 years (M=35.08; SD=5.89). At the time of the survey, workers held the following positions: computer applications specialist (n=38), service support specialist (n=16), programming specialist (n=32), designer and computer systems analyst (n=26). All respondents had predominantly worked remotely since the pandemic. Before the pandemic, the average remote working time of the respondents was 4.5 hrs/week. Detailed characteristics of the study group are 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)		35.08	5.89
Average remote working time per week before the pandemic (h)		4.48	5.13

4.2 Measures

For the study of SE, the *Generalised Self-Efficacy Scale* (*GSES*) of Schwarzer and Jerusalem (in the Polish adaptation by Juczyński) was used, which refers to the concept of expectations and perceived self-efficacy formulated by Bandura (1997) (Juczyński, 2000). The scale includes 10 questions that measure a person's general belief in their effectiveness in dealing with difficult situations and obstacles (Juczyński, 2012). The sum of all scores indicates an overall SE index that ranges from 10 to 40 points. The tool's validity was assessed by showing statistically significant relationships between the GSES and internal locus of health control, optimistic attitude

and self-esteem (Juczynski, 2000). The scale's reliability assessed by the test-retest method (after five weeks) was 0.78.

In turn, the questionnaire *Faith in Humanity - What Are People Like?* developed by Hybiak was used to examine trust. The tool measures the level of belief in people, which is identified with the level of trust in other people (Skrzypińska, 2002). The questionnaire consists of 20 statements about people, to be evaluated by the respondent on a seven-point scale, indicating how much they agree with them. The scale's reliability index is 0.90 (Cronbach's α).

In addition, the study used a self-administered questionnaire while taking account of the following data: the respondent's age and gender, education, position held in the company, while also the number of hours of remote work before the pandemic. The questionnaire also included a question regarding knowledge sharing: *How often do you pass on your expertise to other employees (apart from situations of knowledge transfer that arise directly from instructions from superiors)?* Respondents answered the aforesaid question on a five-point scale: never, rarely, sometimes, often, very often.

4.3 Data analysis

The study was cross-sectional by nature. Spearman's rank correlation was used to assess the association between employees' KS frequency and psychological variables (SE, trust). The statistical program STATISTICA 13.3 from Statsof was used for the calculations. A statistical significance level of $p<0.05$ was adopted.

5. Results

The highest number of employees surveyed (38.4%) stated that they share their expertise with other employees very often, while the lowest number (2.7%) indicated that they never share their knowledge with other employees. Detailed descriptive data on KS and the means and standard deviations of SE and trust test scores are presented in Table 2.

Based on statistical analysis based on Spearman rank correlation, statistically significant relationships were obtained between the psychological variables studied: SE and trust and the frequency of KS. A strong positive correlation was found between SE and KS (r=0.794), while a moderate positive relationship was obtained between trust and KS (r=0.598). Thus, the testing result confirms the assumptions of hypothesis 1 and hypothesis 2. The detailed outcomes of the study are presented in Table 3 and Figures 1 and 2.

Table 2: Descriptive statistics of the frequency of knowledge sharing, SE and trust

	N	**%**
How often do you pass on your expertise to other employees (apart from situations of knowledge transfer that arise directly from instructions from superiors)?		
Never	3	2,7
Rarely	14	12.5
Sometimes	22	19.6
Often	30	26.8
Very often	43	38.4

	Mean	**SD**
SE	32.2	5.5
Trust	87.1	35.6

Table 3: Relationship between SE and trust and frequency of sharing knowledge among IT workers

Variable	**R Spearman's**	***P***
SE	**0.794**	0,000
Trust	**0.598**	0.000

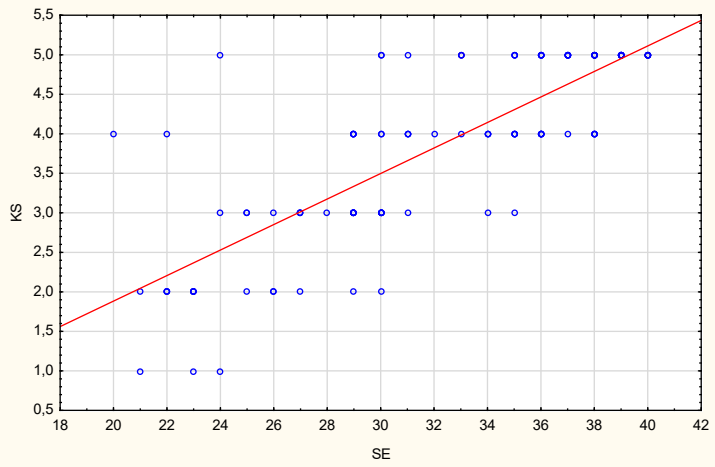


Figure 1: Scatter plot showing the relationship between frequency of sharing knowledge and SE among IT workers

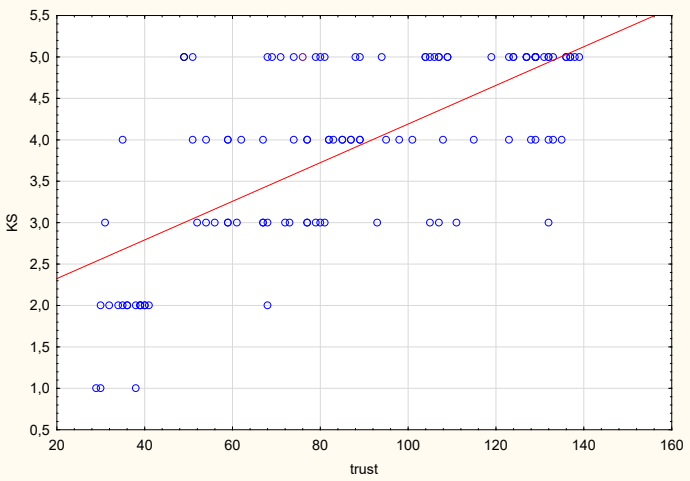


Figure 2: Scatter plot showing the relationship between frequency of sharing knowledge and trust

6. Discussion

As a result of the study, hypotheses 1 and 2 were confirmed. A statistically significant positive relationship was obtained between the SE and KS in the group of IT employees working remotely (H1), as well as a statistically significant positive correlation between the level of the interpersonal trust and KS in the group of IT employees working remotely. This means that those IT workers who have high SE and who are more willing to trust others, will also be more willing to display KS behavioural patterns. The results of the study are confirmed by other studies on the relationship between the SE and KS (Bilginoglu, Yozgat, 2018, Boonmee, 2011; Hsu et al., 2007; Huang et al., 2015; Law, 2012; Olowodunoye, 2015; Othman, Skaik, 2014; Shehab, Rahim, Daud, 2018), as well as between trust and KS (Holste, Fields, 2010; Huang et al., 2011; Paroutis, Al Saleh, 2009; Ridings et al. 2002; Wang et al., 2012). However, the study, conducted precisely on a group of Polish IT employees, fills an important research gap in this area. This is important especially in the context of the universal nature of remote work and the constant need to improve this form of work organization.

The relationship between SE and KS in the surveyed employees may be justified with reference to Bandura's socio-cognitive theory by referring to the motivational value of the SE with regard to the undertaken activities (Bandura 1997; Bandura 2006). It may be concluded that IT industry employees who are convinced of their competences in the scope of the tasks performed, will be more willing to share useful and accurate knowledge with their colleagues. It is significant to add that SE promotes the assessment of tasks as valuable, while work as important, useful and interesting (Bong, 2001). Such attitudes can encourage the IT employees to get involved and increase the effectiveness of their activities; which the KS behaviour undoubtedly serves. Not without significance is the overall mean SE level (32.2) obtained in this group of respondents, which when converted into sten values indicates high indicators of this variable. This result may be related to the specificity of professional

experiences of the studied group of employees, in which the task-oriented approach is strongly promoted, but this hypothesis requires careful testing of cause-and-effect relationships. Moreover, as emphasized by the SE studies, it may be an important predictor of achievement and persistence (Concannon, Barrow, 2010; Hsieh et al., 2012). On the other hand, successes and professional achievements may strengthen the self-efficacy conviction among the surveyed employees. This relationship is confirmed by Zeldin et al. (2008) demonstrating that the ongoing achievements and successes enhanced men's self-efficacy in mathematics, science, and technology. Therefore, it may be a kind of feedback mechanism, where the effective implementation of the professional tasks requiring industry-specific knowledge and specialist competences constantly strengthens the SE of the respondents, and the growing level of this variable encourages effective professional functioning. The KS will be useful in every phase of this coupling.

On the other hand, by justifying the obtained positive relationship between the trust and the KS, one can refer to the significance of the perceived benefits of trust in remote work. The situation of remote work, where face-to-face communication is limited, may make it difficult to build trust, yet on the other hand, remote interactions between the employees may require trust for successful communication and thus effective work (Ridings et al., 2002). This perspective may stimulate an attitude of trust among IT employees. This is probably facilitated by the employees' awareness of the value of their specialized knowledge of industry, which in turn encourages them to share this knowledge in anticipation of reciprocity. This is probably the consequence of the unwritten rule of mutual professional dependence on the knowledge possessed and sharing it, which translates into work efficiency as follows: "The more knowledge I gain, the more successful my professional achievements are." It is also worth noting that the results show that a high proportion of the IT industry employees surveyed (38.4%) declared that they often voluntarily share their knowledge with other employees. This is confirmed by the fact that the KS is a particularly important competence of IT employees, which is also indicated by some empirical studies (Adamczyk, 2014). As is well-known, the IT industry is particularly sensitive to rapidly advancing technological development and specialists such as programmers must constantly update their knowledge, for example, through KS in order to perform tasks effectively. What is more, in the process of mutual knowledge exchange between employees, trust can play an important role by reducing the fear of losing one's unique value in KS (Renzl, 2008). In addition, the same professional rules applicable to the IT employees can stimulate trust between them, which transfers into readiness for KS. As Bakker et al. (2006) show, people tend to share more knowledge with team members if they think they are honest and follow the same principles they have.

7. Limitations

One of the limitations of this study is the use of self-reported measurement tools, which are associated with the risk of measurement error resulting from consciously or subconsciously presenting themselves in a different light than in reality. In addition, the survey was conducted on a group of employees of one company. This creates some limitations in terms of generalizing the results. However, these limitations do not call into question the significance of the results, which may provide an important springboard for further scientific inquiry using different methodological criteria.

8. Conclusions

The results obtained confirmed the existence of relationships between SE and KS, and trust and KS. These results broaden the knowledge of the researched dependencies in a group of IT employees and are of significant importance for the organization of work, especially in the context of remote work. Thus, they imply important practical recommendations for IT managers such as the following:

1. It is important that they are aware of the importance of the psychological factors during the course of the KS process.
2. The assessment of the psychological variables such as: SE and trust should be conducted as early as at the recruitment stage (it is still a rare practice in the recruitment process), especially among specialized employees working remotely.
3. Although the conclusions suggest a potentially high level of SE among the employees in the IT industry, it is worth paying special attention to the stimulation of this resource among employees due to the number of benefits for professional functioning, including a strong positive impact on KS.

In the future, it would also be advisable to analyse other psychological variables that could determine the engagement in KS, while taking the various groups of employees from the IT sector into account.

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Internal Development Strategies of Partners of Eco-Innovative Services Network: Consortium's Source of Knowledge

Robert Kuceba and Grzegorz Chmielarz
Czestochowa University of Technology, Poland
robert.kuceba@wp.pl
grzegorz.chmielarz@pcz.pl

Abstract: In the present paper, its authors present theoretical explanations and summarise developed in the research process stages of creating internal development strategies of R&D entities, offering their eco-innovative services to SMEs, in collaboration with the partners of the created organisational network – also termed as consortium of eco-innovations. These stages included three primary dimensions: I) where a particular entity is at a given moment, II) what the given entity wants to achieve, III) how the entity intends to achieve its intentions? Therefore, twelve common procedures that regulated the development and implementation of internal development strategies were proposed and justified during consultations with all the partners of the network of eco-innovative services ECOLABNET (created in six Baltic Sea Region countries). In the context of the proposed procedures, on the example of the network of eco-innovative services ECOLABNET, the authors have summarised in the form of tables and visualised in the charts activities of all partners so as to compare them, and demonstrate similarities and differences in creating and implementing the strategies of internal development. On this basis, referring to the summarised research results, we have attempted to answer two research questions: 1) What are the similarities and what causes differences in the plans of internal development strategies with regard to economic differences of the partners of the international eco-innovation consortium – implementing a common goal of creating a network of service providers that support eco-innovative actions in small and medium-sized enterprises? 2) To what extent does the information about internal strategies and their implementation by the project partners influence development of accumulated knowledge that ensures: improving the collaboration of the created consortium with the sector of small and medium-sized enterprises and development of eco-innovative initiatives with reference to the needs indicated by the beneficiaries (present and prospective needs)?.

Keywords: eco-innovations, network of providers, strategy, internal development, knowledge of network partners

1. Introduction

Contemporary enterprises, in accordance with the title of the paper the ones that concentrate their activity in the following areas: services, products, eco-innovative technologies, strive at constant improvement of their competencies in the scope of creativity, entrepreneurship, communication, and also collaboration with R&D environment, business, the competitive environment in the coopetition model (Bocken et al., 2014). This collaboration ever more frequently takes formalised forms such as a network of competency interconnections of various groups of entities, among others, Research and Development, micro and small enterprises, intermediary organisations. Simultaneously, these networks lack defined in time and space mutual relations. The contemporary nature of the network is adjusted depending on the competencies of the entities in the area of developing particular eco-innovations – simultaneously in response to the current, frequently only "momentary" market demand. In the group of entities that create networks of eco-innovative services one can distinguish entities that are called "network integrators". Roles and privileges imposed on them by the remaining members entitle them to act, for example, in the area of eco-innovations, such as: organising eco-innovation networks, increasing pro-environmental awareness in the environment, and at the same time also knowledge of, for example, small and medium-sized enterprises, introducing support mechanisms for eco-innovations (financial and non-financial), or monitoring. An example of such organisations – "network integrators", are innovation centres, scientific and technological parks, entrepreneurship incubators, among others, start-ups, spin-offs, technology transfer centres. These organisations accompanied by Research, Development and Innovation (RDI) units (the ones that conduct scientific research, design and test prototypes of eco-innovations), and above all jointly with enterprises (commercialisation of results) co-create the value of eco-innovations (Koszarek-Cyra 2016). In the present paper, its authors attempt to determine, and at the same time justify the concept of developing autonomous internal development strategies of individual partners of an eco-innovative services network. Additionally, the authors strive to determine the impact of these strategies on the synergic growth of value of the created eco-innovative services networks (Kuen-Hung and Yi-Chuan 2017), as well as knowledge, which ensures: improving the collaboration of the created consortium with the sector of small and medium-sized enterprises, and developing new eco-innovative initiatives.

The present research results and scientific discourse pertain to the International network of eco-innovative services ECOLABNET, created by service providers supporting eco-innovations. The ECOLABNET network was initiated within the European project Interreg Baltic Sea Region (Project #R077 ECOLABNET of Interreg Baltic Sea Region). The competences of the network ECOLABNET include knowledge in additive manufacturing, bio-based materials, product-service system design, eco-branding, value chain assessment, business model development, legislation, customer insights, certifications and life cycle assessment. The ECOLABNET network created a founding consortium (project partners from six Baltic Sea Region countries, such as: 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 authors' university - Czestochowa University of Technology - Poland). Currently, the network includes 41 European entities (dynamic data, as of 31.12.2021), including: project partners (Research and Development Units – RDIs), Small and Medium-Sized Enterprises (SMEs) and Intermediary Organisations (IOs) (Ecolabnet 2022, Kuceba 2021).

2. Dimensions and procedures of internal development strategy of the partners of eco-innovative services network

A common point of reference in formulating the internal development strategies of entities forming the ECOLABNET network is the focus and final orientation on the improvement of cooperation with the sector of, among others, small and medium-sized enterprises - with the aim to develop eco-innovative initiatives, in relation to the needs of network partners, both current and prospective (European Commission, 2014). Based on the literature query and in the context of the topic specified in the title of the paper, it is assumed that the internal development strategies of the partners of the network of eco-innovative services subordinate the activities in the scientific and research sphere as well as in the economic sphere to the implementation of the objectives related to reducing the impact of production activities on the environment. Through such eco-innovative activities that lead to ensuring greater effectiveness of environmental protection and serve to increase environmental and social responsibility in the use of natural resources. These strategies should respond to new forms of networking with research and development units and intermediary organisations to improve eco-innovative services and products for, among others, SMEs, thus responding to current and prospective needs (Bocken et al., 2014, Muller el.al., 2017).

Furthermore, it is assumed that the internal development strategies of individual partners of the eco-innovative services network define a set of guidelines for all decisions, actions taken in each area - in a coordinated manner, with respect to both resources and time frames (Kuen-Hung and Yi-Chuan 2017). As a basis for justifying the formulation and adoption of ECOLABNET's internal development strategy for eco-innovative services partners, the identification of three dimensions was adopted: (I) where is a particular entity at a given point in time?; (II) what would the entity like to achieve?; (III) how does the entity want to achieve its intentions? The answers to these questions also constitute structured knowledge about the tendencies of the organisation to design and/or implement eco-innovations, about the opportunities and threats to the transformation of an organisation towards eco-innovations, and about the methods and tools that stimulate the transformation of an organisation into an eco-innovative one. Management of this knowledge in transformation processes is important while formulating the procedures, initiating, creating, implementing and controlling the implementation of the set strategies of internal development. The formulated dimensions of the internal development strategies of the eco-innovative service partners, obtaining answers to the questions and aggregation of the necessary knowledge about the transformation of an organization towards eco-innovative services are the essential motivation, justification of the carried out and described research. Due to the measurement of: the initiation, creation, implementation and control of these strategies in entities that in real conditions form a network of eco-innovative services of an international dimension - in relation to previous studies, this is certainly a novelty.

Accordingly, first of all, it was assumed that each entity while formulating the strategy should determine where it was at a given moment. Referring to the embedding of the very terminology of strategy in the literature, and at the same time in accordance with the subject matter of this article, in response to the question: "where is the entity co-creating the ECOLABNET network at a given moment?", basic activities identified in this dimension were determined. In the group of these activities one can distinguish: 1) formalization of activities through the creation of an independent unit responsible for the development, implementation and control of the strategy; 2) determination of how each entity identifies its basic activities with eco-innovative needs, assigning respectively: a passive attitude in relation to eco-innovations, an active attitude - working with eco-innovations,

a compatible attitude - activities for eco-innovations - integrated with the current strategy of the company, a fully proactive attitude - the mission of the company based on eco-innovations; 3) identification of own internal needs in the field of activating the operation in the area of eco-innovations, considering such needs as: business, financial, development, production and technological, as well as organisational ones; 4) identifying in the subjective and objective grasp the needs pertaining to external support in the field of eco-innovative activities, e.g. what are the reasons for the willingness of particular partners to cooperate and operate jointly in networks of eco-innovative services. Identification of formalization for the activities, identification of attitudes in the previous eco-innovative activities and identification of internal and external needs constitute the justification of the rationale for formulating and implementing the strategies for internal development of the partners of the eco-innovative services network. In another dimension, it has been considered reasonable to identify what each partner would like to achieve when formulating a strategy for the internal development of the partners of the eco-innovative services network. For the transparency of individual network partners' approaches in this dimension, the following activities have been distinguished: 1) identifying competency gaps in particular knowledge areas within the partnership, in terms of theoretical and practical knowledge, know-how, service provision skills, information, technology and infrastructure support; 2) setting directions of actions so as to bridge competence gaps; 3) identifying internal and external sources reducing or eliminating competency gaps; 4) identifying barriers to development and implementation of eco-innovations, among others, in the SME sector; 5) identifying competency gaps of the key partners belonging to the eco-innovative services network, which should be improved first; 6) identifying general areas of cooperation with SMEs (European Commission, 2018), RDI and intermediary organisations in the eco-innovation services network (Marin et.al, 2015). The third determined dimension of developing internal development strategies of the partners of the eco-innovative services network constitutes the answer to the question how the entity wants to achieve its intentions, which is at the same time justified and reflected in the developed strategies. Based on the literature query (Kuen-Hung and Yi-Chuan 2017; Ryszko 2016, Kuceba 2021) as well as the discourse within the eco-innovative services network partners, the general objectives and at the same time the activities that identify the partners of the eco-innovative services network in the literature were adopted (Ecolabnet 2022). In this dimension, the following has been distinguished: 1) research and scientific development of teams in the scope of designing and developing eco-innovative products and services in various fields of science; 2) strengthening the potential of research infrastructure; 3) extending collaboration with intermediary organisations and SMEs in the region; 4) developing a portfolio of eco-innovative services and products for SMEs, taking into account the current and planned research and development opportunities, with the current and planned laboratory infrastructure; 5) permanent and continuous development of the team based on the increase of knowledge, skills, and experience in the field of developing eco-innovative initiatives; 6) applying in heterogeneous competitions for research and development projects, among others, in the scope of diffusion of eco-innovative solutions in SMEs - projects financed by European and national institutions; 7)preparing and conducting training in the scope of increasing the competitiveness of enterprises by raising awareness and introducing eco-innovative activities; 8) developing a common repository of eco-innovative products and services, which constitute a source of professional knowledge on the offered solutions – eco-innovative services.

The answers to the set research questions, concerning the three dimensions of the justification of formulating and adopting the internal development strategies of the ECOLABNET eco-innovation service partners, also reflect the acquired knowledge necessary to define and develop twelve common procedures governing the creation and implementation of internal development strategies (Kuceba 2021). These procedures were this time grouped into four categories: initiating, creating, implementing, controlling ones. They have been visualized in Figure 1.

With reference to the adopted procedures visualized in Figure 1, which regulate the development and control of the internal development strategy on the example of the network of eco-innovative services ECOLABNET, the activities of all partners initiating this network have been aggregated, thus showing the differences and similarities in their development and implementation.

3. Analysis of implementing internal development strategies of the partners of eco-innovative services network

The analysis of the activities with regard to the partners of the eco-innovative service network in the field of initiation, development, and implementation of internal development strategies, in accordance with the adopted procedures, was carried out on the basis of the empirical research in the group of partners (research

and development units) of the International Network of Service Providers for Eco-innovations in SMEs - ECOLABNET. Eleven units can be distinguished in the group of surveyed partners from six countries of the Baltic Sea Region, which include: 6 Baltic universities, 3 R&D units and two companies implementing pilot eco-innovations (Ecolabnet 2022, Kuceba 2021). The choice of these entities was not random, as these are the entities that co-created the ECOLABNET eco-innovation services consortium, being also partners of the project #R077 ECOLABNET of Interreg Baltic Sea Region. Primary research issues have been included in two formulated questions: 1) What are the similarities and what causes differences in the plans of internal development strategies with regard to economic differences of the partners of the international eco-innovation consortium – implementing a common goal of creating a network of service providers that support eco-innovative actions in small and medium-sized enterprises? 2) To what extent does the information about internal strategies and their implementation by the project partners influence development of accumulated knowledge that ensures: improving the collaboration of the created consortium with the sector of small and medium-sized enterprises and development of eco-innovative initiatives with reference to the needs indicated by the beneficiaries (present and prospective needs)?

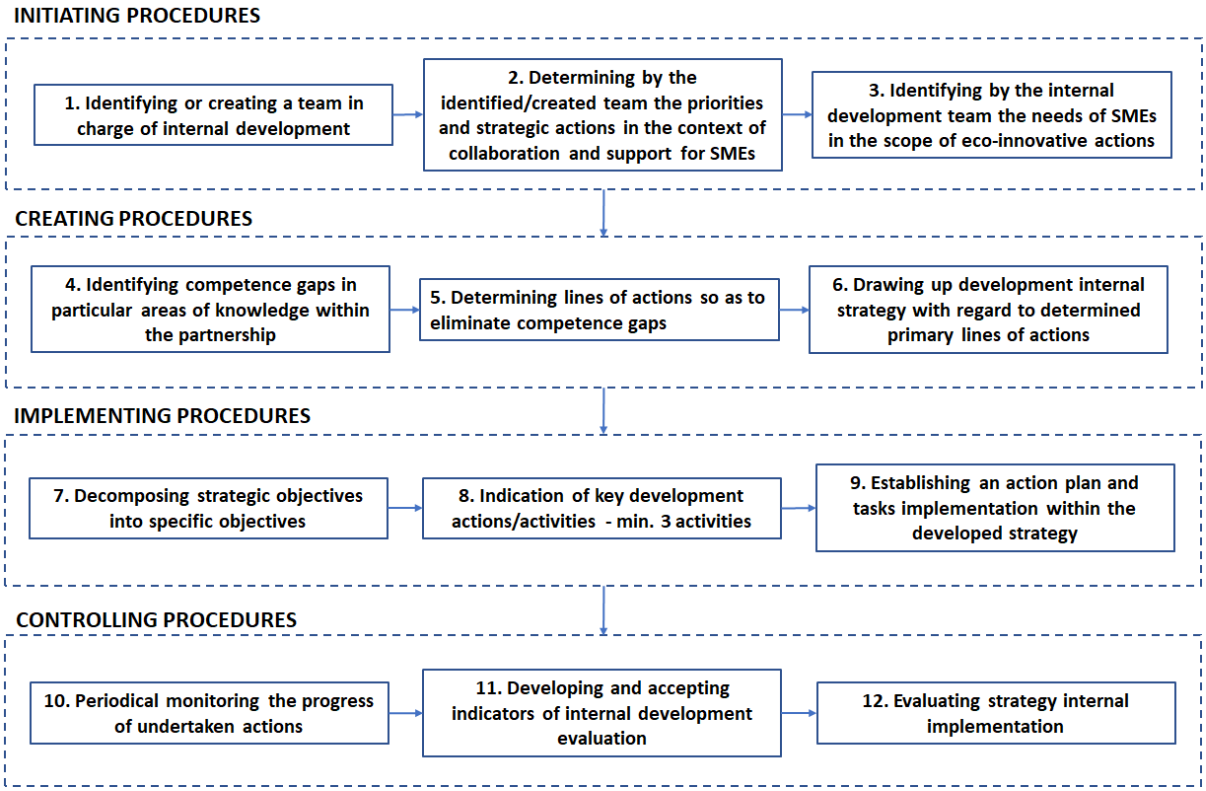


Figure 1: Procedures governing the development and implementation of internal development strategy of the partners of eco-innovative services network

Source: own elaboration

The research was conducted in two stages: 1) Questionnaire research - using a questionnaire sheet "Strategy plan of internal development for ECOLABNET partners" developed jointly by all the project partners during panel meetings. The questionnaire consisted of twelve parts reflecting the procedures governing the creation and implementation of the strategy of internal development for the partners of the network of eco-innovative services. Indications were assigned to each part of the questionnaire, which were proposals of solutions introduced by the project partners during the panel discussion. The questionnaire research was of a quantitative character, each of the examined 11 partners answering the questions in the assigned 12 parts had a multiple choice.

2) Explanatory discourse in a remote form - due to COVID-19 also conducted in a remote form - qualitative explanations of the choice of internal development solutions by each researched partner, conducted during another discussion panel after the end of the first stage. Both stages were carried out in the group of all the participants of the research - partners of the ECOLABNET eco-innovative services network. According to the first

initiation procedure (Figure 1), a team in charge of internal development was formed in all the entities of the ECOLABNET network. These teams participated directly in the development and implementation of internal development strategies on the part of the network partners. Strategies focused on improving the collaboration with, among others, the SME sector and the development of eco-innovation initiatives, in relation to their needs. A common element was the initiation and establishment of such teams for the first time in the investigated entities, with the number of people in each team varying from 2 to 8.

In the context of the second procedure - determining by the identified/created team the priorities and strategic actions in the context of collaboration and support for SMEs, Figure 2 presents a summary of proposed strategic actions identified by the partners of eco-innovative services network ECOLABNET. In reality, thirty-five strategic actions were adopted in total as priorities in the group of investigated group of partners. The presentation includes the ones where the number of indications was greater than half of the investigated entities, N>5.

The key priority for the 10 surveyed entities in terms of strategic actions is to work closely with service providers, to strengthen partnerships and cooperation in the area of research, development and eco-innovations, and to support the SME sector enterprises. An important priority is also developing and synergizing own competencies of the individual project partner in designing and developing eco-innovations through investments in knowledge and skills, and creating their own collaboration networks. The full portfolio of priorities (35), included also individual priority activities - purely related to their individual competencies in the context of local market impact, unique own forms of production, products or services, e.g. general representation and support for the national business environment or in the case of products, support for companies in the fashion and furniture industry, in matters such as business models and testing of materials (which confirms the unique nature of a given partner of the network of eco-innovative services).

The third analysed procedure, which belongs to the ones that initiate strategies of internal development, was identifying by the internal team of the partners of the ECOLABNET eco-innovation services network the needs of SMEs in the field of eco-innovative activities. In this case, it should be emphasised that all the partners in the investigated network, with the use of the same research techniques and methods, identified the needs and barriers of SMEs in their own countries and in total in the partner countries in terms of implementation and diffusion of eco-innovative services. Research on the identification, measurement, and assessment of the significance of the heterogeneous eco-innovation needs of SMEs in the Baltic partner countries, as part of the ECOLABNET project, was carried out in the second half of 2019 (Kuceba et. Al., 2020). In total, N = 296 SMEs in the countries of the project consortium partners participated in the research, including: Estonia – 23,31% (69), Poland – 19,26% (57), Finland –18,24% (54), Lithuania – 15,88% (47), Sweden – 12,84% (38), Denmark – 10,47% (31). Analysing the subject structure of all surveyed SMEs, micro enterprises accounted for 42.23% (125) of the research population, and small enterprises - 27.36% (81). The remaining group - 30.41% (90) are medium-sized enterprises. Moreover, the enterprises surveyed in the BSR countries represented 20 production areas / sectors. When analysing the area of the structure of the studied SMEs, the largest share in the study concerned enterprises from such industries as: Food products 11.14% (33), Other manufacturing 10.47% (31), Machinery and equipment 8.44% (25), Rubber and plastic products 6.41% (19), Wearing apparel and Textiles 6.41% (19), Computer Electronic and optical products 4.05% (12), Paper and paper products 3.71% (11), Fabricated metal products 3.71% (11), Electrical equipment 3.71% (11), Beverages 3.04%.

While analysing the implementation of the fourth procedure, this time in the group of developing internal development strategies of the partners of the network of eco-innovative services, 21 gaps were identified in all the network partners. Figure 3 summarizes the key competency gaps identified, according to the already adopted criterion for visualizing the research results, where the number of indications was greater than half of the number of the investigated entities N>5.

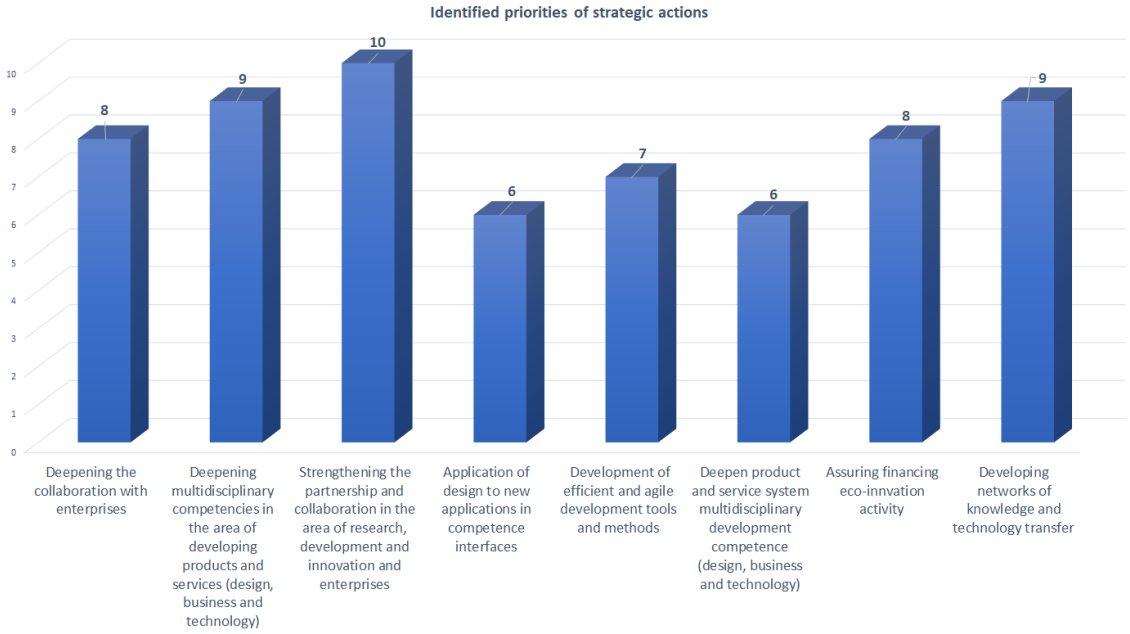


Figure 2: Identified priorities of strategic actions

Source: own elaboration

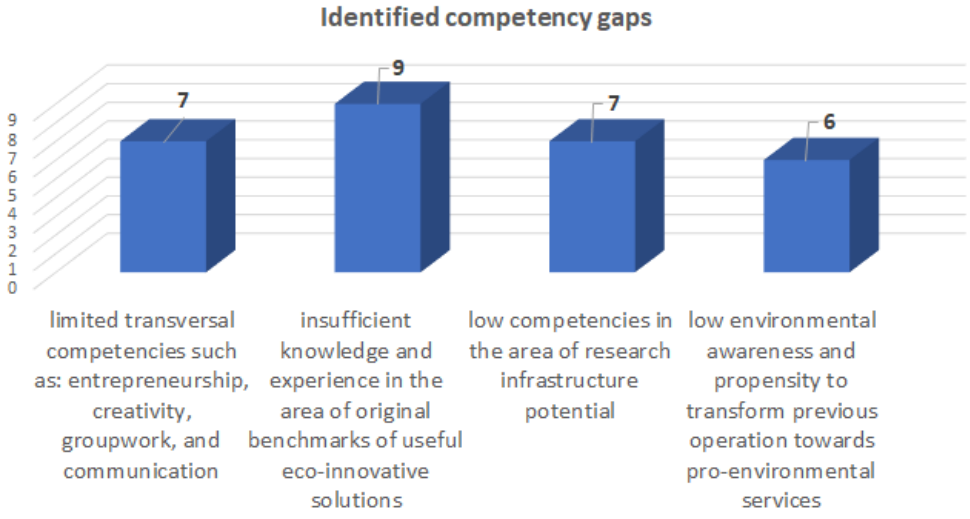


Figure 3: Identified competency gaps

Source: own elaboration

The key identified competency gap of the partners of the eco-innovation services network ECOLABNET distinguished by 9 out of 11 the investigated units is insufficient knowledge and experience in the area of access to benchmarks - useful eco-innovative solutions implemented mainly in the SME sector. The competency gaps highlighted in Figure 3 also include limited existing transversal competences: entrepreneurship, creativity, teamwork, and, what has been emphasised, limited possibilities of access to modern research infrastructure (limited own capabilities). The above competency constituted were the basis for further strategic justification of creating a network of eco-innovative services by the individual ECOLABNET partners. The investigated partners also identify as a competence gap to be reduced at the level of internal development strategies (6 indications) still low environmental awareness especially of SMEs, which translates into still quite low propensity for transformation towards consumption of eco-innovative services offered in the network.

In this context, referring to the fifth procedure (defined at the level of developing internal development strategies of partners - Figure 1), only five partners of the ECOLABNET eco-innovative services network have clearly defined the directions of activities reducing their competency gaps. It can be concluded that among the independently determined activities/directions pertaining to reduction of competency gaps on the part of these five partners, it is important to indicate joint actions within the network, which translates into a synergic increase in the value of developed competencies. The partners of the ECOLABNET eco-innovative services network that indicated activities related to reducing competency gaps - procedure 5, also emphasize the importance of self-improvement of their entities, thus the importance of internal development in terms of improvement. In this case, it refers to the growth of existing competencies in terms of quantitative and qualitative expansion of the portfolio of eco-innovative services, intended, among others, for manufacturing enterprises of the SME sector. An important conclusion, in terms of reducing competency gaps, shaping the approach to developing internal development strategies of the partners of the ECOLABNET eco-innovative services network was indication of the multidimensional nature of activities reducing competency gaps in the following areas: marketing, finance, internal training, infrastructure and diffusion of new knowledge.

Although not all the partners of the ECOLABNET eco-innovative services network identified competency gaps (Procedure 4) and main directions of activities reducing their competency gaps (Procedure 5), all the investigated entities (11) set strategic objectives for internal development. In total, considering all the indications obtained from all the partners, 23 strategic goals were formulated. Due to editorial limitations in this paper, in Figure 4 the authors have summarised the key strategic objectives of internal development from the point of view of the partners of the ECOLABNET eco-innovative services network, in accordance with the previously adopted criterion of research results visualization. The strategic objective summarised include the ones for which the number of indications was greater than half of the number of the investigated surveyed entities N>5.

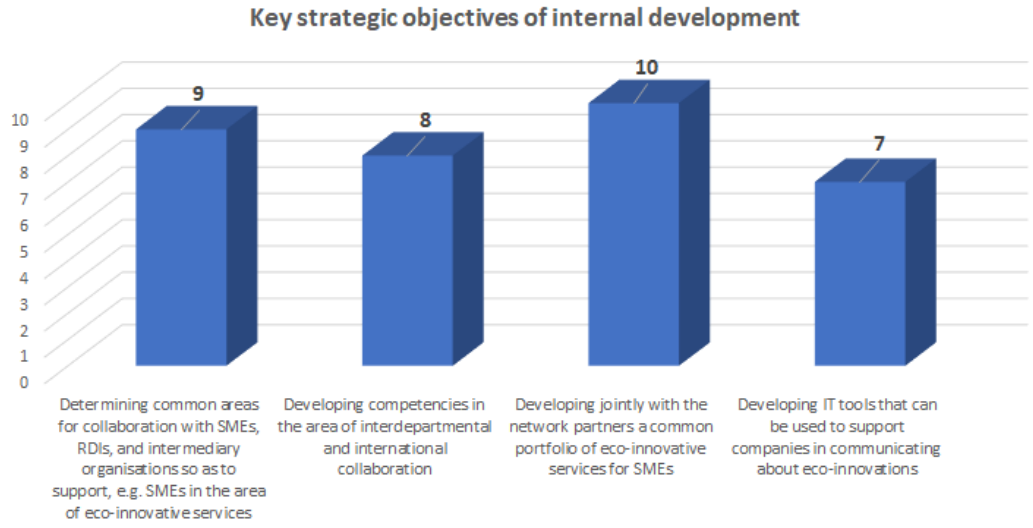


Figure 4: Key strategic objectives of internal development of the partners of the eco-innovative services network

Source: own elaboration

Analysing the summary of key strategic objectives of internal development, the highest number of indications (10) was given to the strategic objective which despite concerning the internal strategies of each partner, opens the entity to the environment, to cooperation in the network in order to develop a common comprehensive portfolio of eco-innovative services and thus expanding the market for recipients of these services. It is important for 9 out of 11 partners to define general areas of cooperation with SMEs, RDIs and Intermediary Organisations to support SMEs in the field of eco-innovative services. It is also important to develop competencies in interdepartmental and international cooperation (8 indications). It is evaluated very positively that formulation of strategic objectives allows us to observe the nature of collaboration virtualization, virtualization of eco-innovative service models through creation of repositories, information portals, digital integrators of the partnership network (Andreadou et al., 2016; Qarabsh et. al., 2020), which supports communication, dissemination of information about eco-innovative services, and frequently their diffusion.

In the context of procedure 7 - implementing - decomposing the strategic objectives into specific objectives, only five partners of the eco-innovation services network have done so. In the process of a comparative analysis, searching for a common framework of specific objectives, the following have been distinguished: research and development of personnel of individual partners, strengthening the potential of research infrastructure, seeking for new sources of funding for research and development of new eco-innovative services. Other specific objectives pertain to increasing productivity or promoting new products, expanding communication channels, e.g. for increasing the availability of services provided by related business structures, and also lobbying to promote and accelerate cooperation between business sectors and business organizations. Specific strategic objectives are also aimed at: branding, promoting the development and availability of the business ecosystem and RDI infrastructure of the partner network. In turn, in the context of the partners' shared portfolio of eco-innovation services, the specific objectives are directed at: defining how to implement, launch, test and operate the digital integrator of the partner network (Kasaei et.al., 2017): a system for collecting and presenting eco-innovative products and services, constituting a source of professional knowledge about eco-innovative solutions.

In the next stage of the research, this time referring to procedure 8 - identifying key development activities, the partners of the eco-innovation services network were requested to indicate at least three key activities that they identify in their internal strategies. As a result, a total of 54 key development actions were identified in the case of 10 out of 11 partners of the eco-innovative services network. Following the comparative analysis, a common framework of key development activities can be distinguished. Conjunctive key activities include: acceleration of R&D activities in the core business areas of the partners as well as acquisition of new competencies, e.g. in the eco-innovative service network. Furthermore, a key activity perceived by the network partners is development of the contacts networks, which correlates with common internal development strategies. A key development activity that also emerges from the comparative analysis of the research results obtained at this stage is the design, development, and creation of a joint service portfolio for the SME sector. In addition to the jointly perceived key development directions, the partners also distinguished those that identify their unique activities in the field of eco-innovative services intended for SMEs, and at the same time, from the perspective of the partner network, extend the competencies of the other actors (Karaarslan 2015).

In accordance with Figure 1, the next step (procedure 9) pertained to the analysis of the plan for implementing the tasks within the developed strategies for the internal development of the partners of the investigated network of eco-innovative services. While analysing these plans it can be concluded that they are differentiated in the context of place and time of implementation, and partly in the context of the planned substantive tasks resulting from the developed strategic objectives. This confirms the autonomy of the internal development strategies developed by individual project teams, despite their cooperation in one eco-innovative service network. Since, in this case, each entity should be analysed separately, this study distinguishes the fundamental steps in the implementation of these strategies, such as: 1) defining objectives and priorities of activities; 2) diagnosing the current level of competency in the field of eco-innovations; 3) development of competencies, strengthening the image of eco-innovations (products, processes and services) through the use of differentiated communication tools; 4) expanding the portfolio of financial and material resources; 5) strengthening the potential of research infrastructure; 6) expanding the portfolio of eco-innovative services for the SME sector; 7) expanding the network of contacts; 8) monitoring and controlling the progress of implementing the internal development strategies 9) identifying risks and taking corrective actions; 10) current and periodic evaluation

The next three procedures implemented in the internal development strategies of the partners of the eco-innovative services network, as visualised in Figure 1, are of a control nature. These procedures were developed by four partners, therefore, according to the recommendation of one of the partners represented by the authors of the paper, the same criteria and control restrictions were adopted in all 11 analysed entities so as to ensure: transparency, openness of the obtained control results, systematicity, periodicity and possibility of comparing the implementation of fundamental common strategic objectives highlighted in this paper in the network. In the case of monitoring the progress of actions undertaken (procedure 10), the common idea was to control and evaluate the current implementation of internal strategies at intervals not longer than one month and periodic evaluation at intervals not shorter than six months. Based on the indications from four partners of the analysed network, 10 most relevant quantitative indicators of internal development evaluation were aggregated (recommended to all 11 entities). The use of the same indicators ensures transparency and comparability of the development of individual partners in the network of eco-innovative services.

The unified indicators (procedure 11) include: 1) number of specialized training/workshops held; 2) number of publications on sustainable development, promotion of pilot eco-innovative services; 3) laboratory base utilisation degree (%); 4) number of acquired partners from business environment; 5) number of developed new eco-innovative products and services for SMEs; 6) number of designed new eco-innovative products and services

for SMEs; 7) number of prepared and submitted project applications for R&D grants; 8) number of R&D projects accepted for implementation; 9) number of developed patents, industrial patterns of eco-innovative services, 10) number of conducted events/training/workshops supporting processes of eco-innovative services transfer to business. It was assumed that the partners of the network of eco-innovative services are free to extend the portfolio of internal development evaluation indicators with other indicators strictly tailored to their own needs. In the context of evaluating the implementation of the strategy (procedure 12), an annual cycle of periodic evaluations was recommended to all the partners. Annual assessments include the evaluation of the quantitative effects achieved, as measured by the determined indicators. The evaluation also concerns the conditions and constraints of the implementation, the correctness of the adopted assumptions and the measurement of the degree of strategic goals implementation.

4. Conclusion

Despite the differences resulting from the mission, objectives, service activities of individual partners of the analysed eco-innovative services network Ecolabnet, common competency gaps, priorities, determinants and directions of internal development strategies can be clearly identified. This confirms the stability and synergy of interdepartmental and international cooperation. An asset that can make the investigated entities and, above all, the eco-innovative services network an example of good practice is the close cooperation with service recipients, strengthening of partnerships and cooperation in the area of research, development of eco-innovativeness and supporting eco-innovativeness, especially for SMEs. The common value is development and synergy of partners' own competencies in the scope of designing and creating eco-innovations by investing in knowledge and skills, and also the possibility of creating cooperation networks.

In the autonomous portfolios of independently determined activities/directions of internal development of the partners of the Ecolabnet eco-innovative services network, the basic common direction can be unambiguously identified, which is development of competencies in the partner network, being a platform for transfer of knowledge, competencies, experiences, and also skills.

The conducted scientific discourse, introduced analyses and aggregated information on internal strategies and their implementation by partners of the network of eco-innovative services constitute cumulative knowledge concerning strategic objectives, tasks intended for economic entities that show a tendency to develop new eco-innovative initiatives, as well as a tendency of self-improvement and strengthening their value in networks of partners, in this case, in networks of eco-innovative services. This knowledge, its management and especially its transfer, acceleration in business areas can contribute to diffusion on the market: 1) reorganization, transformation towards eco-innovative changes of existing business entities, 2) creation of new eco-innovative start-ups. Thus, the research novelty is not only the set directions of strategic activities of the researched Ecolabnet partners, but the knowledge, which certainly through its transfer will facilitate the identification of barriers and at the same time development activities, identified by the entities of the researched consortium, which has been introduced in this article. It should be mentioned that in the context of knowledge transfer about, among others, the internal strategies of the partners of the eco-innovation services network the partners conducted: 3 trainings and 5 events in the form of workshops and online webinars of international scope, directed to the SME sector. The tangible result was an increased awareness pertaining to eco-innovations in the case of 337 participants from 10 countries (LT, FIN, EE, DK, SWE, PL, NL, SK, ES, US). In addition, the Digital Collaboration Tools (DCT) website - https://dct-ecolabnet.pcz.pl – has been designed and developed within Ecolabnet. More than 50 services and products have been introduced on the DCT website. Users of this service can intelligently search for links between partners, services and eco-innovation products. Number of users of the service: 247, total number of views: 3166 (accessed on 31 December 2021).

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Social Capital, Human Capital, Tacit Knowledge, and Innovations: A Polish-US Cross-Country Study

Wioleta Kucharska[1] and G. Scott Erickson[2]
[1]Gdansk University of Technology, Fahrenheit Universities Association, Gdansk, Poland
[2]Ithaca College, Ithaca, USA
wioleta.kucharska@pg.edu.pl
gerickson@ithaca.edu

Abstract: This study measures the relationship between human and social capital (internal and external) and tacit knowledge sharing's influence on innovativeness among knowledge workers employed in Polish (n=1050) and US (n=1118) organizations. The structural equation modeling method revealed that internal social capital matters more for organizational innovativeness in the US. In Poland, both external and internal were important. Specifically, in the US, external social capital supports internal innovativeness directly and external - indirectly. On the contrary, in Poland, social capital directly influences internal and external innovativeness. These differences are partially due to country differences regarding public and private financing. Also apparent is the need for strong social bonds between employees in innovative companies. Furthermore, this study confirms that internal innovativeness is vital for external innovativeness and reveals that social capital is a structural enabler for innovativeness, given its critical role in the distribution of tacit knowledge.

Keywords: Tacit knowledge, social capital, process innovation, product & service innovation, IT industry, Poland, US

1. Introduction

Human capital encompasses individuals' knowledge and abilities, whereas social capital connotes social bonds. Since organizations exist to achieve communal aims, not individual ones, human capital and social capital are consistently positively correlated with organizational performance (Dimov & Sheperd, 2005; Felício et al., 2014). Both are vital for organizational development and, similarly, organizational innovativeness and are of scientific interest. Recently, human capital's influence on social capital has been shown by Felício et al. (2014) and Dahiyat et al. (2021), revealing that human capital fosters social capital, both foster knowledge transfer, and thus has a positive, significant effect on organizational capital. This study extends these findings, exploring how both influence organizational innovativeness (external and internal) through tacit knowledge sharing.

Tacit knowledge has been a core KM idea since its beginning. Evolving from sociology (Polanyi, 1961), the explicit/tacit differentiation was fundamental to understanding organizational knowledge assets. Nonaka (1994) and Nonaka & Takeuchi (1995) focused on the distinction, contrasting codifiable, explainable explicit knowledge with hard-to-express, hard-to-share tacit knowledge. To leverage these knowledge assets, this distinction is important. Explicit knowledge can be codified and so more amenable to organizational capture and sharing through formal processes and procedures as well as information technology systems (Matson et al., 2003; Thomas et al., 2001). Alternatively, tacit knowledge is more personal knowledge, strongly contextual, and uncodified. The tacit knowledge owner may not even be aware, especially when first acquired (Asher & Popper, 2019; Olaisen & Revang, 2018). So, tacit knowledge is harder to identify and perhaps impossible to formalize, but since it often represents more discontinuous insights and ideas, it is the main source of organizational innovations (Kucharska, 2017; Kucharska et al., 2017). Therefore, it is extremely precious as a potential source of competitive advantage. Specifically, Liu & Han (2012) associated tacit knowledge with creativity in innovation processes. Sheng (2019) was able to show that tacit knowledge does conditionally contribute to product innovativeness. Finally, Ganguly et al. (2019) demonstrated tacit knowledge characteristics are connected to organizational innovation capabilities. Indeed, Kucharska (2021 a-c) empirically identified tacit organizational mechanisms influencing internal and external innovativeness.

This paper expands Kucharska's (2021a-c) and Dahiyat et al.'s (2021) studies, linking human and social capital to innovative performance due to tacit knowledge sharing in a cross-country approach.

2. Conceptual Framework

According to human capital theory, knowledge is a source of personal development, contributing to fuller organizational and societal development (Becker, 1964; Mincer, 1974). Alternatively, social capital theory refers to individuals' ability to extract benefits from their social network's structure, intensity, and quality (Lin et al.,

1981; Portes, 1998). Social capital encompasses the context and number of relationships and their qualities such as interpersonal trust and organizational norms shaping the cooperative behaviors and relationships, including knowledge sharing, contributing to organizational development (Anklam, 2002; Felício et al., 2014; Dahiyat et al., 2021). Social capital facilitates the discovery of opportunities inside and outside the organization, fostering the configuration of organizational resources required by these opportunities (Felício et al., 2014; Uzzi, 1999). Therefore, social capital found in formal and informal organizational social networks is a kind of infrastructure for human capital dissemination and its transformation into internal and external innovations.

Organizational human capital is related to employees' knowledge, capabilities, experience, education level, soft and professional skills, and other personal characteristics (Bellucci et al., 2021; Hussinki et al., 2017), allowing a broader range of internal and external development opportunities (Davidsson and Honig, 2003). But these opportunities are highly dependent on cooperation. Since a company is a collective achieving more than individuals alone, it is reliant on a higher level of social capital and high-quality organizational bonds beyond simple relations. Individuals with higher human capital possess the potential to form these bonds based on their perceived usefulness. Hence, the following hypotheses:

H1a: Human capital positively influences internal social capital
H1b: Human capital positively influences external social capital

Moreover, Dahiyat et al. (2020) empirically demonstrated that human capital has a positive and significant effect on knowledge transfer. Following them, in a tacit knowledge context: We propose:

H2: Human capital positively influences tacit knowledge sharing

Social capital reflects relationship stock and quality, visible in interpersonal trust and cooperation. It then can influence organizational growth and development through knowledge sharing (Anklam, 2002; Felício et al., 2014). Moreover, Ganguly et al. (2019) proved that social capital fosters tacit knowledge sharing. Again, we propose:

H3a: Internal social capital positively influences tacit knowledge sharing

Felício et al. (2014) and Dahiyat et al. (2021), showed that social capital has a positive and significant effect on organizational performance. Kianto & Waajakoski (2010) demonstrated that accumulated organizational social capital stimulates growth. Cooperative knowledge is vital to organizational learning and innovation capabilities (Berraies et al., 2020; Rothberg and Erickson, 2018). Social capital facilitates the discovery of opportunities inside and outside the organization and organizes and configures resources needed to use these opportunities (Felício et al., 2014; Uzzi, 1999). Social capital found in formal and informal social networks is a kind of infrastructure for human capital dissemination and transformation into innovative internal and external solutions. Thus, we hypothesize:

H3b: Internal social capital positively influences internal innovativeness
H3c: Internal social capital positively influences external innovativeness

Moreover, Göksel & Aydintan (2017) and Ganguly et al. (2019) established that social capital fosters tacit knowledge sharing. Our hypothesis:

H4a: External social capital positively influences tacit knowledge sharing

Given that social capital influences internal innovativeness, it's reasonable to expect it will also influence external innovativeness. Additional hypotheses include:

H4b: External social capital positively influences internal innovativeness
H4c: External social capital positively influences external innovativeness
Yang et al. (2018) and Kodama (2019) showed that knowledge sharing positively influences innovation. Goffin et al. (2010) and Goffin & Koners (2011) demonstrated tacit knowledge specifically drives new product development. Kucharska (2021a-c) provided mechanisms for how tacit knowledge influences internal organizational innovativeness. So, based on this, the hypothesis is formulated as below:

H5: Tacit knowledge sharing positively influences internal innovativeness

Moreover, Hagedoorn & Wang (2012) suggested complementarity exists between internal and external innovativeness, while Jisr & Maamari (2011) and Jiménez-Jiménez et al. (2008) noted internal process innovations might increase overall innovativeness. Moreover, Donbesuur et al. (2020) suggested external innovations often flow from internal technological innovations. Therefore, internal innovations may significantly support external, market-oriented product innovations, both goods, and services. As a final hypothesis:

H6: Internal innovativeness positively influences external innovativeness

2.1 Mediation expected:

Based on Davidsson & Honig (2003), tacit knowledge previously acquired from startups is particularly influential for entrepreneurs' later ventures. Still, human capital alone is not enough to ensure success. Therefore, internal and external social capital mediates between human capital and tacit knowledge sharing. Further, since social capital shapes cooperative behaviors, it is likely that social capital also mediates between tacit knowledge sharing and internal and external innovation.

2.2 Cross-country study:

Considerable recent work examined these KM and innovation connections in the context of comparisons across countries (e.g., Papa et al., 2021; Totell et al., 2021; Terán-Bustamante et al., 2021; Kucharska 2021a-c). This research follows this line, measuring the above-hypothesized relationships among both Polish and US knowledge workers. This comparison can be interesting, given that the USA is one of the most technologically innovative countries. In contrast, Poland is a post-soviet nation with high ambitions and motivations for development that, however fast-growing, is only 30 years free from the soviet system. Therefore, findings can bring some engaging implications.

3. Method

To verify these assumptions, samples were gathered from January–to February 2020 among knowledge workers in Poland and the US. The questionnaire included filter questions to establish a minimum of one year of work experience in the same company. Measurement scales of the tacit knowledge sharing, internal and external innovativeness constructs source is Kucharska and Erickson (2020), the internal and external social constructs source is Chen et al. (2016), whereas human capital construct scale comes from Kianto et al. (2017). Respondents were also prompted with a short explanation of "tacit knowledge." The core of the survey, excluding classification items, used a seven-point Likert scale to assess the intensity of measured constructs' feelings. Data management was straightforward. Only fully completed questionnaires with SD>.4 were included. Where comparable, the sample generally matched the underlying populations (jobs, gender) of both countries (Statistics Poland, 2017; US Bureau of Labor Statistics, 2020). While some differences were apparent in the underlying populations, they were not sufficiently significant to justify varying the quota targets. Since there is a huge discrepancy in the labor market structure and size between both countries, the Polish quota structure was used as a pattern for both countries' samples. Table 1 presents the characteristics of samples employed in this study. Sample quality was assessed by the KMO measure of sampling adequacy (KMO test), CMV, and Harman single factor tests, and, at this stage, little bias in the US sample has been detected. Further analyses revealed that the US's sample bias does not result from the measurement tool. Still, rather it is an issue caused by the remarkably close correlations between social and human capital observed in the US. Specifically, since samples come from two countries, invariance tests of adequacy were run to verify that the measurement instrument operates properly across the different populations. Invariance was assessed through a multigroup CFA analysis (Byrne, 2016). Both sample sizes are above 1000, so the more liberal model global fit indices (CFI, RMSEA) were applied (Chen, 2007). The measured change in model fit is .002/.019 (unconstrained/measurement/structural model) for CFI and .000/.012 for RMSEA, with an expected value of .01 or less and .015 or less for RMSEA (Byrne, 2016; Chen, 2007; Raudenska, 2020). The national invariance of the measurement tool is confirmed, and the bias observed bias is not the effect of the measurement tool.

Table 1: Sample Characteristics

Characteristic	Poland (n =1050)	USA (n = 1118)
C-suite	3%	3%
Top managers	7%	7%
Middle managers	23%	23%

Characteristic	**Poland (n =1050)**	**USA (n = 1118)**
Professionals	67%	67%
Company size		
Micro (<10 employees)	2%	1%
Small (10-50 employees)	76%	8%
Medium (51-250 employees)	6%	40%
Large (>250 employees)	6%	52%
Age 18-24	1%	2%
25-34	19%	27%
35-44	49%	50%
45-54	21%	16%
55-64	9%	6%
65 and over	2%	1%
Gender Female	50%	49%
Male	50%	50%
Other	0	1%
Industries (33% each)	IT, Construction, Healthcare	

Table 2: Square root of AVE and implied correlations analysis, Poland/US

	AVE	CR	HC	SCext	SCint	TKS	INNint	INNext
HC	.73/.66	.91/.85	**.852/.812**					
SCext	.83/.67	.94/.86	.417/*.856*	**.896/.820**				
SCint	.83/.63	.93/.84	*.89*/.734	.305/.765	**.909/.793**			
TKS	.50/.58	.74/.80	.323/.231	.193/.274	.228/.754	**.707/.761**		
INNint	.54/.63	.82/.90	.346/.816	.366/.823	.39/.261	.326/.326	**.735/.791**	
INNext	.57/.64	.88/.90	.388/.783	.457/.763	.43/.781	.253/.317	.679/.785	**.753/.799**

Note: Poland/USA

4. Results

Findings revealed that internal social capital matters more for organizational innovativeness in the US, whereas in Poland, external and internal capital contribute to organizational innovativeness. Specifically, in the US, internal social capital fully mediates between human capital and tacit knowledge sharing; in Poland, such mediation is not observed, but at the same time, external social capital takes the full mediator function. Furthermore, in Poland, social capital directly influences internal and external innovativeness. In the US – internal social capital act as a strong direct influencer and as a key mediator of innovativeness internal and external.

Figure 1 and Table 3 present details of hypotheses verification.

Table 3: Hypotheses verification

	POLAND n = 1050	**USA n = 1118**
R2	53%	80%
KMO	.924	.953
CMV	74%	71%
Harman one factor test	35%	46%
Cmin/df	3.92	3.75
CFI	.960	.968
TLI	.953	.962
RMSEA	.053	.050
H1a	.73(.000) sustained	.89(.000) sustained
H1b	.42(.000) sustained	.83(.000) sustained
H2	.09(.114) rejected	(.259) rejected
H3a	.13(.028) sustained	.59(.000) sustained
H3b	.27(.000) sustained	.58(.000) sustained
H3c	.15(.000) sustained	.18(.004) sustained
H4a	.12(.004) sustained	-.02(.767) rejected
H4b	.24(.000) sustained	.38(.000) sustained
H4c	.21(.000) sustained	-.02(.702) rejected
H5	.22(.000) sustained	.01(.733) rejected
H6	.54(.000) sustained	.75(.000) sustained

	POLAND n = 1050	USA n = 1118
Mediations analysis – indirect effects analysis		
HC->SCi->TKS	.048(.052) no mediation	.367(.004) full mediation
HC->SCex->TKS	.025(.007) full mediation	-.013(.797) no mediation
TKS->Sci->INNint	.018(.044) complementary mediation	.212(.003) full mediation
TKS-> SCex ->INNint	.015(.007) complementary mediation	-.005 (.787) no mediation
INTint-> SCi ->INNext	.036(.000) complementary mediation	.098(.04) complementary mediation
INTint-> SCex ->INNext	.044(.000) complementary mediation	-.006(732) no mediation

Note: ***p < 0.001; **p < 0.01; *p < 0.05 ML = standardized results

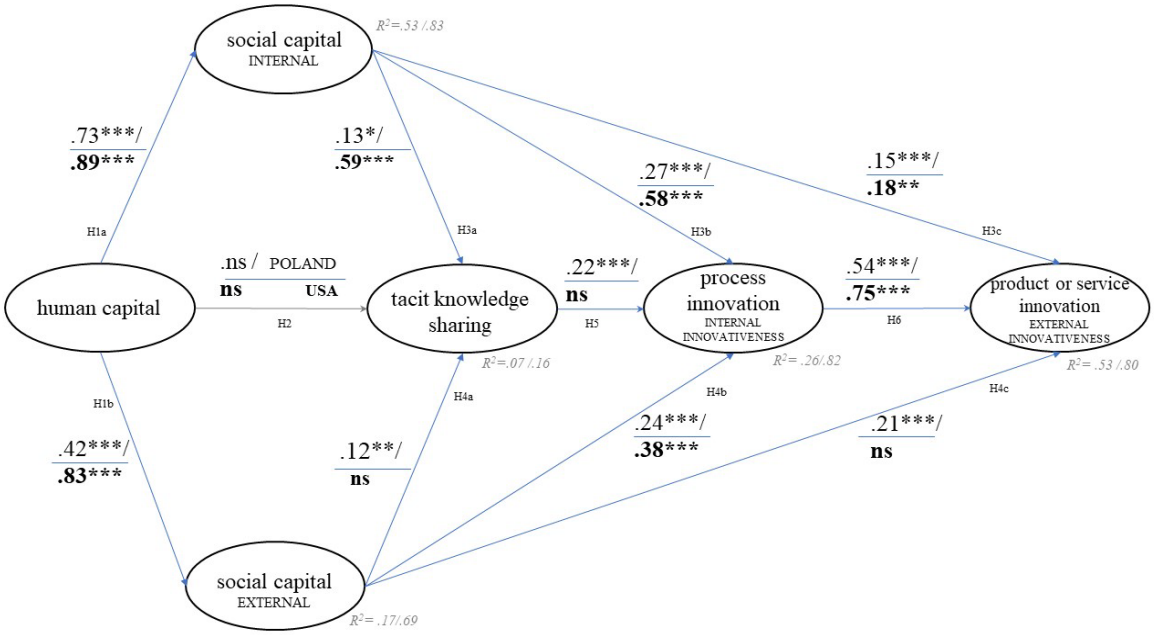


Figure 1: Results visualization

Note: Poland/USA ***p < 0.001; **p < 0.01; *p < 0.05. Poland, n = 1050/USA, n = 1118; Cmin/df=3.92/3.75 CFI=.960/.968 TLI=.953/.962 RMSEA=.053/.050 ML - standardized results

5. Discussion

As illustrated, the majority of the hypotheses fail to be rejected. This is particularly true on the Polish side. The overall fit of the model is good (R^2 = .53), and all hypotheses are supported, with the right sign except for H2. In short, human capital supports both internal and external social capital. Both internal and external social capital support tacit knowledge sharing. All three (internal social capital, external social capital, and tacit knowledge sharing foster internal process innovation. And finally, internal, and external social capital as well as process innovation foster external product innovation. The hypothesis not supported is that human capital has a direct correlation with tacit knowledge sharing.

The results do suggest human capital might have an impact on tacit knowledge sharing through the social capital variables. That can be assessed through the mediation results. As shown, internal social capital fully mediates the human capital to tacit knowledge sharing, but external social capital does not. The other mediations show complementary results: internal and external social capital mediating the tacit knowledge sharing relationship with both types of innovation as well as the internal innovation and external innovation relationship. Altogether, it exposes that internal social capital determines organizational innovativeness in Poland and that human capital is a base for this. The focal meaning of human capital for internal relational capital in Poland was also exposed by Kucharska (2021a).

But contrary to the given model, she explored the influence of tacit knowledge sharing on human capital. The reciprocal relation of both was noted by Garcia-Perez et al. (2020). In this bidirectional knowledge and IC relation context, the meaning of internal social relations among employees seems to be even more critical for innovativeness.

The US results are somewhat different though still largely supported and in a model with a better fit (R^2 = .80). Human capital is correlated with both internal and external social capital. Internal social capital is correlated with tacit knowledge sharing as well as internal and external innovation. External social capital is correlated only with internal innovations. And internal innovation is correlated with external innovation. Not supported is the hypothesis of human capital's relationship with knowledge sharing, similar to the Polish results. Unique to the US results are rejected hypotheses related to external social and its correlation with both tacit knowledge sharing and external innovation, as well as the tacit knowledge sharing and internal innovation connection.

The mediation results for the US are consistent with the role of internal social capital, showing full mediation between human capital and tacit knowledge sharing and between tacit knowledge sharing and internal innovation. Internal social capital also partially mediates the internal innovation and external innovation relationship. No mediation is seen in the role external social capital plays with the other three assessed, mirroring those just reviewed.

To what might we attribute these results? Space is short, and the outcomes should be analyzed further in more detail, but a couple of initial insights are appropriate. Initially, the Polish results clearly demonstrate more use of external social capital and larger networks with stronger ties to those outside the organization. The sample was drawn from Polish IT knowledge workers, similarly to the US, but the Polish sample would tend to match the makeup of the Polish economy, including quite a number of subsidiaries or branches of foreign multinational corporations. While there are homegrown Polish companies, they are not present in the same numbers or the same level of maturity as what might be seen in the US

As a consequence, it's no surprise that Polish organizations use social capital connections to take in knowledge for both internal process improvements and external product innovation. For internal innovation, knowledge could be drawn from both Polish workers as well as those at locations outside Poland. And there is likely more to be shared about process improvements in less mature operations. For external innovation, of course, knowledge from all sources inside and outside would be appropriate. Not only Polish knowledge workers but outside partners or other organizations, as well as customers, could supply knowledge leading to product innovations. Essentially all knowledge solicited from internal social networks and external social networks could be of use to Polish organizations.

In the more mature US economy, one would not be surprised by more self-sufficient approaches to knowledge. For internal process improvements, it might make sense to use all connections (internal and external social capital) to solicit knowledge. The state-of-the-art is important to know in the industry, and best practices can often be gleaned outside the firm as everyone seeks to keep up with current methods. Further, the more advanced processes are probably more likely to be improved by codifiable, sharable knowledge easily applied across applications and locations, perhaps explaining why tacit knowledge sharing is not necessarily important to internal process innovation. External product innovation, on the other hand, is more likely to be intended as proprietary, and so knowledge sharing may be held more closely. Ideas might come from a variety of sources, but the actual knowledge in developing the ideas for product innovation would be more internal and confidential. External social capital would be less important.

A second explanation may have to do with the wider understanding we have about Poland and the US Comparisons of national characteristics are often made in studies such as this. As above, more space would allow a deeper conversation, but as an initial pass, the Hofstede indices can suggest some important differences. Poland is higher than the US on the power distance and uncertainty avoidance scales while lower on individualism (Hofstede Insights, 2020). Those reading suggest respect for authority and a hesitance to stand out or take risks in an uncertain environment. They also suggest a tendency toward a more cooperative environment and less individualism. Those general characteristics square with some of the findings of this study, from the use of all forms of social capital to less risky, less disruption internal process innovations, to an acceptance of knowledge sharing with entities outside the firm, including larger parents and affiliates, or partners.

This research value is the more in-depth exploration of the generally confirmed relationship between human capital and innovativeness (Kucharska, 2021a; Mathew et al., 2021; Wang, 2021).

6. Limitations

The main limitation regarding the included samples is the detected bias. Precisely, for the Polish sample, there is a strong correlation between human capital and internal social capital, whereas for the US sample – there is a strong correlation between human capital and external social capital.

Limitations of the results of this study include the obvious fact that they represent only these two countries and only the IT sector (and the knowledge workers in it). Further, the discriminant validity in the US results is shaky regarding the difference between the two innovation types. The discrimination is clear in the Polish results and also in both countries in two other sectors (healthcare and construction) also covered in the broader study. So, it appears to be more of an issue with US knowledge workers' perception of any difference between internal and external innovation than an instrument problem. Future research could further clarify the factors and look at their patterns across other countries and other industries.

7. Conclusions

This study has presented results from a sizable survey conducted with knowledge workers in the IT sector of both Poland and the US. The student relied on the literature for definitions, constructs, and survey items concerning the perception of human capital levels, sharing of tacit knowledge, the social capital environment both internally and externally, and perceived levels of internal process innovation and external product innovation. Structural equation modeling was used to explore hypotheses suggesting human capital drives tacit knowledge sharing and internal/external social capital, which then relate to internal process innovation, which then, along with the internal/external social capital, correlates with external product innovation.

The hypotheses were generally confirmed for both countries. The full range of relationships was clearer in Poland. Human capital does affect internal and external social networks. Those social networks, along with shared tacit knowledge, do correlate with internal process innovation. And the internal/external social networks then work alongside internal process innovation to drive external process innovation. Essentially all sources of human capital, but especially tacit knowledge, interact with both types of social capital to drive innovation. And internal innovation further influences external innovation.

In the US, the pattern is similar except for the impact of external social capital, which is important only to internal innovation. Tacit knowledge sharing also fails to link to internal innovation. In the US, it appears the respondents perceive internal process improvements to rely more on internal human capital and not of the tacit variety. Further, both types of social capital support those process improvements, suggesting knowledge comes from a wide variety of sources. But only internal social capital is linked to external product innovation, perhaps because of its more proprietary nature.

The study shows the importance of evaluating human capital and innovation from a variety of perspectives. The variables and supporting conditions such as social capital can and do vary by industry and country. Research concerning these factors from more industries and more countries will further clarify what is more universally similar as well as what differs. All should lead to a deeper understanding of the impact of variables such as tacit knowledge, social capital, and others on organizational performance.

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Knowledge Sharing Co-operative Structures: The Case of WikiProjects

Katarzyna Kukowska
Częstochowa University of Technology, Częstochowa, Poland
katarzyna.kukowska@pcz.pl

Abstract: The effects of cooperation that may be observed based on voluntary activities of a global institution online like Wikipedia illustrate the social potential arising from the spontaneous need for activity. The basic activity of a Wikipedia user by way of assumption comes down to the creation of verbal content. The maintenance of high quality in the contents presented through controlling their verifiability is already a multi-faceted form of cooperation. The quintessence of such cooperation is the organization of Wikipedia users around internal WikiProjects. The research presented in the paper aimed to verify the magnitude of WikiProjects from the viewpoint of the number of users of Wikipedia, the most frequent number of participants of WikiProjects, and their compliance with the numeracy of groups and communities in the notion of Dunbar. Moreover, it was assumed that the number of WikiProjects in a given language version, while also the number of their participants is associated with the indicator of individualism-collectivism (IDV) according to Hofstede. The method applied was the analysis of entries of the activities in WikiProjects, as well as the number of their participants. The research has shown that WikiProjects, as groups of Wikipedians working as a team, show a similarity to the layered community formation proposed by Dunbar. A positive correlation was also found between IDV and the number of WikiProjects for individual language versions. A high IDV mainly relates to countries with a high GDP per capita. In these countries, we are dealing with a developed IT infrastructure. The high level of participation in WikiProjects with a high IDV may also be motivated by the desire to build user's position, as well as the desire to have an impact on the community as individuals. WikiProjects may fulfil the function of clubs, in which participants may try to build their autonomy in terms of activities to a certain extent, regardless of the entire system in which they operate. WikiProjects as a group of Wikipedia users working as a team indicate the similarity to the tiered creation of communities proposed by Dunbar.

Keywords: activity in virtual communities, collaboration in WikiProjects, sharing knowledge

1. Introduction

Wikipedia is a global project based on the work of individuals who share their knowledge. It is important to maintain a high quality of content that can be created by anyone. Keeping the entries compliant with encyclopaedic format and content reliability requirements necessitates multi-aspect cooperation with other Wikipedians. Wikipedians constitute a very diverse and geographically dispersed group, yet through the creation of the content, they build mutual relations and a common identity. One specific form of the cooperation of Wikipedians focused on a specific problem which is the organization of the content creators in WikiProjects. WikiProjects are perceived as embedded organizational structures engaged in content creation that support both the entire group and the individual members of the latter (Forte et al. 2012).

The research presented in this paper has been inspired by two subject areas: 1) the issue of the cultural dimension of cooperation based on the analysis of Hofstede and 2) the isolated quantity of the social strata according to the concept of the relation closeness defined by Dunbar (2016, pp 92-97). The research area covered the organized cooperation structures focused on WikiProjects and the goal of the research was to verify the number of user groups engaged in the individual WikiProjects and to determine the most common quantities of the WikiProject members and their compatibility to the numbers presented by Dunbar. It was also assumed that the number of WikiProjects in one language version and the number of WikiProject members are related to the IDV as defined by Hofstede (Kukowska, Skolik 2021). Research also accounted for the possible differences in the WikiProjects engagement for the particular language version related to GDP per capita PPP and IDV of particular countries.

2. Literature

Dunbar determined a natural size of the human communities that amounts to about 150 individuals. He proved that the capability to maintain stable interpersonal relations is limited by human cognitive abilities (the so-called social brain hypothesis). In the comparative research, Dunbar indicated many examples of the emergence of relatively autonomous communities with a size of approx. 150 individuals: Neolithic villages, villages in medieval England, production units in the Gore-Tex Inc. factory and private contact networks in cyberspace. The groups of roughly 150 individuals have existed in all human communities for tens of thousands of years and we can treat them as a common cultural factor (Dunbar 2016). Determining the levels of the relationship closeness,

Dunbar proves that the communities emerge in layers in accordance with the following structures (Dunbar 2016; Gamble, Gowlett, Dunbar 2017):

- personal group: approx. roughly 5 individuals and consisting of the family members or closest friends, people with whom we usually share a household;
- support groups: approx. 15 individuals that are usually our close friends and relatives, the contact with such group is either direct or maintained through telephony and digital media; these groups allow us to mitigate stresses created in larger structures and can provide everyday support, both emotional and material;
- good acquaintances: approx. 50 individuals, this group is often composed of our co-workers whom we meet throughout the working day;
- acquaintance communities: approx. 150 individuals;
- groups of approx. 500 individuals and composed of people we barely know and with whom we usually trade and among whom we form marriages;
- approx. 1500 individuals are distant acquaintances we might not know well but we can still remember their names and faces.

The layers presented by Dunbar determine not only the emotional closeness and time spent on interactions, but also the functional specifics of the individuals and communities (Dunbar 2016). The number of individuals in respective layers determined as 50, 150, and 500 are considered optimal for social relations. The population size oscillates around those numbers. The risk of disintegration of a given community increases as a community size diverts from the presented numbers either up or down (Dunbar, Sosis 2018).

The concept of Dunbar's number has been challenged by, e.g., de Ruiter, Weston and Lyon (2011). They pointed out that Dunbar disregarded the cultural practices and social structures that are supposed to counteract the limitations of the physiology of the human brain related to the successful operation within a network of complex social relationships. The research team also presented empirical observations of the various group sizes, many of which were not limited to Dunbar's numbers. Recent research by Lindenfors, Wartel and Lind (2021) also challenged the concept of the social brain and the natural size of the community equal to 150 individuals. Admittedly, the empirical evidence has been criticized by Dunbar himself, who noticed that the form of regression analysis (LSR) utilized by Lindefors and others to determine the relationship between group size and brain size provided misleading results. In addition, Dunbar claimed that the authors mentioned above ignored the evidence provided by neural imaging (Dunbar 2021).

The subject of Dunbar's number in the Wikipedia environment has been described in the paper by Lothar-Marcus (2018) which presents a theoretical model of self-organizing decentralized open systems (SODOS). This proposed model assumes structural limitation of the group interaction and member coordination to 150 group members. When describing conditions for the model functionality, the author used the example of Wikipedia, including WikiProjects. An empirical examination of the WikiProjects has been conducted by, e.g., Qin Cunningham and Salter-Townshend (2015) who attempted to investigate the structural properties of the discussion page network and their influence on the WikiProjects efficiency in the English language version of Wikipedia.

Knowledge sharing creates a space for cooperation that is inherently influenced by cultural factors. Many authors invoked Hofstede's analysis of the cultural dimensions in the context of cooperation and coordination in Wikipedia space. Nemoto and Gloor (2011) attempted to identify cultural differences in the Internet cooperation networks connected with innovation by comparison of Wikipedia pages. Cultural differences related to the articles and other forms of communication were also part of the investigation. Petrushyna, Klamma and Jarke (2014) analysed IDV differences in 13 European and Asian language versions, researching the involvement of registered and anonymous users in the Wikipedia content creation. Usman and Yennita (2018) used surveys to examine differences between the groups of Italian and Indonesian Wikipedia users and their levels of involvement in Wikipedia usage. Their results have shown that the users recruiting from a collectivist Indonesian culture are more eager to promote their own community and have a stronger intent to share knowledge than the Wikipedians representing a more individualist Italian culture. Lemmerich et al. (2019) surveyed 210,000 readers of 14 language versions of Wikipedia. Their research involved the correlation between Hofstede's cultural dimensions and reading behaviours. The IDV dimensions have shown a clear relationship between Wikipedia usage and the influence of media, work, or school, with the members of more collectivist

societies being less likely to visit Wikipedia due to the media influence. The authors in question also proved that Wikipedia usage correlates with the socio-economic traits of the user's country.

The cooperation context fits in with the cultural dimension of individualism and collectivism that defines the bonding between the individuals. While individualist cultures promote caring about themselves and the immediate family, collectivist cultures form cohesive internal groups. The level of individualism in a culture is tied to the national wealth, with countries dominated by individualist culture that are wealthier than more collectivist countries (Hofstede, Hofstede, Minkov 2010, pp 125-127). The author of the study, together with the team, assessed the relationship between the IDV of the national cultures Wikipedians recruit from and the indicators related to the activity levels and regulation of actions. It has been shown that a smaller number of internal rules users adhere to and a large number of edits per page correlate positively with IDV, whereas in the cultures with low IDV, there is a lower tendency to change the content that has already been posted (Kukowska, Skolik 2021).

Analysis of the subject literature has shown that the scientific debate concerning the natural size of the social groups, the structure of which has been confirmed among, e.g. Facebook groups or online game communities (Dunbar 2021) is still ongoing. The concept of Dunbar's number has not been explored to a significant extent in relation to the structures of the Wikipedia community, where users create groups focused on particular WikiProjects. Thus, WikiProjects form cooperation structures within a decentralized Wikipedia. In addition, these spontaneously created social structures remain an interesting scientific opportunity for the research of the cultural background of such activities. The author of this study fills the research gap and continues the research focused on the IDV, thus enhancing them with new parameters.

3. Methodology

This paper presents the results of quantitative research conducted in 2021 and 2022 and focused on 36 selected language versions of Wikipedia edited by communities characterized by homogeneous national cultures. All selected versions were required to show at least 300 active users per month. The method used in the study was based on the analysis of the activity logs and the number of participants of the WikiProjects. Data on the number of users was obtained from the publicly accessible comparative summaries of the language versions of Wikipedia (*List of Wikipedias*). In addition, a database containing data detailing e.g. user activity (*Wikimedia Statistics*) was used. The analysis included 55 WikiProjects that were popular in different language versions. It is worth mentioning that the analysed pool of the WikiProjects selected for the research did not guarantee the occurrence of a particular project in all 36 language versions.

The research was based on the following hypotheses:
H1: There is a relation between the number of WikiProjects and the number of their members, and a level of individualism presented by the users recruiting from their national cultures.

H2: The increased number of users organizing themselves for WikiProjects facilitates such activity both in terms of the number of users participating in a given project, as well as in terms of creating new projects.

H3: The activity level of the WikiProjects members is relative to the GDP per capita PPP of the countries represented by the members and to the IDV level of their national cultures.

H4: WikiProjects that are understood as groups of Wikipedians show similarities to the layered formation of communities according to Dunbar's 'rule of three' (Dunbar 2016, p. 93)

In order to verify the hypotheses, the following variables were selected:

1. the number of active users in language versions – data included all users of selected language versions who made edits (created or modified the Wikipedia page contents) in January 2022;
2. the average number of participants in WikiProjects – data was limited to the selected 55 WikiProjects for particular language versions;
3. the number of WikiProjects – the number of all the WikiProjects presented in the Wikipedia statistics for particular language versions that also included the projects that could have been finished or await active users;

4. the number of active users/number of active WikiProjects – the number of the active users in all active WikiProjects in separate language versions presented in Wikipedia statistics;
5. IDV – individualism and collectivism in the world values acccording to Hofstede (Hofstede, Hofstede, Minkov 2010, pp 95-97);
6. number of WikiProject domains – number of WikiProjects from the initial pool of 55 selected projects belonging to particular knowledge areas of WikiProjects, present in a given language version;
7. GDP per capita PPP – the value of GDP per capita calculated for the Purchasing Power Parity and expressed as a Purchasing Power Standard relative to the average for the European Union in the period of 2020-22 (https://tradingeconomics.com/country-list/gdp-per-capita-ppp).

Collected data was standardized due to their high variance in scales, which was then used for the agglomerative cluster analysis using the Euclidean distance as a metric.

4. Research findings and discussion

The minimization of the sum of the cluster deviations squared using Ward's agglomerative grouping method enabled control over the resulting group number, thus facilitating the presentation of the most natural clusters of the study elements (Szajt 2014). The resulting hierarchical tree graph clearly indicated two groups numbering three variables each. The first group consisted of more closely associated variables, while in the case of the latter, the variables were connected more loosely. Using these results in the latter part of the study, the researchers attempted to analyse the influence of the variables considered to be the determinants of the active user numbers relative to the number of active WikiProjects, and specific Wikipedia language versions (Fig. 1).

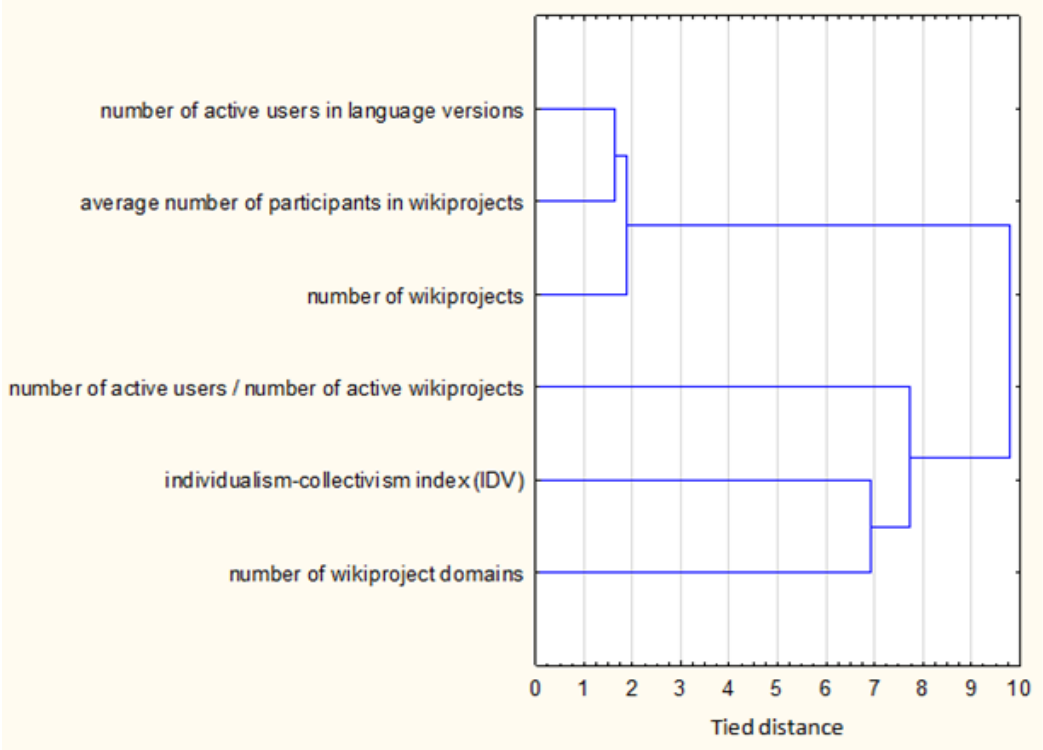


Figure 1: Cluster analysis using Euclidean distance for selected variables

4.1 Testing and verification of H1 and H2

4.1.1 Relation between the number of WikiProjects and the number of their participants, and IDV

Simulation has been conducted in Statistica software using the distance-weighted least-squares smoothing method.

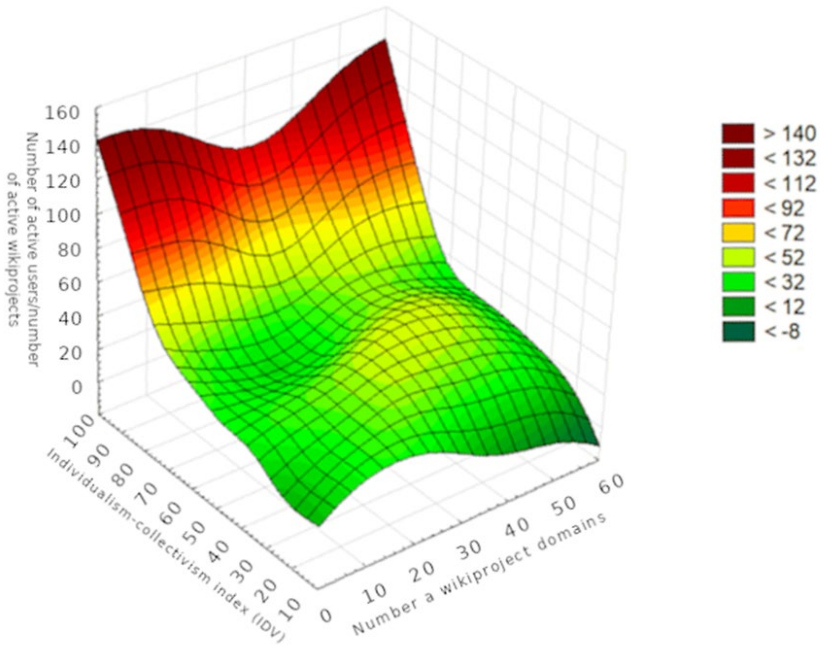


Figure 2: Simulate of the relationship between the number of active users/number of active WikiProjects, the IDV and number of WikiProject domains

The number of active WikiProjects from the pool of WikiProjects selected for the study in specific language versions (the number of WikiProject domains) influences the increase of the active users to a slight extent, with the influence being more pronounced in the case of the community of Wikipedians sharing a moderately low IDV and less pronounced in case of those with a high IDV. In addition, an increase of IDV to 80 causes a significant (albeit not rapid) increase in the number of active users in the communities of 30-50 members. The increase of IDV beyond 80 results in an almost exponential increase in the number of active WikiProjects members (Fig. 2).

4.1.2 The relation between the number of WikiProjects' participants and the activity of participants, and the number of WikiProjects

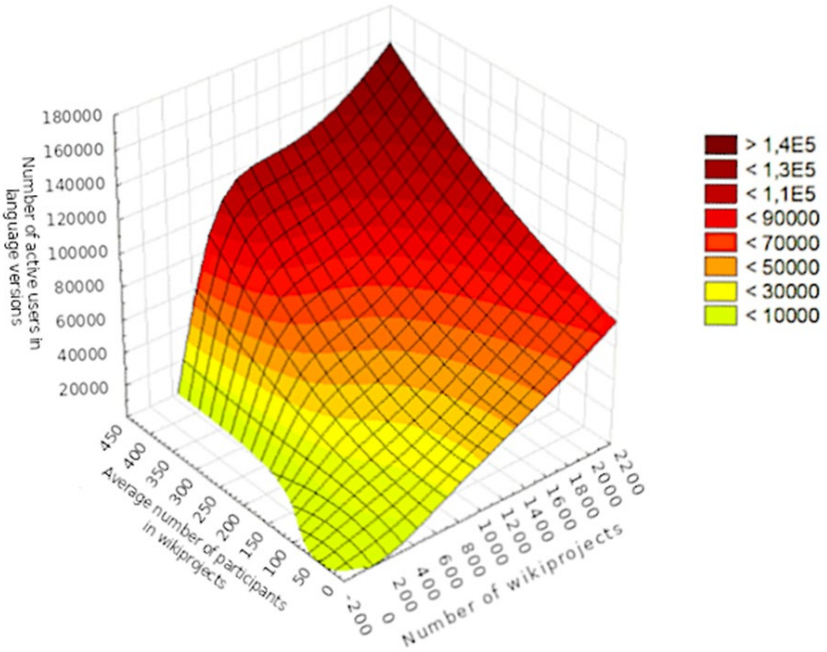


Figure 3@ Simulation of the relationship between the number of active users in language versions, the average number of participants in WikiProjects and the number of WikiProjects

As for the number of active users of a given version, with a low-moderate number of WikiProjects members, the increase in the number of WikiProjects results in an almost linear increase. As the average number of WikiProject members rises, the increasing number of WikiProjects translates to a progressively dynamic increase in the number of active users, especially up to a certain level (roughly 10,000) after which the dynamics of the growth drop slightly. With the currently identified levels of the maximum determinants, the number of active users of a particular version should not exceed 160,000 (Fig. 3).

4.1.3 Testing of H1 and H2 with the use of Spearman's ranks

Table 1: Values of Spearman correlation indicators for selected variables (p<0.05)

variable	measure	number of WikiProjects	number of active users/number of active WikiProjects	IDV	average number of participants in WikiProjects	number of WikiProject domains
number of active users in language versions	r	0,8075	0,7006	0,2462	0,8502	0,7539
	p	0,0000	0,0000	0,1477	0,0000	0,0000
number of WikiProjects	r		0,2696	0,4026	0,7704	0,8652
	p		0,1117	0,0149	0,0000	0,0000
number of active users/number of active WikiProjects	r			0,1153	0,5380	0,2448
	p			0,5030	0,0007	0,1501
IDV	r				0,1454	0,2918
	p				0,3976	0,0842
average number of participants in WikiProjects	r					0,7803
	p					0,0000

The strongest correlation was observed between the total number of WikiProjects for the particular language versions and the frequency of WikiProjects subjects from the studied pool of 55 subjects. The correlation was equal to 0.8652. This result facilitates the assumption that the WikiProjects subjects are representative of the selected sample. It can therefore be expected that the statistical analysis accurately mirrors the realities of the group functioning within the WikiProjects. Spearman's rho correlation between the number of active users and the number of WikiProjects within a given language version was equal to 0.8075, thus indicating a strong relationship. A slightly lower correlation value of 0.7006 was found in the case of the influence of the number of active users on the variable: number of active users/number of active WikiProjects. A strong relationship (0.8502) was also observed between the number of active users and the average number of active users of the WikiProjects in each language version. The number of active users correlates with the number of WikiProjects belonging to the selected knowledge domains from the pool of 55 WikiProjects that existed in the investigated language versions with a correlation equal to 0.7539. The weakest correlation (0.4026) was found between the number of WikiProjects and IDV, although it still statistically significant. The relationship between the number of WikiProjects and the average number of participants in WikiProjects is statistically significant (0.7704). Spearman's rho correlation between the ratio of active users and all active WikiProjects in particular language versions and the average number of the members in the investigated WikiProjects was equal to 0.5380. This in turn translates to a moderate level of statistical significance. A statistically significant correlation (0.7803) was observed between the average number of members in the investigated WikiProjects and the number of WikiProjects present in the studied pool for a given language version.

The research findings confirm H1, which assumed a relationship between the number of WikiProjects and the number of their members, and IDV for the investigated language versions. Taking into account all the WikiProjects registered in particular language versions with relation to IDV, the correlation between these variables is lower than average. In the case of the WikiProjects selected for the study, the higher activity of the WikiProject members is on average more pronounced in the collectivist cultures. Yet, when the values achieve the level of IDV>80, indicating cultures that are strongly individualist, the number of the active users in the WikiProjects quickly increases.

H2 is verified by a strong correlation. Together with the increase in the average number of WikiProjects members, the number of WikiProjects in a given language version also increases. Hence, the organization of a higher number of users in WikiProjects facilitates the creation of new WikiProjects. The more Wikipedia users

are active, the more WikiProjects they generate and, on average, such WikiProjects have more members. Activity related to WikiProjects measured by the number of the latter and the number of their members influences a dynamic increase in the general user activity. Keeping in mind that such activity is measured as the involvement in editing and discussions, we can say that cooperation within WikiProjects positively influences individual involvement.

4.2 Verificationof H3 – the activity of WikiProjects' participants depending on GDP per capita PPP, and IDV

Hofstede argued that the level of individualism within a culture is relative to the national wealth (Hofstede, Hofstede, Minkov 2010). Therefore the GDP per capita PPP was included as one of the investigated variables. The study attempted to answer whether in the case of the investigated 36 language versions of Wikipedia, the relation between IDV and the personal wealth of the users will be observed and whether the variance of these variables will be modulating the number of users involved in WikiProjects.

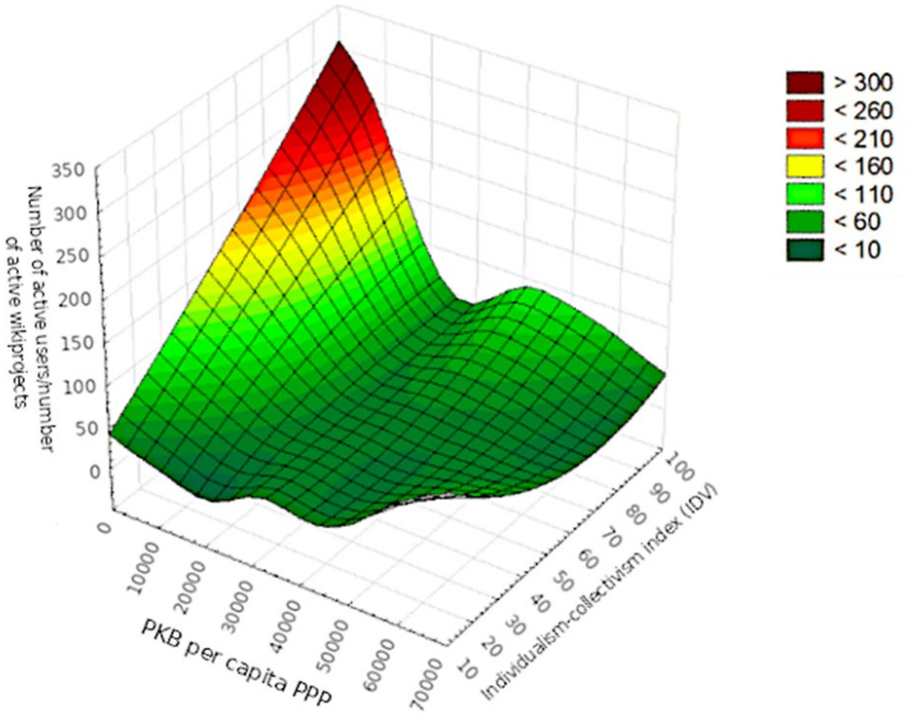


Figure 4: Simulate of the relationship between the number of active users/number of active WikiProjects, the PKB per capita PPP and the IDV

In the case of a low level of GDP per capita PPP, an increase of IDV results in a dynamic, quasi-linear increase in the number of active users relative to the active WikiProjects. The increase of the wealth in the community Wikipedians recruit from leads to the significant reduction of such reaction to the IDV increase. For the value circa USD 2000 per capita PPP or higher, the aforesaid reaction is almost non-existent. A change in the number of active users can be observed for the areas characterized by moderately high wealth (USD 3000-6000 per capita) only for an individualism level of IDV>70 (Fig. 4).

The obtained results confirm H3, i.e. prove that the activity of the WikiProjects members is relative to the GDP per capita PPP of the countries the said members represent, and is also relative to the IDV of their national cultures. Hence, the IDV influence on the activity in WikiProjects is observed among the user from the two extreme environments, namely the low-income countries and countries that are moderately wealthy. Ultimately, the highest level of involvement in WikiProjects may be observed in the countries with relatively high GDP per capita PPP and high IDV.

4.3 Verification of H4 – conformity of the size of WikiProjects to the Dunbar's 'rule of three'

The study verified user activity via 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 is equal to 1.96. The change of the user number in particular WikiProjects was very fast for the WikiProjects

numbering 19-20 members, with these dynamics decreasing when the group size rises to approx. 35-37 members. The next significant change occurs when the groups achieve the size of 53 and decreases when the groups number 62-63 members (67 for the 11-period sequence). The final statistically significant drop in the number of active WikiProjects users (up to 180 members) is observed for groups with 124-132 members. For k=11 significant drops are observed in groups numbering 158-160 members. Interestingly, a statistically significant increase in group size was observed for the groups counting 115-116 members for k=9 (Fig. 5).

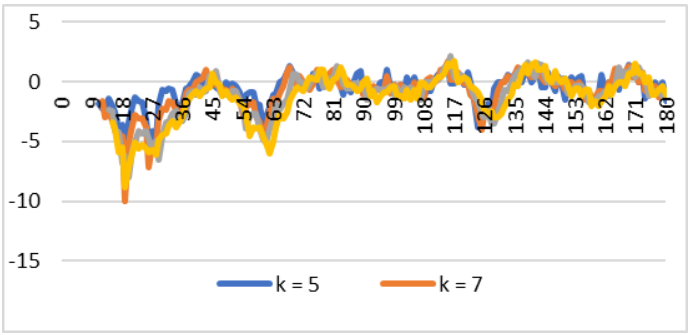


Figure 5: Average test values or the numbers of WikiProjects with a specified number of members relative to the size of WikiProjects

The verification of the number of members in the WikiProjects selected for the study confirmed the hypothesis stating that the size of the group formed by Wikipedians involved in WikiProjects is compatible with the concept of the layered formation of communities based on Dunbar's number. The study findings have shown significant changes in the numbers of the WikiProjects members in the ranges typical of the layers proposed by Dunbar.

Morgan et al. (2013) noted that the defined boundaries of the WikiProject membership is a trait typical for the traditional groups and the previous studies assumed that the work focused on the content generation is proof of the identification with a group. However, their direct conclusions stated that the actions are loosely coordinated, so this activity does not promote strong bonding that is typical of traditional groups. The results of the study presented in this paper prove that WikiProjects present the typical traits of groups and show similarity to the naturally emerging social layers. This may be explained by the actual influence that separate WikiProject members exert on the mutual behaviours. Lotan-Marcus (2018) proposed a theoretical model of the self-organizing decentralized open systems and assumed that the size of social networks equal to 150 individuals is commonplace. However, she remarked that the decentralized structures of Wikipedia is representative of are quite rare and translation of these paradigms onto the realities of modern lifestyles might be quite difficult. This study confirmed the functionality of Dunbar's number in the scope of WikiProjects. Hence, the assumptions of the theoretical SODOS model appear to be correct.

Pfeil, Zaphiris and Ang (2006) assumed that the higher number of activities would be related to the language version identified with collectivist cultures. However, the study findings presented above have shown that the greatest engagement in WikiProjects is expressed by the users recruited from wealthy countries where societies are characterized by a high level of individualism and well developed IT infrastructure. Their residents might have more free time, so they can more easily get involved in activities other than labour. Bigger WikiProjects groups formed by residents of countries characterized by higher IDV might be explained by the stronger need to influence the community and to build one's individual position in the Wikipedia's structure.

5. Conclusions

This paper is a contribution to research on the determinants of knowledge sharing within the structures of spontaneously emerging virtual communities. The main group of recipients that might be interested in the results presented here are knowledge management and teamworking practitioners who continuously look for the possibilities that would allow them to optimize the coordination of activities in professional settings. This is why the knowledge related to the emergence of the social structures following specific rules might be an argument for the solidification of the principles determining the formation of successful worker teams and task groups. The studies conducted on the number of WikiProjects members prove once more that online communities form in accordance with the processes present in the formation of social structures in real life.

The research findings presented may be a source of experience and inspiration for the management of other virtual organizations. They may also be an example for the organizations that manage online work, especially when the workplace is culturally diverse. It is worth noting that Wikipedia, being an example of a decentralized structure, functions on the level of individual motivations. It seems that this is an ideal system of social utility. Therefore, the analysis of the cultural determinants accompanying such activities might be practically applied in the organization in the new forms of cooperation structures.

6. Limitations

Although the results of the statistical relations of the analysed variables appear to confirm the initial assumptions, extending the scope of further studies can significantly influence the overall results. The problem related to data collection is the intrinsic uncertainty of the actual number of active users who work on particular WikiProjects as not all language versions update such information sufficiently. In addition, there is a persistent problem of type of research related to the cultural determinants of the Wikipedia space, resulting from the existence of a certain percentage of people recruiting from a different cultural background.

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The role of Mentorship in Universities: The Knowledge Management Framework

Kristina Kuznetsova-Bogdanovitsh[1] and Annukka Jyrämä[1, 2]
[1]Sibelius Academy, Uniarts Helsinki Finland, Estonian Academy of Music and Theatre, Tallinn, Estonia
[2]Estonian Academy of Music and Theatre, Tallinn, Estonia, Aalto University School of Business
kristina.kuznetsova-bogdanovitsh@eamt.ee
annukka.jyrama@aalto.fi; annukka.jyrama@eamt.ee

Abstract: In this paper we discuss mentorship in the university context with a focus on knowledge sharing and creation. We assume from the outset that academics and actors representing practice, as well as students, can be considered as distinct or interlinked communities of practice, where the participants of the community share similar values, norms and practices that follow community-specific dominant logics. We suggest there is a role for mentors between academia, student life and fields of practice, and that the knowledge creation and sharing processes can take different formats, similar to changing mentor roles in facilitating or sharing the knowledge processes. We discuss the roles of mentors in the knowledge sharing contexts of communities of practice building on previous studies reflecting the professional identity of students and mentoring in those same contexts. We look at knowledge and learning as processes, acknowledging the specific nature of tacit and explicit knowledge following the perspectives from the SECI model and experiential learning. We further elaborate the role of mentors in sharing and building knowledge focusing on the university context. The results indicate that mentoring takes various forms and needs different enabling processes in different contexts within university cycles. The role of informal unexpected mentoring occurring within the 'ordinary' learning context is often ignored. The contribution of the paper provides a deeper understanding of mentoring in the university, as well as elaborating on the mentor as a knowledge activist contributing new insights in knowledge management discussions. The study has managerial implications related to new approaches to transforming mentoring from being an "add-on" activity to an integrated part of university curriculum development.

Keywords: Mentorship, arts universities, communities of practice, experiential learning, knowledge, professional identity

1. Introduction

This paper explores knowledge management in an arts university context. It discusses the challenges of sharing knowledge, finding a common language and identifying enablers for (or barriers to) knowledge co-creation in this particular setting. We introduce mentorship relations and processes as a unique perspective for exploring ways to facilitate and enhance knowledge sharing and creation in an arts university. We argue that communities of academic staff, and actors and students of a certain practice can be considered distinct or interlinked communities of practice (Lave and Wenger, 1991), where the participants of the community share similar values, norms and practices that follow community-specific dominant logics (von Krogh and Grand, 2000). We explore how mentoring could act as a facilitator within and between these communities of practice.

As each community of practice has its own practice, sometimes based in a discipline (i.e., academic field) and sometimes based on other university activities (e.g., entrepreneurial education offered across disciplines), this creates a multitude of communities for a student to enter. Since these communities are often discipline based, they are connected to a specific professional identity (see e.g., Henkel, 2000), but as mentioned earlier, the different communities may also have different perspectives or an emphasis on the future professional identity of the students. This diversity can be rather confusing and complex from the perspective of individual learners and the organization. We suggest there is a role for mentors between academia, student life and fields of practice. We discuss mentorship through previously identified mediating roles in knowledge sharing contexts (Wenger, 1998; Kauppila et al., 2011; Jyrämä and Äyväri, 2007 updated 2017;). The theoretical framework is built based on communities of practice, while specifically considering facilitation and the role of mentorship across communities. Our understanding of knowledge is based on contributions from Nonaka and others (Nonaka et al., 1996; Nonaka et al., 2000, 2001) and discussions of the nature of knowledge processes and experiential learning in general. We will also briefly discuss the connection between communities of practice in universities and professional identity.

We propose that mentors can be seen as helping, introducing, interpreting or integrating elements of one community or practice into another, or building new-shared practices or knowledge. We specifically look at the arts management/entrepreneurial classrooms and examine whether the learners or teachers can be perceived as unexpected mentors for other participants and their mindsets. We aim to discover the various ways in which mentorship takes place in an art university. Consequently, our research question is: How is mentorship manifested in art universities from a knowledge sharing perspective?

The paper builds on the REMAM EU project and recent findings from a doctoral study on knowledge management and the entrepreneurial mindset in an art university context.[1] Chapter 2 will discuss the theoretical basis of our study, our understanding of the nature of knowledge, followed by presenting the main discussions – communities of practice, experiential learning and professional identity. It will also integrate the mentorship approach with connections to knowledge mediating and facilitating perspectives. Chapter 3 will present the research design followed by the results and discussion in Chapter 4, and Chapter 5 will conclude.

2. Theoretical discussion

2.1 Perspectives on knowledge – the SECI model and experiential learning

Knowledge can be classified and comprehended in different ways. Tacit and explicit knowledge offer a perspective on comprehending knowledge and the process of learning, knowledge sharing and construction. Addressing, managing and constructing those two types of knowledge needs to be different – different activities albeit represented in the same context. Explicit knowledge is always grounded in tacit knowledge (Polanyi, 1962); they are in some ways inseparable. Explicit knowledge is accessible through consciousness, in plain words, as information, and an individual is aware of possessing that type of knowledge. Tacit knowledge is tied to the senses, tactile experiences, movement skills, and it is rooted in action, procedures, routines, ideals, values and emotions. Tacit knowledge contains elements of explicit knowledge and contextual elements which support applying the given knowledge (e.g., Von Krogh et al., 2000; Nonaka et al., 1996). On an individual learner level, critical reflection skills and self-awareness are needed to navigate, structure and manage the interrelationships between tacit and explicit knowledge. From the organizational perspective, it is important to build ways and processes to consistently work with both types of knowledge – tacit and explicit – continuously moving through individual and collective stages, which is well presented in the SECI model of knowledge management.

The SECI model emphasizes the flow of knowledge through socialization, externalization, combination and internalization phases (see e.g., Nonaka et al., 2000, 2001). The movement and actual knowledge creation inside the model is along two main continua: tacit and explicit, individual and collective (Nonaka and Takeuchi, 1995). The SECI model is not only a categorization of the movement, but it highlights the emphasis on enabling all the knowledge transformations to build spaces and practices that facilitate the flow of knowledge. By combining the SECI model and experiential learning theory within communities of practice we can explore the reflective processes taking place at the individual level within an organization. This allows us to address the essence of mentorship as a knowledge mediating activity. The experiential learning cycle (e.g., Kolb, 1984) focuses on experience, which is the basis and centre of the cycle, as well as experiential learning theory. Moreover, conceptualization and reflection are equally important steps in the experiential learning cycle and crucial for contextualising and building sustainable learning from the given experience.

2.2 Communities of practice, identity and knowledge

The concept of communities of practice has been widely used to study learning and knowledge sharing and creation (e.g., Lave and Wenger, 1991; Wenger 1998; Wenger, 2000; Brown and Duguid, 1991). A community of practice is defined as a freely created community that engages in an activity together and then gradually forms a tight community that learns together through joint practice. The main elements of a community of practice are "the language, tools, documents, images, symbols, well-defined roles, specified criteria, codified procedures, regulations, and contracts that various practices make explicit for a variety of purposes'' (Wenger, 1998, p. 47). Wenger (1998, p.73) further emphasizes the following as the property of a community: mutual engagement, joint enterprise, and shared repertoire. Hence, communities of practice can be summarized as a community of

[1] Kuznetsova-Bogdanovitsh, K. "Co-Constructing Knowledge Management Practices in Arts Universities: the Role of Entrepreneurial Mindset and Education." Sibelius Academy, University of the Arts Helsinki. (forthcoming) REMAM About – REMAM

people who share some activity or practice and have similar values, norms and language (Lave and Wenger, 1991; Wenger, 1998).

Communities of practice are based on a hierarchical structure where a novice moves from peripheral positions through learning towards the core of the community of practice – adopting the community's 'practice', meaning the values, norms and ways of acting (Lave and Wenger, 1991; Wenger, 1998). As identity and knowledge are closely connected, and the learning, especially the accumulation of knowledge, is a means to build the hierarchical position within communities, it can be assumed that it can also result in individuals hoarding knowledge rather than sharing it (e.g., Davenport and Prusak, 1996).

In the university context, communities of practice have been viewed as communities consisting of students, teachers and other academic staff. Hence, communities of practice are viewed as spaces for learning through shared experience and socialization processes. While the context of the communities of practice is seen as strongly supportive of a variety of knowledge sharing opportunities, the occurrence of a learning process is not a given but might need some catalyst for the learning process to start.

Nonetheless, communities of practice are supportive of members' individual identity development through socialization processes. Through joint practice and learning, students build not only skills and competences but also a shared understanding of the profession; that is, professional identity. Several studies have adopted a communities of practice perspective when analysing the learning or identity building processes in educational or higher educational contexts (e.g., Jawitz, 2009; Wiles, 2013). Fitzgerald (2020) conceptualized professional identity through the following dimensions, "(professional identity) ... including actions and behaviors, knowledge and skills, values, beliefs and ethics, context and socialization, and group and personal identity" – therefore, the dimensions of professional identity are closely connected to communities of practice.

Professional identity starts to emerge and is influenced by education from the commencement of studies (Lamote and Engels, 2010) and continues through the learning context, as well as via the socialization process inherent in communities of practice at the university, but also during work experience (e.g., internships) as well as through personal identity and the individual's own values and other experiences (Trede et al., 2011; Wiles, 2013; Goldie, 2012). Professionalism in a field and position in a community is created through the body of knowledge learned. When practitioners or professionals come together within (or visit) communities of practice, an effective opportunity for shared reflective space is constructed with little effort (Héliot et al., 2010). Still, the capacity of each individual to reflect and systematize all that knowledge varies widely. Mentoring offers crucial support.

2.3 Mentoring as a tool for knowledge sharing and facilitation across communities

Mediating, enabling and facilitating knowledge creation and learning has received considerable interest in previous research. The conceptualizations for catalysing or enabling creation are many (e.g., mediator, activist, broker, facilitator). For example, Jyrämä and Äyväri (2007) have categorised the various conceptualizations of mediating or facilitating into: the invisible hand, enabling more through structures than people, and brokers or mediators, looking at knowledge facilitation or mediation through individuals or groups of individuals, such as knowledge activists (see also Kantola 2010). It is important to point out that although the categories somewhat overlap, each does bring forth new tasks for consideration.

These mediating or facilitating categorizations can be used as a starting point for examining mentoring in the context of learning. We therefore reflect on what is needed to mentor or facilitate interaction between differing communities of practice. In order to pinpoint the role of the mentor in the knowledge creation context, we further elaborate the conceptualizations of knowledge mediating and contribute by adding a new perspective to gain a deeper insight.

The key elements involved in mediating knowledge can be summarized into three main elements. First, understanding the student and yourself, being aware of possible differing values and goals for the mentoring relationship. The practitioners might have a different understanding and perspective on the professional identity, especially since a professional or career identity is linked to mission (e.g., Bennett et al., 2008; Huhtanen, 2004). Hence, it is important to see the relationship as a process of co-creation involving the respective roles of each mentor and mentee, thereby acknowledging the individual level of mentorship. Second, at the process level, the mentorship usually has a beginning and an end; this involves the setting of aims for the

process but also an exit plan. Third, mentoring is a way to support overall learning goals, and can be integrated into the curriculum in the form of the required knowledge, skills and competencies, including academic competencies. To summarize, mentoring is not only being a practitioner role model but sharing experiences that build personalized relationships with respect for both participants (Johnson, 2003; Amayry and Crisp, 2007).

The relationship between knowledge and mentoring has been proposed as focusing mainly on tacit knowledge, seeing mentoring as sharing experiences in the organization, policies, methods of solving problems in a certain context (Karkoulian et al., 2008). Mentorship programmes are often formal, pairing up mentees (novices) with mentors (experts) – these mentors can be several levels inside the organization, often superior or more experienced peers. However, challenges in formal mentoring programmes can emerge in terms of ensuring relationships of trust and managing the personality match. It is worth emphasizing that in formal and informal contexts the perception of the mentor by the mentee (where they are seen as experts by the mentees on the topic of the mentorship) was found to affect the success of the mentoring relationship (Srivichai et al., 2012). When looking from a communities of practice framework, the roles of mentor and mentee are similar to expert and novice, one leading the other towards the core knowledge of the community.

Bryant (2005) looked at peer mentorship, which is less discussed than supervisor-novice mentorships, and pointed out that peer mentorship, often used either explicitly or implicitly to integrate newcomers into an organization, could be seen as an act of formal or informal mentoring. Peer mentoring was also explored in a study of the university context (Grant-Vallone and Ensher, 2000), emphasizing that the mentoring relationship that is student-to-student gained better results in terms of mentee adaptation to the social context of the university, although it did not provide a similar effect in terms of career setting as was the case in supervisor-student mentoring. Hence, we could suggest that peer-to-peer mentoring is a means for entering a community of practice, whereas moving from the periphery to the core might be better served by the supervisor (expert)-student (novice) relationship.

As discussed by Swap et al. (2015), people learn consciously but also spontaneously through experience, informal teaching and so on. We wish to emphasize that in order to have a holistic mentoring programme, both informal and formal practices as well as peer-to-peer and supervisor/expert-mentee relationships are needed; as is acknowledging the need for mentoring across different communities of practice and disciplines. The following figure (Figure 1) summarises these discussions.

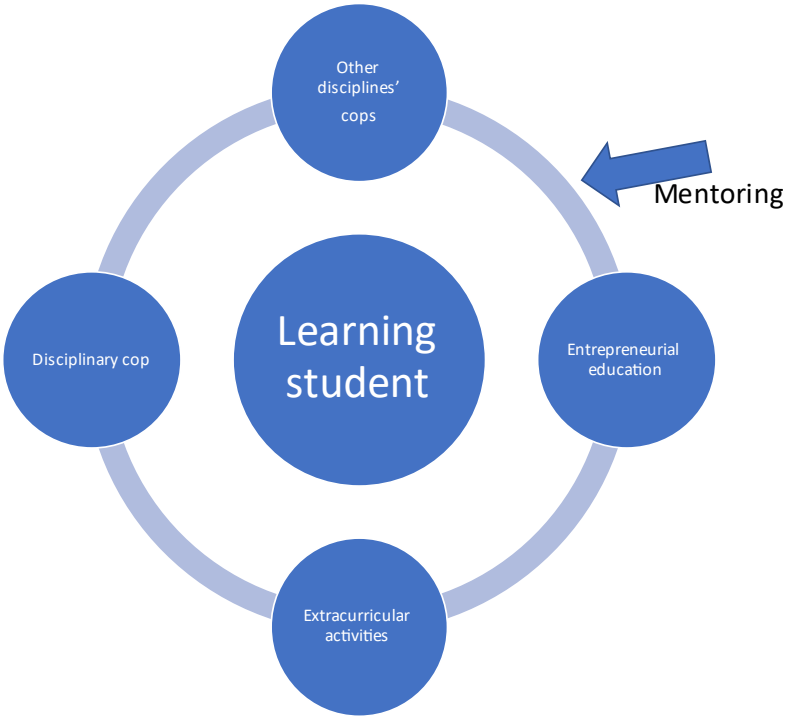


Figure 1. Holistic mentoring framework

The framework above opens up the cyclical and multiple ways mentoring may occur in the art university context, from education aiming to provide work life skills and entrepreneurship, to extracurricular activities, like project work or internships, as well as field-specific content and content from studies outside one's own discipline, such as minor studies. These are intertwined through the students' learning processes, sometimes in formal and sometimes in informal ways.

3. Research design

This is a qualitative study building on the acknowledgement of the importance of interaction and co-construction between the researcher and the study material according to the social constructionist paradigm (Moisander and Valtonen, 2006). We encourage the reader to contextualise and transfer the findings from this empirical analysis to other contexts of relevance for them (Moisander and Valtonen, 2006). We also attempt to keep a self-critical account of the research process, and remain self-reflective as educators in the arts university (Lincoln and Guba, 1985; Tobin and Begley, 2004). Finally, we admit that the challenge in qualitative research, including data gathering and analysis, is to interpret the meanings that individuals attach to their experiences (Easterby-Smith et al., 1991; Murphy et al., 1998). In order to address this difficulty we have used a wide range of data in several layers for the analysis.

To analyse mentorship we have used the Estonian Academy of Music and Theatre (EAMT) as the sample case. The data consists of observations from content and entrepreneurial classrooms, and from academic life in general, yet primarily from entrepreneurial modules between 2015 and 2020. Entrepreneurial education at EAMT takes place (among other programmes) within the Entrepreneurship Education Programme "Systematic Development of the Entrepreneurial Mindset and Education at All Levels" for the systematic and methodological implementation of entrepreneurship education based on the entrepreneurial competence model.[2][3] EAMT has entrepreneurial courses that are obligatory for all bachelor students; master students can choose from among specialist modules, and an Entrepreneurial Mindset module is one of those choices (up to 20 ECTS). Some programmes include specially designed courses that respond to their specific needs in preparing for working life.

The data analysis is based on generic data from teachers notes and observations as well as specific data from student survey-interviews, interviews with the leadership, teaching and administrative personnel, and follow up focus group interviews with students. This data was collected and analysed as part of a doctoral thesis looking at knowledge co-creation and management experiences, while in this instance the actors (mentors) were the focus of the analysis.

4. Knowledge sharing and co-creation in the university context, mentorship as building bridges

In this chapter we will further elaborate upon the specific context of the university setting, discovering what is mentorship – who are the actors, existing or potential mentors and mentees, and how is knowledge shared and created in this particular context. We will highlight this through the analysis of an art university (case). We look into the different mentor roles, conceptualizing these with communities of practice, experiential learning and knowledge related processes, with suggestions on the roles required in the specific context.

From our research we learned that in the context of an arts university as an organization, learning, knowledge sharing and co-creation occurs in communities of practice, where the community is often created around a discipline or main professor (e.g., violin players, harpists or cultural managers). Therefore, in the context of an arts university, the community of practice usually corresponds to an experiential learning situation involving arts studies but also entrepreneurial and other 'supportive' studies. Students go through the stages of an experiential learning cycle (or a combination of them) (e.g. Kolb, 1984). Conceptually, the communities of practice have borders and it could be argued that they encompass only the insiders in the university. However, in an (art) university context these communities often open up towards the professional field of the discipline in the larger context and this blurs the borders of the university as an organization. For example, **we know from existing studies that** many professors have both artistic as well as academic careers. They belong to broader communities of practice that encompass both academic and practice-based professions, and thus the

[2] eamt.ee/en/about/the-academy/development-plan/

[3] The project publication can be found here: https://ettevõtlusõpe.ee/wp-content/uploads/2018/12/Raamdokument_web_3.pdf

communities become potential platforms for wider professional networks, where future contacts are created and the logic of the given art field is learned (see also Ibarra et al., 2005).

The role of a mentor in such a context can be manyfold, occurring in both a formal or informal manner, as well as according to a variety of relationship models – peer-to-peer, supervisor-student relationships that happen unintentionally or intentionally, and others. The table below (Table 1) summarizes some of the key mentor roles based on conceptualizations of mediator roles with the potential actors within the academic context.

Table 1: Mentoring roles and examples of actors in the context of the art university

Mentor role (adapted from mediator roles, see appendix)	**Examples of actors in the arts university**
Activist: catalyzing knowledge sharing and creation Invisible Hand: creating structures and enablers for knowledge sharing and creation Note that the Invisible Hand is needed for all knowledge management processes	Activists: often peer-to-peer model Also administrators and educators as mentors Invisible Hand: mostly leadership
Brokers	Mostly educators/experts as mentors In certain situations peer-to-peer model
Cultural intermediary; building understanding from one community to another through a translator; explaining specialist concepts; language from one community to another	For example, administrative workers; arts managers;
Supporters in identity building. Cultivators of care: identity building is often sensitive, and empathy and care are needed	Supporters in identity building and cultivators of care rather experienced practitioner-mentors

It is important to notice again **what we learned through the research** – that these mentor roles (Table 1) can function in the formal sense as mentoring, or occur in informal settings in an unexpected manner, as anyone may take the role of a mentor by sharing his or her expertise. We identified the relationship between mentor and mentee in terms of the mentorship roles and examples of activities in each category. These categories are not exclusive. Art universities, like many others, offer formal mentoring programmes using university alumni or other experts to mentor the students. External mentorship is often sought by the students and offered by universities especially as the students approach graduation as a means to prepare them for working life. In addition, the Invisible Hand of the university can demonstrate itself in the overall learning climate. We generally wish to emphasize the importance of university structures and the leadership as an Invisible Hand enabling mentoring to occur in its many formats (e.g., Maden, 2012). **In the following 3 sections, we discuss the outcomes of the research relying on the previous conceptualizations.**

4.1 Peer-peer mentoring among students

Above we have outlined peer-to-peer or student participation in mentorship processes as activists and brokers. This does not mean they cannot participate in other contexts and roles. The peer-to-peer mentorship model involves questioning the respective levels of expertise. Therefore, students might initially have trouble trusting the knowledge or guidance of their fellow student. However, within the socialization process, students are easily trusted as experts (see also Grand-Vallone and Ensther, 2000) sharing their experiences, stories, and best practices.

Such mentorship often happens unexpectedly in the process of (group) learning; for example, in the entrepreneurial classroom, sharing professional experiences, successes and failures, ideas and projects in relation to career development. At the same time, **we found** the role of brokers is offered to music students in the entrepreneurial classroom, so that practicing sharing between their respective communities is encouraged

within the wider economy (as entrepreneurial studies often involve diverse disciplines) . For arts management students in particular, they are often expected to act as translators or cultural intermediaries. These unexpected mentor roles are often the ones the arts management students quite readily accept and adopt, and although this might intervene with free knowledge flow and shared novel knowledge construction, at the very least, this acceptance should be discussed and reflected upon.

In the mentor-activist role in particular, creating opportunities for others to share knowledge (e.g. events, projects) is more complex because it is often seen as a personal initiative, yet it needs support from the structural level of the organization. Such opportunities initiated by the activists offer a trigger for communication and knowledge sharing or socialization (e.g., Nonaka et al., 2001; Nonaka et al., 2000) that may vary between formal and informal modes (e.g., invited speakers versus coffee break discussions).

4.2 The educator-peer mentoring perspective

The role of educators (teachers) in sharing and co-creating knowledge has received significant attention from various perspectives. Often educators are seen as the experts guiding student-novices to a community of practice, as well as offering access to a diversity of communities within the university (see e.g., Wiles, 2013; Jawitz, 2009). The role of educator as mentor guiding the student mentee is an often-accepted position, albeit a problematic one. The educator-student relationship when seen in a mentorship context highlights the problems associated with the strong power position the teachers hold within the academic community. As discussed by Hall et al. (2009), educators (professors) might implicitly, and even explicitly, provide only one possible path for student learning and a singular image of their future careers, thus limiting the potential learning paths that, for example, external mentorship could provide. Hence, there might be a tendency to guide students toward specific (accepted) tacit and explicit knowledge rather than offer a diversity of learning paths and contexts.

In the course of the research we found that entrepreneurial or work life educators and core field educators as mentors manifest different perspectives on working and learning life. Entrepreneurial educators often refer to the wider economy and career context, while core educators often focus on skill and knowledge development for a particular career in the art university as an artist, musician, actor etc. Yet, both teacher groups find the importance of professional networks, starting from communities of practice in academia, crucial, especially in relation to the sustainability discourse.

While brokering is one of the key elements in the case of the knowledge of educators, a broker is required to pass knowledge from one field or community to another. The way mentors do this might be quite different **as we learned above.** Ranging from a more authoritarian approach (this is the knowledge you need) to a mentee-driven approach (let us explore the knowledge you need). If a long-term identity-building and cultivation of care role is expected and accepted by the mentors, then considering the identity, values and tacit knowledge of learners becomes essential.

4.3 The internal knowledge worker or administrator-peer perspective on mentoring

Analysing the diverse academic roles in an art university **we reached the conclusion that** the role of often unidentified groups of internal mentors (e.g., administrators, study department specialists, R&D project managers) with potential for impacting professional identity development across disciplinary communities (internal knowledge workers) is neglected. Administrative workers acting as mentors have the potential to take on the role of identity builders across communities, as they have an awareness of the organization, knowledge of the learning and teaching activities across departments, as well as additional (out of class) knowledge/training in mentorship activities. These qualities provide broader perspectives for mentorship. They can potentially be considered skilled facilitators between individual learners and different organizational collectives, performing many different functions as cultural intermediaries between different disciplinary communities of practice and potentially enabling access to professional fields outside academia.

Arts managers work between art, management and society, and therefore arts managers (including students, practitioners) are often expected to fall into this category due to the nature of their work. Even when working with explicit knowledge, we need to understand what is meant by the terms, data and information, and be able to judge and evaluate it; mentoring can open up and enhance the building of these competences.

5. Conclusion

As we set out to look for ways to transform mentoring from an 'add-on' activity to an integrated model as part of university curriculum development, we underline first and foremost that mentorship needs to be present in a diversity of ways and practices throughout the learning and teaching journeys in academia. Moreover, connecting students to the variety of communities in and around an arts university could prove to be the common ground between core educators and entrepreneurial educators, even if their perspective may be different.

The above discussion of mentoring in an art university and analysis of mentoring through various positions or roles within academia, indicates that mentoring can occur through learning activities, yet the context of learning, namely the distinction between core disciplines and others (e.g. entrepreneurship), plays an important role in understanding what career or community students belong to and are being prepared for. In addition, the power position between student and mentor might influence the mentoring activity and the sharing of knowledge, especially what is perceived as relevant knowledge and necessary competences.

It is also important to recognise the experiences of mentorship (or being mentored) to create a holistic understanding and awareness of mentorship. The recognition of these activities would empower individuals and enable them to seek mentorship support as needed. These activities could also work across communities and disciplines.

Based on the findings that highlight the importance of sharing through language, we also encourage the use of storytelling as a tool for mentoring. Sharing experiences and doing things together are ways to share and co-create tacit knowledge and should be recognized as part of the mentoring process in informal contexts but also when the mentoring processes is formalised.

To summarize, we analysed mentoring in a university context using communities of practice as a framework. The mentor roles were adapted from previous literature on mediating. It is important to notice that these roles might relate to individual, collective and organizational structures. Hence, mentoring needs organizational structures and practices that enable knowledge sharing in the mentor-mentee relationship informally through events (e.g., openings, premieres, showcases), as well as formally through customized programmes, but also through creating an organizational culture that supports knowledge sharing and creation, and sees knowledge as a base for power positions in organizational hierarchies. We highlight that mentor roles can be integrated into several organizational positions within academia and discuss each to identify the relevant positive and negative elements.

Through this analysis of mentoring in an art university, we conclude by arguing that it is not enough to perceive mentoring through formal mentoring programmes, but to also acknowledge the informal and often unexpected mentoring occurring in peer-to-peer relationships, as well as in the context of learning both in the core educational programme and additional courses and activities.

5.1 Implications for further research

In this paper we explored in detail the different mentor roles of different actors in an arts university: peer-to-peer, mentor-to-mentee and so on. We discussed some of the key examples and situations these are applied and the implications they have for the university as an organization and the individuals therein. We suggest that looking at how one and the same actor can take on various mentorship roles simultaneously (in the same environment) would be an interesting avenue for further research. Similarly, research is needed to further elaborate how learners can be at different stages of Kolb's experiential learning cycle at the same time, and how they can navigate between different roles in the same mentorship situation.

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