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**Edited by
Professor Alexeis Garcia-Perez
Professor Lyndon Simkin**

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Proceedings of the

**21st European Conference on
Knowledge Management
ECKM 2020**

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2–4 December 2020

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Contents

Paper Title	Author(s)	Page No
Preface		viii
Committee		ix
Biographies		xi
Research papers		
The Impact of Intellectual Capital in Information Centers on the Sustainable Development Goals	Mohamed A. Abdulla	1
University- Industry Collaboration: A Case Study of a Research Programme	Jorge Afonso and Fernando Romero	8
Knowledge Café: New Approach to Teaching and Learning in Higher Learning Institutions	Noryana Binti Ahmad Khusaini, Mohd Shamsul Bin Daud, Seri Intan Idayu Binti Shahrul Asari and Nordibradini Binti Selamat	17
Organizational Knowledge as an Element of the Innovation Climate in the TOP 500 Polish Enterprises	Anna Albrychiewicz-Słocińska	28
The Mediating role of Knowledge-Oriented Leadership Between Bureaucratic Culture and Knowledge Creation: The case of Public Universities in Northern Iraq	Shwana Hassan Ali and Mustafa Sagsan	37
Organizational Factors Affecting Knowledge Sharing Capabilities: A Study with Portuguese Health Professionals	Maria Helena Almeida, Alejandro Ramos, Maria José Sousa, Carina Martinho Santos and Ana Paula Fontes	46
A Framework for Enhancing the Sharing of Teaching Practices among University Instructors	Nouf Almujally and Mike Joy	55
Knowledge Management Approaches for Smart Services for Designing Adaptable and Personalised Video Games	Albena Antonova, Boyan Bontchev and Elissaveta Gourova	65
The Cultural Complexity of Knowledge Sharing in Multicultural Teams	Joana A.O. Ayesu and Dolores S. Bengoa	73
The Visegrad Group and the Industry 4.0	Andrea Bencsik, Kitti Lekszikov, Gabriella Michalec and Boglárka Konka	81
New Collaboration is Knowledge-Based: What, Why and How	Marco Bettoni and Eddie Obeng	89
Collaboration for Innovation in Small KIBS Companies: Implications for Knowledge Management	Ettore Bolisani, Enrico Scarso, and Luca Giuman	99
A Maturity Model for Storytelling Development in Knowledge Organizations	Johel Brown-Grant	107
Knowledge Management in Peace-Building Scenarios in Colombia: The Special Jurisdiction for Peace	Vanessa Cano Mejía, Juan David Arias Suárez and Diana Gómez Santamaría	114

Paper Title	Author(s)	Page No
Knowledge Translation in Challenging Healthcare Environments: The PIOppo Experience at the National Centre of Oncological Hadrontherapy (CNAO Foundation)	Lorenzo Cobianchi, Francesca Dal Mas, Amelia Barcellini, Viviana Vitolo, Angelica Facchetti, Andrea Peloso, Maurizio Massaro, Alessandro Vanoli, Silvia Brugnattelli, Mario Ciocca and Francesca Valvo	124
Removing Barriers to Share Knowledge in Digital Transformation with LEGO® Serious Play®	Sharon Cox and Deborah Evans	133
Challenges of Digital Knowledge Sharing in the Cultural and Creative Industries	Lukáš Danko and Zuzana Crhová	141
Implementing UN Sustainability Development Goals Through Engagement within University Communities of Practice	Kevin Delaney and Conor Horan	149
Information Management (IM) and Big Data	Souâd Demigha	157
A Review and Content Analysis of the Quality of Knowledge Sharing Mobile Applications	Wafeequa Dinath	164
Information and Knowledge Management Publication Trends in Preparing Society for the 4IR	Wafeequa Dinath	171
The Importance of Using Knowledge Transfer Practices within a Small Family-Run Business	Wafeequa Dinath	179
Development of Intellectual Leverage Concept as a way to Assess Effectiveness of Investments in Human Resources	Nikolay Dmitriev, Andrey Zaytsev and Natalya Goncharova	186
Creating a Knowledge Strategy for The Virtual Sphere: A Conceptual Framework for Knowledge Societies	Ayhan Dolunay and Mustafa Sağsan	195
How Clients and Consultants use Dialogic Practices in Knowledge Creation	Wendy Dubbeld and Rob Blomme	204
Are the Knowledge Management Times “A-Changin’”?	John S. Edwards	212
Incentives as a Trigger for Consumer Knowledge Sharing with Enterprises and Public Sector Organizations	Monika Eisenhardt	222
Public Private Collaboration and the Role of Learning in Developing Zero-Emission Neighbourhoods	Anandasivakumar Ekambaram, Ann Kristin Kvellheim and Luitzen De Boer	233
Major Categories of Best Practices and Lessons Learned in Building Renovation	Anandasivakumar Ekambaram and Andreas Økland	242
Artificial Intelligence based Knowledge Management in Public Administration: A Mapping Study	Hayat El Asri and Laila Benhlima	250
Relational Capital: Knowledge Assets and Branding	G. Scott Erickson, Julia Schmidt and Helen N. Rothberg	263



Paper Title	Author(s)	Page No
Organizational Culture as Support for Knowledge Sharing in Polish Companies Focused on Managing Employees from Different Generations	Joanna Gajda	270
Determinants for Crafting a Winning Organisational Strategy for the South African Manufacturing Sector: Perspectives from Shop Floor Employees	Vangeli Wiseman Gamede and Thea van der Westhuizen	277
Capturing Tacit Knowledge in Evaluation of Development Projects	Tadeusz A. Grzeszczyk	284
Sources of Information for SMEs Innovation Performance in Selected CEE Countries	Solomon Gyamfi and Jan Stejskal	292
The Importance of Tacit and Explicit Knowledge Transfer in an Onboarding Programme	Hanne Haave, Tone Vold and Aristidis Kaloudis	300
Creating Knowledge Management Policy in Human Resources Management based on Job Satisfaction	Nabard Othman Hama and Mustafa Sağsan	308
Collaborative Knowledge Building: The Case of IAKM as a Scientific Community of Practice (CoP)	Meliha Handzic, Constantin Bratianu and Ettore Bolisani	318
Seniors in eHealth: Challenges for Knowledge Acquisition During Information Retrieval	Ilona Heldal, Ingebjørg Børsheim, Eva Haukeland Fredriksen and Tobba Therkildsen Sudmann	327
Reframing Hospital Practices:HR Use of Big Data to Facilitate Knowledge Creation	Inge Hermanrud, Ole Andreas Haukåsen and Svein Bergum	335
Engaged Scholarship: How to Improve University Engagement within Academic-Industry Relationships	Conor Horan and Nkechinyem Omeife	344
Designing Innovation Strategy in the Context of Competitive Advantage in Telecommunication Industry	Goran Yousif Ismael and Mustafa Sağsan	352
Knowledge Management and Artificial Intelligence (AI)	Haddy Jallow, Suresh Renukappa and Subashini Suresh	363
Traveling Management Ideas like Virus Infections	Birgit Helene Jevnaker and Johan Olaisen	370
Working Smarter and Greener in the age of Digitalization: The Corporate Knowledge Work Design in the Future	Birgit Jevnaker and Johan Olaisen	378
Processing Imprecise Knowledge for Innovation Variants Evaluation Using Fuzzy TOPSIS	Magdalena Jurczyk-Bunkowska	386
Joint Activities of Employees and Their Relation with Knowledge Sharing in Large Polish Enterprises	Anna Karczewska	396
Knowledge Management Practices in Supply Chains: A Literature Survey	Tomas Cherkos Kassaneh, Ettore Bolisani, Enrico Scarso and Juan Gabriel Cegarra	405
A Conceptual Framework of Knowledge Sharing for Enhanced Performance in the HEIs	Nasrullah Khilji, Yanqing Duan and Jasmine Tehrani	414



Paper Title	Author(s)	Page No
Knowledge Management Processes and Organizational Change Towards Sustainability: A Case Study	Beate Klingenberg, Caroline Rider, Helen N. Rothberg and Ken Sloan	425
Developing Tacit Knowledge and Skills Through a Game-Based Learning Approach in Online Distance Learning Environments	Eric Kong	435
The Power of Mistakes - Constant Learning Culture and Hierarchy	Wioleta Kucharska and Denise A.D. Bedford	441
The Web 2.0 Revolution and Knowledge Sharing in Formal Organizations in Poland	Katarzyna Kukowska and Sebastian Skolik	447
Tertiary Students' use of Social Media for Networking, Personal Branding and Job Seeking	Pheladi Tracy Lefika	456
The use of Social Media by Community Police Forums as a Platform to Generate Crime Awareness	Pheladi Tracy Lefika	464
Organizational Unlearning and Digital Transformation: A Conceptual Approach	Regina Lenart-Gansiniec	469
A Meta-Analysis Study on the Relationship Between Strategic KM and firm Performance	Gang Liu, Eric Tsui and Aino Kianto	477
Internationalization of Contact-Center Services: A Look to Colombian Organizations	Campo Elías López-Rodríguez, Fernando Augusto Poveda-Aguja, Dania Vanessa Beltrán-Bejarano and Luisa Fernanda Cárdenas-Calderón	484
Challenges Facing Knowledge Management in Public Organizations in Arab Countries	Aya Maher, Heba Samir and Nashwa Ghoneim	494
A Knowledge Management Lens to Talent Management: Towards a Framework	Kais Mejri and Mohamed Doghan	503
Conflict Management Styles and Knowledge Management Cycle Categories: Theoretical Analysis with Application in Portugal	Pedro Soares de Mello and Eduardo Tomé	510
Poly-scale Evaluation of the Knowledge-based Economy	Andrey S. Mikhaylov and Anna A. Mikhaylova	520
Knowledge Management Process Through E-Learning Approach	Ekaterina P. Mochalina, Galina V. Ivankova, Oleg V. Tatarnikov and Sergei A. Smirnov	528
Using Online-learning in Audit Education: Impact on Student Satisfaction and Knowledge Sharing Processes During the Outbreak of COVID-19	Hoang To Loan Nguyen	538
Delivering Business Value through Actionable Insights: A Case Study	Habsah Nordin, Chung Yin Min ² and Mohd Muizzuddin Wahab	547
Deep Learning and Tacit Knowledge Transfer: An Exploratory Study	Funmi Obembe and Demola Obembe	556
Industry 4.0: Are we Robots?	Nóra Obermayer, Tibor Csizmadia, Dávid Máté Hargitai and Tamás Kigyós	566

Paper Title	Author(s)	Page No
Making Knowledge Management More Relevant and Creative: A Comparative Study of ECKM papers	Johan Olaisen and Birgit Helene Jevnaker	576
Bidirectional Fragment to Fragment Links in Wikipedia	Szymon Olewniczak, Tomasz Boiński and Julian Szymański	585
University Interactions: Forms, Peculiarities and Tensions	Nkechinyem Omeife and Conor Horan	595
Intellectual Capital: A Third Party's Point of View	Dan Ophir	603
The role of Marketers' Knowledge and Motivation in the Generation of Positive Customer Experience	Carmela Peñalba-Aguirrezabalaga, Josune Sáenz, Paavo Ritala and Mika Vanhala	612
The use of Blockchain-supported Reward Systems for Knowledge Transfer between Generations	Alexander Pfeiffer, Stephen Bezzina, Thomas Wernbacher, Vince Vella, Alexiei Dingli and Alesja Serada	620
Innovating Sustainable Development: A Best Practice from Ecuador During COVID-19	Danilo Piaggese, Jorge Andres Wills, Helena Landazuri, Carol Zambrano and Bo Jia	630
Knowledge Sharing: A Link Between Organizational Wisdom and Organizational Spirituality	Paulo Pinheiro and Raysa Rocha	639
"The Man Who Wasn't There" A Systematic Literature Review on Human Behaviour Profiling	Elizabeth Real de Oliveira, Pedro Rodrigues and Ana Saraiva	648
Building a Knowledge-Based Competitive Advantage in Service Firms: Role of High-Performance Work Systems	Junaid Rehman, Igor Hawryszkiewicz, Osama Sohaib and Fatuma Namisango	658
A Knowledge Management System for Evaluating the Potential of a New Product	Marcin Relich	668
Shaping Successful Stakeholder Engagement by Design: Digital Transformation in Healthcare	Daniela Robu and John B. Lazar	677
Spirituality and Knowledge Sharing: A Case Study	Raysa Rocha and Mario Franco	687
Knowledge Management in Sustainable and Smart Tourism: A Review of Empirical Research	Paula Rodrigues, Elizabeth Real de Oliveira, Pedro Rodrigues and Miguel Guerreiro	694
Spiritual Knowledge at Work: Linkages Between Managers' Spiritual Intelligence and Workplace Perspective	Joanna Samul	702
External Knowledge and Technology Acquisition and Firm Innovation Performance in CEE Countries	Yee Yee Sein and Michael Vavra	712
Awareness of Digital Literacy on Young Innovators in the Fourth Industrial Revolution	Khumalo Sithembiso	719
Determining key Features of Business Intelligence Tools for Decision-making in Small and Medium Enterprises	Khumalo Sithembiso and Tanya du Plessis	729
The Largest Polish Companies and the Transfer of Knowledge in Cyberspace	Sebastian Skolik	738

Paper Title	Author(s)	Page No
Revisiting the Knowledge Management Audit: Learning from Practice in a High-Performance Sport Organisation	Divyata Sohal, Gillian Ragsdell, Donald Hislop and Peter Brown	747
Comparative Analysis of the Formation of Intellectual Capital at the University	Inese Spica, Baiba Berzina and Ernests Spics	756
Digitalization and Knowledge Management in Large Norwegian Banks and Insurance Companies	Fred Strønen	765
Knowledge Creation and Sharing in the Inter-organizational Oncology Network in Poland	Aleksandra Sus	772
HR Professionals' Knowledge of Firms' Quality Requirements: An Exploratory Study	Maciej Szafranski and G. Scott Erickson	779
Codifying Knowledge about Ethics into ICT Professional Bodies of Knowledge (BoKs): An Analysis of Approaches	Clare Thornley, Wanda Saabeel, Shane McLoughlin and Sinéad Murnane	788
Knowledge Management, Agile Businesses and Foreign Languages: A Theoretical Analysis Illustrated with the Cases of Russia and Portugal	Eduardo Tomé and Elizaveta Gromova	798
Vulnerability of Intellectual Capital in the Age of Artificial Intelligence and Disruptive Technologies	Lina Užienė	807
Supporting Vision Competence Creation for Sustainable Education in Tanzania	Vibeke Vågenes, Kari Ludvigsen, Ilona Heldal and Carsten Helgesen	816
Innovation Cooperation as a Crucial Source of Firms' External Knowledge	Michael Vávra, Yee Yee Sein and Gregor Vohralík	824
Relationship Between Traditional and Innovation Economies: Russian Case	Maxim Vlasov	832
Understanding Generational Differences in Knowledge Sharing	Gunilla Widén, Farhan Ahmad, Tom Siven and Evgenia Ivantsova	841
Knowledge Capture to Monitor the Alignment of Hospital Processes and Applied Information Technologies	Janusz Wielki, Magdalena Jurczyk-Bunkowska and Dariusz Madera	850
Embedding Social Capital into the Value of the Firm	David J. Williams	859
Transformational Leadership Revisited: Digitalization and Learning by Doing... What?	Stig Ytterstad, Johan Olaisen and Birgit Jevnaker	868
Effectiveness of Knowledge Management in the Healthcare Sector	Maryam Mohamed Zainal and Allam Hamdan	874
Three-Dimensional Encoding of Emerging Meanings in AI-Systems	Igor Zatsman	878
How can Systems Thinking Help Us Handling the COVID-19 Crisis?	Krzysztof Zięba	888
Regional Observatory of Technology – Theoretical Framings and Practical Implementation: Case Study	Sławomir Olko	895

Paper Title	Author(s)	Page No
Phd Research Papers		905
Leveraging on Tacit Knowledge: Which way for African Small and Medium Enterprises?	Aderonke Olaitan Adesina and Dennis N. Ocholla	907
Enhancing the e-Visibility Status of Environmental Science Researchers at the University of South Africa	Leslie S Adriaanse and Chris Rensleigh	915
Implementation of the Custom-Made Knowledge Management System at the South African Council for Social Professionals	Tshepo Chauke and Mpho Ngoepe	924
Learning from Negative Experience to Evade Knowledge Loss	Natalia Khazieva and Dagmar Caganova	934
Creativity, Knowledge and Human Resource Development: A Conceptual Framework	Anastasia Kulichyova, Sandra Moffet, Martin McCracken and Judith Woods	943
A Training Approach to Improving Knowledge Management in Organizations	Patricia Quiroz-Palma, M. Carmen Penadés and Ana-Gabriela Núñez	953
Masters Research Papers		965
The Challenges Affecting Effective Knowledge Management in FET Training Organisations	Gladys Ujunwa Okoye	967
Using Enterprise Social Platforms in the Innovation Process	Simone Zanni and Kathrin Kirchner	975
Non-Academic Paper		983
Domain Ontology Implementation in a Slovak Bank: A Case Study	Roman Ujbányai and Martin Podhajský	955
Work In Progress Papers		995
“Dictionnaire”: A Platform for Managing Medical and Quality Terminologies - A Case from Morocco	Lamiae Bentaleb, Ghita Essoudy Mourry, Saâd El Kabbaj and Mimoun Zouhdi	997
Integrating Open Innovation Process with the Double Diamond Design Thinking Model	Igor Hawryszkiewicz and Areej Alqahtani	1003
Appropriating Smartphone Applications and Wearables Data for Knowledge Management and Effective Health Management	Mampho Tsabalira and Rambe Patient	1007
A Framework for Knowledge Management System Adoption in Small to Medium Enterprises	Werner Richardt van Zyl, Sanchen Henning and John Andrew van der Poll	1013
Late Submission		1019
Exploring Use of Mobile Messaging Applications in the Vietnamese Construction industry	Irfan Ulhaq, Tayyab Maqsood, Malik Khalfan and Tiendung Le	1021

How can Systems Thinking Help Us Handling the COVID-19 Crisis?

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Abstract: Purpose: COVID-19 pandemic outbreak remains one of the most influential events in the global economy over the recent years. While being primarily public health-related, it has a tremendous impact on many other aspects, such as public transport, education, and business management. Many businesses were forced to introduce rapid changes to their business models in order to survive. The aim of this paper is to show the complexity and inter-relations of changes triggered by COVID-19 outbreak. Understanding of this complexity is crucial for developing business resilience to similar events in the future. Methodology: The paper uses Systems Thinking approach to analyse influence of COVID-19 pandemic on business operations. Causal loop diagrams are used to show the complicated mechanisms behind the impact of pandemic on several aspects of business operation and management. Findings: Causal loop diagrams indicate that complicated relations between various elements may produce surprising and unexpected outcomes. The existing delays may result in actions bringing counterintuitive results. Perceptions of some variables play more important roles than actual variables and it often requires more than one actor to solve a particular problem – hence the need for organisational, as well as social learning. Adaptive business management may prove to be a particular challenge for small business owners. Research limitations: The paper is mostly of a conceptual nature. Causal loop diagrams require extensive data in order to be transformed into full Systems Thinking models. Hence this paper may serve as a basis for further development. Practical implications: The paper provides useful insights into the complex nature of contemporary business operation and management in the wake of a major epidemiological crisis. It may contribute to a better understanding of important factors that often tend to be disregarded and not paid enough attention to by business owners/managers. Originality/value: The paper links one of the major current challenges for the global economy with Systems Thinking, which offers a holistic perspective on business operation and management with emphasis on linkages and interactions between numerous stakeholders involved. It offers food for thought not only for academics, but also to business owners/managers, aware of the complexity of contemporary world.

Keywords: COVID-19 crisis, Systems Thinking, continuous learning, adaptive business management, global knowledge economy

1. Introduction

The year 2020 marked its place in the contemporary history through the outbreak of the COVID-19 pandemic. Looking for an event of a similar character, one has to go back over one hundred years back to the pandemic of Spanish flu. But even referring to the Spanish flu pandemic does not cast a lot of light on the current developments with COVID-19, because the way the global economy works now is substantially different from the way it worked one century ago (Fernandes, 2020). The complexity of business relations crossing not only single borders of countries but spanning across continents, the speed of the COVID-19 spread, as well as the speed and availability of news (and fake news) on this topic (Ramnath, Kairaitis, & Malhotra, 2020), make this pandemic an unprecedented event.

The COVID-19 pandemic, even though at the beginning perceived mostly as a challenge for public health care systems, proved to be a multifaceted phenomenon (Donthu & Gustafsson, 2020). Currently it seems to have influenced and transformed several areas of our life (van Bavel et al., 2020), including public transportation and education systems. However, one of the most important changes triggered by the COVID-19 outbreak refers to the business sector. Along the development of the COVID-19 pandemic, governments started to introduce numerous regulations, limitations and restrictions intended to maintain the spread of the virus under control. As in the spring 2020 the situation in most countries started to deteriorate, the intensity of those government activities also increased reaching its peak during many lock-downs, administered in many European countries. That had a very significant and negative, sometimes even devastating impact on many businesses, especially those from the SMEs sector. In the spring and summer 2020 numerous “shield programmes” were launched to protect the business sector against the most severe economic consequences of the imposed restriction. The autumn 2020 brings further increase in the number of new active cases of COVID-19 and the hope that pandemic can be already over disappeared. The COVID pandemic seems to become a long-term issue and the COVID-19 crisis in most countries will not be a matter of weeks or months, but rather quarters or even years.

Therefore, taking the above into account, the following research question can be formulated: How businesses response to the prolonged exposure to the COVID-19 crisis? What kind of actions are they prone to undertake and what are the drivers of those actions?

This paper will aim at answering this question by the application of systems thinking theory and the usage of Vensim PLE tool. The paper develops as follow. First, the brief characteristics of the COVID-19 crisis is presented. Second, the systems thinking approach is discussed and its applicability to the COVID-19 crisis analysis is justified. Then, the proposed model of business response to the COVID-19 crisis is presented and explained. Finally, in the conclusion section the paper is summarized, theoretical and practical contributions are presented, paper limitations are listed, and avenues for the future research are indicated.

2. COVID-19 crisis

A new coronavirus SARS-COV-2 appeared in Wuhan, China in December 2019. It started an epidemic of a respiratory syndrome of COVID-19 that has spread from China reaching 114 countries in three months, hence causing a global pandemic as declared by the World Health Organisation (van Bavel et al., 2020). The seriousness of the COVID-19 crisis is also reflected by the rapidly growing body of literature dedicated to this topic; it is estimated that since January 2020 during two quarters the number of papers on the COVID-19 doubled every twenty days (Ramnath et al., 2020).

The economic impact the COVID-19 crisis is so far very significant, and since the crisis is not over yet, the ultimate effects remain unknown and business forecasts remain highly ambiguous (Baker, Bloom, Davis, & Terry, 2020). The lock-downs introduced in the spring 2020 already decreased consumption and had dramatic effects in some sectors, especially small scale services. Supply chains that span globally were disrupted introducing chaos in business operations in virtually all countries. Consumption pattern were changed rapidly, creating numerous shortages of many goods while at the same time leaving markets with substantial surpluses of other goods. Volatility in global financial markets rose to the levels recorded during the last financial crisis of 2008 (Fernandes, 2020). This volatility suggests that apart from clearly adverse influence of the COVID-19 crisis on the global economy, this crisis causes also a lot of uncertainty. Similar conclusions come from analysing newspaper feeds and business expectation surveys (Baker et al., 2020). Nevertheless, the progression of the pandemic can be modelled and for example SIR models are used for this purpose by public health experts. They may also serve economists as a source knowledge on trade-offs between the public health and economic consequences of COVID-19-related restrictions and social distancing measures (Atkeson, 2020).

As the COVID-19 crisis unfolds and uncertainty about the around it grows, the role of mass media and – even more importantly – social media remains very important. Yet, the danger of misinformation phenomena during the pandemic is as serious as never before, leading to coining the new term of “infodemic” (Cinelli et al., 2020). Infodemic can speed up the epidemic process by shaping and fragmenting social response to the COVID-19 pandemic. Research show that social media are particularly prone to spread false information on this topic (Pennycook, McPhetres, Zhang, & Rand, 2020).

To sum up, even though at the time of writing this paper the COVID-19 crisis lasts already for more than half a year, the developments are still very fresh and quite often, unverified. The number of new papers on the COVID-19 pandemic does not correlate with their overall quality. It could be said that the state of the art is being created on our eyes and we have only limited options at hand. The scientists need to use their experience, intuition and the common sense in the analysis of the situation and in the proposal of certain solutions related to the COVID-19 crisis.

3. Systems thinking

Systems Thinking is a term having a few meanings. It can be treated as a perspective, a language or as a set of tools, which include causal loops used in the model presented in this paper. Systems Thinking is defined as opposite to linear thinking and offers holistic approach to the analysed phenomena. Its possible applications span across various fields and disciplines (Monat & Gannon, 2015).

Systems Thinking approach has already been used with application to public health problem before the COVID-19 crisis. It is mostly because improving public health requires deep understanding of system complexity that is behind public health problems, when it comes to both causing and solving them. It was in 2008 when Leischow

et al. claimed that collaboration across a wide array of disciplines and fields is necessary for preventing and containing pandemic influenza, pointing out that each separate activity to address this disease is necessary but insufficient in itself (Leischow et al., 2008). All the observations made in this paper are fully applicable to the COVID-19 crisis. Particularly valuable in the current situation, the fundamental systems-thinking perspectives and approaches include: attention to how new knowledge is gained, managed, exchanged, interpreted, integrated, and disseminated, a network-centric approach based on building relations among and between individuals and organizations, the development of models and projections, using a variety of analytic approaches (Leischow et al., 2008).

Among a number of papers dedicated to the COVID-19 crisis, System Thinking approach is rarely used. This kind of perspective was presented in the case of healthcare mask production in Korea (Lee, Chen, McDonald, & O'Neill, 2020). A more comprehensive attempt to employ Systems Thinking can be found in the paper on drive-through testing sites (Araz, Ramirez-Nafarrate, Jehn, & Wilson, 2020), where a conceptual framework for addressing disease dynamics and logistics of mass distribution was provided. A causal loop diagram showing societal response to the COVID-19 threat serves as an example that Systems Thinking approach may bridge public health issues with social relations, perceptions, attitudes and actions undertaken on their basis (Bradley, Mansouri, Kee, & Garcia, 2020). A very general and hence hardly useful view on the use of Systems Thinking in the current situation was presented by Hassan et al. (Hassan et al., 2020). Probably the most inclusive effort to capture the complexity of the COVID-19 crisis was made by Sahin et al. (2020). Their causal loop diagram includes four areas: economy, environment, health and society. They are inter-related and all linked to the fifth element, which is government activities performed due to the COVID-19 outburst.

Unfortunately, there are no scientific papers using Systems Thinking approach to explain in a more detailed way business behaviour during the COVID-19 crisis. The above mentioned attempts to use this methodology in other fields suggest that the characteristics of the current situation makes System Thinking a very suitable framework for studying business management in these turbulent times. The current situation is multifactorial, dynamic and nonlinear, hence compartmental knowledge originating from scientific silos is likely to obstruct understanding of the inter-relations among all the significant variables (Leischow et al., 2008). Therefore, the Systems Thinking approach can be considered as the one offering adequate tools for analysing business operations and management in the wake of the COVID-19 spread.

4. Business response to the COVID-19 crisis

The current COVID-19 crisis affected many aspects of everyday life, bringing significant changes. Businesses around the world had to respond to those changes. The actions they had to undertake can be divided into two categories. The first one ("Business Actions Aimed at Compliance") comprises of actions that were forced by regulations, restrictions and limitations imposed by the authorities. In most cases their direct impact on business performance was harmful, yet those actions were carried out either entirely voluntarily or in the fear of legal sanctions and reputation risk (pressure from various stakeholders to comply). The other category ("Business Actions Aimed at Survival & Development") include all the actions that were undertaken to protect the business from the adverse impact of the COVID-19 pandemic. Some of them were intended to achieve or continue firm growth in spite of the unfavourable external conditions, while others were meant to save the business from discontinuance or bankruptcy. Naturally, some of the actions from this category may be contradictory with compliance actions or can be even illegal (e.g. breaking quarantine or concealing the fact of being infected). The intensity of both types of actions mentioned above depends heavily on the question of how serious in the perception of business owners, managers and employees, the COVID-19 crisis and its impact on businesses are. Perceptions may play a more important role than their real analogues (van Bavel et al., 2020). That is why "Perceived Seriousness of COVID-19 Crisis" is the central part of the proposed model of business response to the COVID-19 crisis – see Figure 1.

The general concept of this model is that the real danger resulting from the pandemic is filtered by three different channels, through which the knowledge is passed to business owners, managers and employees building their awareness about the current situation. On the basis of this awareness, business activities are planned and carried out and that refers to the both above-mentioned categories of actions. Those actions, in turn, have their – positive and negative – consequences for the development of pandemic situation in the country, hence closing feedback loops.



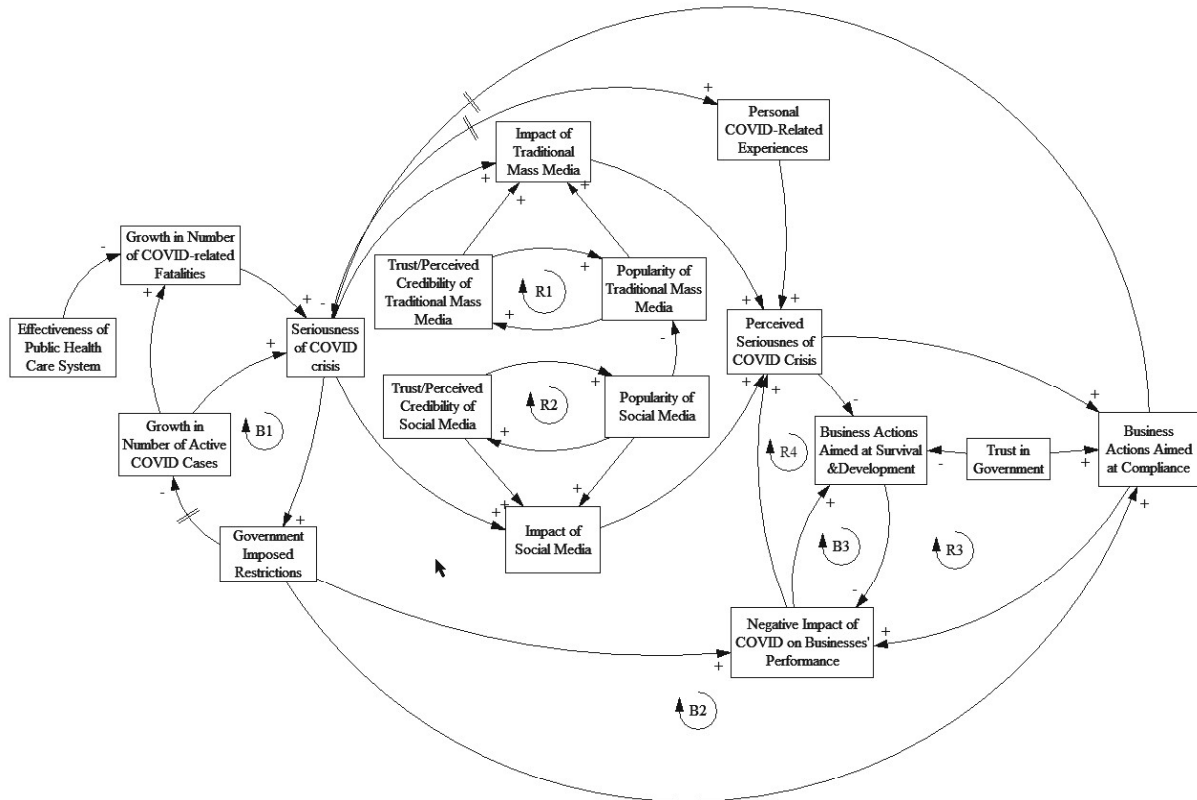


Figure 1: Business response to the COVID-19 crisis – causal loop diagram. (own elaboration using Vensim PLE)

The perception of the seriousness the COVID-19 crisis is based on how serious it really is. Two important elements illustrating the spread of the virus, which are understandable to the general public, are the number of newly detected infections and the number of fatalities. Both numbers are published and widely discussed over the media – traditional mass media and social media as well. In this way, the media serve as a kind of relay, transmitting the description of the reality to their recipients. Furthermore, the real impact of COVID-19 is filtered by personal experiences regarding severity of the pandemic: personal knowledge of people infected (how many and how seriously impacted), own experiences of infection or those related to the closest family members). In addition to that, the perceived seriousness of the COVID-19 crisis is to a high extent influenced by the negative impact of COVID-19 on business conduct and performance; this can be called the professional experience of the pandemic.

The scale and seriousness of the COVID-19 crisis can be influenced by the government (in the broad sense of this term, including the central government as well as regional and local governments and other public institutions) in two ways. Firstly, the number of newly infected people (cases) can be to some extent controlled via restrictions and regulations imposed by the government (obligatory face masks, limitations regarding attendance in public places, restrictions applied to bars, restaurants, banned mass events, etc.). This number of new cases is obviously related to the number of fatalities, but additionally, a rapid accumulation of active cases can result in exceeding the capacity of the health care system and increased number of deaths, hence the effectiveness of public health care system is vital when it comes to restraining the number of fatalities. Appropriate preparations, proper organization and management of hospitals should be the priorities for the government (McKibbin & Fernando, 2020).

The government imposed restrictions are generally triggered by seriousness of the COVID-19 crisis – governments respond to the growing number of active cases and COVID-19-related deaths by issuing regulations aimed at getting pandemic under control, including even full lock-down, when necessary. This is shown in the model by the balancing loop B1. It should be noted here that there is a significant delay between introducing restrictions and their visible consequences, expressed in the decrease in the growth of active COVID-19 cases. On the other hand, all those restrictions have immediate and negative impact on businesses and their performance. The delayed influence on the number of active COVID-19 cases combined with the immediate negative impact on businesses may result in undermining trust in government. People in business sector may

challenge the imposed regulations, when they see they are costly to their business and yet they do not improve the pandemic situation in any visible way. The level of trust to the government will influence the efforts made both to comply with restrictions (the greater trust, the greater efforts) and to survive and develop businesses (the smaller trust, the greater efforts).

The government imposed restrictions force businesses to perform actions aimed at compliance with these restrictions. The scale of those actions will be dependent not only on the scale of restrictions, but it will also reflect the level of trust in the government (i.e. the belief that restrictions are necessary, adequate to the current situation and effective). Another important determinant of those actions is the perceived seriousness of the COVID-19 crisis – if business owners, managers and employees perceive situation as serious, they are more engaged in compliance-oriented activities. If the actions aimed at compliance (such as wearing masks, maintaining social distancing, adhering to other rules and norms) are popular in the business sector, they contribute to lowering the level of seriousness of the COVID-19 crisis (Atkeson, 2020), therefore closing the balancing loop B2.

The perception of how serious is the COVID-19 crisis is, as mentioned before, built partly on the basis of information revealed by the media, both traditional and social. The impact of the media is dependent of their popularity and their perceived credibility, between which there are the reinforcing loops R1 and R2. The more popular is the medium, the more tight is the information bubble created by this medium and hence its perceived credibility grows (Kaakinen, Sirola, Savolainen, & Oksanen, 2020). The more credible is the medium in the perception of the user, the more often it is used. Technological changes, including growing availability of stable Internet connection, continuously improved algorithms of content selection and general social trends make social media more and more popular, which reduces the popularity of traditional mass media (Pentina & Tarafdar, 2014; Spohr, 2017). Therefore, it seems that social media are likely to play the leading role in formulating opinions on the COVID-19 crisis, which brings well-known concerns about the accuracy, reliability and truthfulness of information they present (Cinelli et al., 2020; Pennycook et al., 2020). If the share of fake news presented in social media grows, then the perception of the COVID-19 crisis may be to a great extent based of the false picture created by those media.

If the business sector perceives the COVID-19 crisis as a serious threat, then the tendency to undertake actions that are aimed at compliance with the imposed restrictions and rules is stronger, as the need to protect business partners, employees and customers is more evident. Most of such actions have adverse impact on businesses, as they usually result in increasing the costs of business operations which is additionally accompanied by a decrease in revenues. Hence, the greater adherence to the restrictions and rules imposed for protecting the society against COVID-19 infections, the more perceptible is the negative influence of this crisis on business sector. This, in turn, leads to the increased level of the perceived seriousness of the COVID-19 crisis and in this way the reinforcing loop R3 is closed.

However, if the perceived seriousness of the COVID-19 crisis is low, then naturally businesses would rather focus on the actions that are aimed at their survival and development, reducing their efforts to comply with the restrictions to the necessary minimum that is forced by e.g. legal sanctions. In this case the negative impact of the COVID-19 crisis is less perceptible for businesses and that leads to two different outcomes. Firstly, the less severe is the negative impact of the crisis, the less incentives appear to try and save the business, as it does not seem to be endangered that much. That is the mechanism grasped by the balancing loop B3. Secondly, the less severe is the negative impact of the crisis, the less seriously it is perceived by businesses, closing the reinforcing loop R4, leading to even greater disproportion between the efforts to successfully run businesses in spite of the COVID-19 crisis and the efforts to comply with the policies adopted to protect the society against the pandemic.

5. Conclusions

As can be seen from the proposed model, the response of the business sector to the current COVID-19 crisis and its development may be channelled into two streams of actions, aimed at either compliance (with the primary view on protecting own staff as well as other members of the society) or business survival and development (with the primary view on business performance). To what extent businesses would engage in each of those actions depends to a great extent on their perception of how serious is the threat of the COVID-19 crisis. This perception is formed by media and by experiencing the reality by personal and business experiences. Additionally, the question of how adequately the government reacts to the crisis and its perception of the



business sector remains an important factor. From the proposed model it is clear that there are many actors involved in shaping the business response to one of the most challenging events in our recent history.

With regard to the academic contribution, it should be noted that using systems thinking approach to analyse the consequences of the COVID-19 outbreak is relatively novel and not extensively used. The characteristics of systems thinking makes this methodology particularly useful when applied to complex relations, interdependencies, positive and negative feedback loops and delays.

From the practical point of view, this paper may be helpful in achieving better understanding of how businesses may react to some changes initiated by other businesses, government institutions or media. It emphasises the fact that the perceptions of some phenomena are a far more important determinant of actual actions than the real phenomena as such. For business owners and business managers this paper offers a reflection on how they may respond to what they know about the COVID-19 crisis in their country and how their knowledge on that is shaped.

The paper is not free from some limitations. First of all, it is a conceptual work. Making a complete systems thinking model requires extensive data, which may be difficult to obtain. Furthermore, there are some more elements that can be potentially included in the model, such as factors capturing cultural differences; research suggest that cultural aspects are important in this context (van Bavel et al., 2020). Hofstede cultural dimensions, including individualism, could help explaining differences in attitudes towards the pandemic between countries. Finally, the proposed model is of a preliminary character and it can – and should – be developed to offer more in-depth insights into the business response to the COVID-19 crisis.

This paper offers several research avenues to follow. As mentioned above, a more detailed version of the proposed model can be created. When fed with the sufficient data, the model can contribute to a much deeper understanding of how business react to the pandemic and how their response can be changed to suit the current social and economic situation in a better way.

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