

Challenges in Economic Policy, Business and Management in the COVID-19 Era

edited by Anna Ujwary-Gil
& Bianka Godlewska-Dzioboń



Challenges in Economic Policy, Business and Management in the COVID-19 Era

Edited by

**Anna Ujwary-Gil
Bianka Godlewska Dzioboń**



**Institute of Economics
Polish Academy of Sciences**



FUNDACJA

Cognicione

Reviewers

Barbara Błaszczuk, Justyna Bugaj, Anna Fornalczyk, Marta Gancarczyk,
Anna Maria Lis, Andrzej Lis, Mieczysław Morawski, Paweł Pisany,
Natalia R. Potoczek, Anna Ujwary-Gil

Proofreader

Paweł Japoł

Cover design

Joanna Długosz

Cover photo

Adobe Stock

© Copyright by Authors & Publishers. Warsaw 2021

These are the open access articles under the CC.BY license
(<https://creativecommons.org/licenses/by/4.0/legalcode>).

Publisher

Institute of Economics, Polish Academy of Sciences, Nowy Swiat 72, 00-33 Warsaw, Poland;
Websites: <http://inepan.pl>

Publishing partner

Cognitione Foundation for the Dissemination of Knowledge and Science; Bohaterów
Tobruku 5, 34-400 Nowy Targ, Poland; website: <http://fundacjacognitione.org/en>

ISBN: 978-83-61597-80-3 | eISBN: 978-83-959006-6-2

Printing, binding and typesetting

Wydawnictwo i Drukarnia Nova Sandec
ul. Lwowska 143, 33-300 Nowy Sącz, Poland, e-mail: biuro@novasandec.pl

CONTENTS

TABLES	5
FIGURES	6
FROM THE EDITORS	9

PART 1

COVID-19 – RESEARCH OVERVIEW

1. Solutions and research directions to the COVID-19 pandemic at the economy, industry and business levels: A literature review Anna Ujwary-Gil, Bianka Godlewska-Dzioboń	15
2. SCDS spreads and the level of public debt in Poland during the Covid-19 pandemic Maria Czech	41
3. The impact of the COVID-19 crisis on the Czech luxury fashion industry Radka MacGregor Pelikánová	61
4. Importance of knowledge management in COVID-19 pandemic: A case of small and medium-sized enterprises Tereza Horáková, Kateřina Maršíková	79

PART 2

INDUSTRY AND INTER-ORGANIZATIONAL COOPERATION

5. Photovoltaic cells industry in China: Industrial policy and revealed comparative advantage in the XXI century Bogusława Drelich-Skulska, Paweł Brusilo	111
6. The Chinese photovoltaic cells industry and the Belt and Road Initiative: The intra-industry perspective Paweł Brusilo	139
7. Selected conditions for the development of inter-organizational cooperation in innovative processes on the Polish capital market Joanna Kurowska-Pysz	165

PART 3

PRO-ENVIRONMENTAL, RESILIENT AND INNOVATIVE ORGANIZATIONS

8. Symptoms of pro-environmental culture in companies located in Poland Katarzyna Piwowar-Sulej	203
9. The concept of organizational resilience model and adequate measurement mechanism Bartosz Grucza, Piotr Tomszys	221
10. Measuring innovative management with Management Innovation Assessment Tool Magdalena Gorzelany-Dziadkowiec	245

TABLES

Table 1.1. Thematic areas of articles on COVID-19	18
Table 2.1. Public debt structure. Sectoral approach	43
Table 3.1. Case Study – Twenty Czech fashion businesses and their key parameters	67
Table 3.2. Information related to the COVID-19/coronavirus/face masks on Internet pages – January 2021	68
Table 3.3. Information related to the COVID-19/coronavirus/face masks on Internet pages – July 2021	69
Table 4.1. Potential knowledge sharing barriers	88
Table 4.2. Selected studies in the field of knowledge management and knowledge sharing in SMEs	90
Table 4.3. Respondents of the knowledge management in in-depth interviews	93
Table 4.4. Factors influencing the implementation of knowledge management in chosen SMEs	96
Table 4.5. Preparedness of SMEs to knowledge management implementation	97
Table 4.6. Aspects of knowledge sharing culture in selected SMEs	99
Table 5.1. New structural economics recommendations towards industrial policy instruments for individual categories of industries ..	117
Table 5.2. Total energy generation by source in China (2000–2019)	126
Table 5.3. Chinese PV trade flows and RCA index of the Chinese photovoltaic cells industry in 2000–2019	130
Table 6.1. Intra-industry trade index for photovoltaic cells in the context of the trade between the People’s Republic of China and the Belt and Road Initiative countries in 2019	152
Table 7.1. Held and key soft competences – science	177
Table 7.2. Held and key soft competences – business	178
Table 7.3. Held and key soft competences – the legislative and economic environment	179
Table 7.4. Key hard competences – science, business, and the legislative and economic environment	181
Table 7.5. Motivators of inter-sectoral cooperation – science, business, and the legislative and economic environment	182
Table 7.6. Barriers in the inter-sectoral cooperation – science, business, and the legislative and economic environment	184
Table 7.7. Assessment of the effectiveness of particular forms of inter-organizational cooperation – science	185

Table 7.8. Assessment of the effectiveness of particular forms of inter-organizational cooperation – business	186
Table 7.9. Assessment of the effectiveness of particular forms of inter-organizational cooperation – legislative and economic environment	187
Table 7.10. The most effective forms of inter-organizational cooperation	188
Table 8.1. Statements (items) related to cultural symptoms	209
Table 8.2. Characteristics of the research sample	210
Table 8.3. The values of Pearson correlation coefficient calculated for the items used in this study (results with $p < 0.05$)	212
Table 9.1. Hard and soft resilience	223
Table 9.2. Objectives and activities for different categories of resilience ...	227
Table 9.3. Map of the resilience model	228
Table 9.4. Black Swans and Gray Rhinos	233
Table 9.5. Organization Resilience Assessment Form	235
Table 9.6. Estimated level of organizational resilience	239
Table 10.1. Innovative management assessment questionnaire with random data	254

FIGURES

Figure 2.1. The structure of public debt during the COVID-19 pandemic	52
Figure 2.2. State Treasury debt and the level of SCDS spreads in the period before and during the COVID-19 pandemic	53
Figure 2.3. Level of SCDS spreads and indicators of the government response to the pandemic in Poland	54
Figure 5.1. Installed electricity generation capacity from PV cells in China 2000–2019 (in GW)	128
Figure 5.2. Chinese exports and imports of photovoltaics in 2000 – 2019 (in million USD)	129
Figure 5.3. Presentation of the Revealed Comparative Advantage index for the Chinese (HS) 854140 products in 2000 – 2019 with the polynomial trend line	131
Figure 6.1. Belt and Road Initiative member countries in 2019	143
Figure 6.2. Development of Chinese aggregated exports and imports of solar (PV) energy technology-based components 2000–2019 (in million USD)	149
Figure 6.3. Net exports of photovoltaic cells between China and the BRI countries in 2019	150
Figure 6.4. The value of intra-industry trade between China and BRI countries in 2019	153

Figure 7.1. Key soft and hard competences in innovation processes on the capital market	194
Figure 7.2. Effective forms of inter-sectoral cooperation in innovation processes on the capital market and correlations between them	195
Figure 8.1. The results obtained for 20 cultural symptoms in Poland (PL) and in the UK	211
Figure 9.1. Disruption life cycle on bathtub curve model	225
Figure 9.2. Phases and resilience categories	227
Figure 10.1. Innovative management – graphical representation of the assessment	255
Figure 10.2. Innovative management in Respekt Myślenice – graphical representation of the assessment	257
Figure 10.3. Innovative management in the investigated enterprises – graphical representation of the assessment	258
Figure 10.4. Innovative management in medium and large enterprises – graphical representation of the assessment	259

FROM THE EDITORS

The COVID-19 pandemic has made it necessary to redefine the most significant challenges faced by individual economies and society today. It contributed to the change of contemporary social, technological and economic trends, the effects of which will indeed be the subject of many scientific studies in the coming years. As the pandemic progresses, it promotes reflection and summaries of the consequences of behaviors or omissions in each country. One of them is a synthetic presentation of ten lessons from the pandemic (Gorynia, 2021), which the professor accurately diagnoses in the economic context: 1) the pandemic as a non-economic (sanitary-medical) shock that caused the economic, social and political crisis; 2) the pandemic as a “black swan”, an unpredictable threat of high species gravity, but requiring anticipation to minimize its harmful effects in the future; 3) determining the causes of the appearance of the virus determines different preventive actions for future threats; 4) resilience as the foundation of long-term economic efficiency; 5) the set of measures to counteract the harmful effects of a pandemic should not be unified but adapted to the specificity of the facilities it is to affect; 6) the world economy as a system of vessels connected with its positive and negative consequences; 7) the pandemic highlighted the role of coordination of international cooperation; the shortcomings of globalization must be overcome by fairly sharing the positive fruits of international cooperation and resilience aimed at diversifying supplies; 8) economic policy pursued by individual states with a view to preventing the effects of the economic crisis caused by a pandemic cannot be voluntary; 9) the pandemic has sharpened the perception of the shortcomings of contemporary economic, social and political systems and prompts the questioning of certain pillars of the market economy (e.g., homo oeconomicus, individual and global rationality, private and state property, canons of monetary, fiscal, budgetary or industrial policy); 10) the pandemic increases the pressure on systemic and holistic thinking taking into account green economic development, saving energy, water and other resources, using renewable energy sources, avoiding wastage of resources,

paying attention to social inequalities in the world, regions and countries, solving poverty problems, and social exclusion. This monograph is partially a response to the in-depth issues covered in these lessons. The authors of individual chapters challenge contemporary topics relating to the COVID-19 pandemic, industry and inter-organizational cooperation, pro-environmental, resilient, and innovative organizations. The monograph consists of three parts.

The first part (PART 1) covers an overview of very recent research, considering the impact of COVID-19 on the economy, industries, and business. The article by Anna Ujwara-Gil and Bianka Godlewska-Dzioboń deals with, among others, the issues relating to pandemic impacts on the slowdown in the functioning of the construction, electric automotive, and water industries. Also, it affects the tourist industry, where countries are starting to pay attention to the resource-saving green economy and problems of professional exclusion in the pandemic era. In another article, Maria Czech refers to the influence of public debt on the volatility of spreads during the COVID-19 pandemic. This research is part of the study on the use of sovereign credit default swap spreads to assess a country's credit risk, which may be distorted in a pandemic period. It is undisputed that the COVID-19 pandemic has a global dimension. The crisis resulting from disorders such as in value chains has caused industry to slow down. The Czech luxury fashion industry is no exception. As Radka MacGregor Pelikánová points out, COVID-19 has turned out to be a threat to its development.. Leading Czech luxury fashion companies withdrew to a passive role and felt the negative consequences of the pandemic. As the Author points out, few have engaged in corporate social responsibility and showed ingenuity, which increases their chances of survival in the future. In other studies, Tereza Horáková and Kateřina Maršíková identified factors influencing the environment of effective knowledge exchange in SMEs, which in the era of hybrid work during COVID-19, is particularly important.

The second part of the monograph (PART 2) includes two studies on the photovoltaic cell industry in China from the perspective of comparative and intra-industry advantage. As a significant player in the global trade scene and various value chains, China is a fascinating subject of research undertaken by Paweł Brusilo and Bogusława Drelich-Skulska. The results of the first article demonstrate the success of the Chinese industry in terms of growth potential, competitiveness, and development opportunities thanks to effective state support and favorable market forces. As the authors point out, the Chinese solar cell industry has not been studied so far in the context of comparative advantage and the new structural economy. The results show the way for other countries to consider or develop innovative industries, such as renewable energy and solar energy. In the second article, Paweł Brusilo examines the topic of the Belt and Road Initiative in the context of the Chinese photovoltaic

cell industry, energy transition policy, identification of modern intra-industry trade patterns and opportunities for this industry, which is characterized by significant state interventionism. The considerations in this article may inspire EU countries to deepen economic and trade cooperation in the export and import of solar cells with China. On the other hand, Joanna Kurowska-Pysz has undertaken the analysis of the cooperation conditions within the innovative processes of representatives of science, business, the legislative, and economic environment cooperating on the capital market. The Author focused on the motivators, barriers, but also the search for an effective form of development of intersectoral cooperation enabling the exchange of knowledge and experience, learning, including the flow of personnel between sectors, joint organization of conferences, seminars, training, and implementation of research projects constituting the basis of innovative processes, or the diagnosis of network relationships. The model proposed by the Author will surely inspire other researchers.

The third part of the monograph (PART 3) includes articles referring, *inter alia*, to the pro-environmental organizational culture of enterprises. Katarzyna Piwowar-Sulej, as an advocate of this valuable orientation today, has shown that organizations are interested in developing pro-ecological behavior and are aware of their impact on the natural environment. The article is in line with the global trend focused on the sustainable, ecological, and green economy enterprises operating in this trend, not only because of COVID-19. Taking action to develop a pro-ecological organizational culture, taking care of the natural environment is not only a moral and ethical requirement but also an obligation for the future generation. This part also includes an article by Piotr Tomszys and Bartosz Grucza, who present an inspiring model of organizational resilience and an attempt to operationalize it. The organizational resilience model proposed by the Authors is in line with the growing interest in the analyzes and measurement of the enterprises' resilience. The conceptualization and measurement of economic resilience can inspire other researchers to further research in this area. The COVID-19 pandemic, as an unpredictable and destructive shock, might be a unique opportunity to verify the developed model, as the authors point out. The last article deals with the issue of innovative management and its measurement based on a proprietary tool developed by Magdalena Gorzelany-Dziadkowiec. The considerations undertaken by the Author are a reliable starting point for further research concerning the impact of COVID-19 on the organization's functioning, the development of innovative management, changes in work processes, and interpersonal relations in the era of increasingly dominant digital technology and skills to use it.

The editors profoundly thank all the Authors for their valuable contribution to this monograph and cooperation in its co-creation. We address our grateful thanks to all the Reviewers for their insightful evaluation and high standards of their work. These special thanks go to (in alphabetical order) Barbara Błaszczuk Institute of Economics, Polish Academy of Sciences; Justyna Bugaj, Jagiellonian University; Anna Fornalczyk, COMPER Fornalczyk and Wspólnicy; Marta Gancarczyk, Jagiellonian University; Anna Maria Lis, Gdańsk University of Technology; Andrzej Lis, Nicolaus Copernicus University; Mieczysław Morawski, Warsaw University of Technology; Paweł Pisany, Institute of Economics, Polish Academy of Sciences; Natalia R. Potoczek, Institute of Economics, Polish Academy of Sciences. We also thank Paweł Japoł for his thorough proofreading of this monograph.

Anna Ujwary-Gil, Bianka Godlewska-Dzioboń

Reference

- Gorynia, M. (2021). Dziesięć lekcji z pandemii. *Rzeczpospolita* z dnia 27 października 2021. Retrieved from <https://www.rp.pl/opinie-ekonomiczne/art19051481-marian-gorynia-dziesiec-lekcji-z-pandemii>.

Part 1

COVID-19 – RESEARCH OVERVIEW

Solutions and research directions to the COVID-19 pandemic at the economy, industry and business levels: A literature review

Anna Ujwary-Gil¹, Bianka Godlewska-Dzioboń²

Abstract

This article responds to the contemporary challenges of COVID-19 that require a structured approach to the analysis of research areas undertaken by researchers around the world. It identifies solutions in response to the COVID-19 crisis at the level of the economy, industries and business, as well as the areas for further research in this field. The literature and narrative reviews were used to select sources and analyze. Using the “COVID-19” keyword included in the 1) Title, the Scopus database showed 142,521 results that iteratively narrowed down to 2) Title, Abstract, Keywords were searched within these results, taking into account the following keywords: “economy,” “industry,” “business,” 3) Subjects areas: Business, Management and Accounting; Social Sciences; Environmental Science; Economics, Econometrics and Finance; Energy; Agricultural and Biological Sciences; Engineering; Arts and Humanities; Earth and Planetary Sciences; Decision Sciences; Multidisciplinary – showing 144 results; then published 4) Articles, in the 5) Journal, in 6) English, 7) All Open Access – creating the result including 63 articles and finally limited to 43. The research review allowed for the division of articles into four main research areas in which the impact of COVID-19 was determined: economy and industry, value chains, tourism and hospitality, business, and management. As a consequence, the review of these studies, the directions of solutions, and the directions for further research were indicated. The research discussed in this article may contribute to identifying research gaps using a more rigorous research approach. For practitioners, provided a condensed overview of what was happening in the economy, industry, and business in the COVID-19 era. This is the interdisciplinary research review that addresses the economic, industry, and business impact

¹ Anna Ujwary-Gil, Ph.D., Hab., Professor of the Institute of Economics, Polish Academy of Sciences, Nowy Swiat 72, 30-330 Warsaw, Poland, e-mail: ujwary@inepan.waw.pl (ORCID: 0000-0002-5114-7366).

² Bianka Godlewska-Dzioboń, Ph.D., Assistant Professor, Cracow University of Economics, Rakowicka 27, 31-510 Kraków, Poland, e-mail: godlewsb@uek.krakow.pl (ORCID: 0000-0001-9668-458X).

This is an open access article under the CC BY license (<https://creativecommons.org/licenses/by/4.0/legalcode>).

of COVID-19, aimed at identifying solutions proposed by governments and enterprises during COVID-19 and future research directions.

Keywords: *COVID-19, economy, industry, business, management, value chains, tourism, hospitality, solutions, research directions.*

1. Introduction

The COVID-19 pandemic has triggered a formalized response from governments worldwide, which has affected society, the economy, and including changing the work model of many organizations. The primary focus of most countries during COVID-19 was healthcare or the economy. Governments that have identified healthcare as a key target have generally experienced fewer deaths and infections than governments that prioritize business and politics. COVID-19 has imposed a series of fiscal and monetary incentives to protect and sustainably transform the economy, business, and society. These transformations are overly complex and multidirectional because changes in the economy force changes in the behavior of society. In turn, changes in the behavior of stakeholders or consumer habits lead to changes in business in times of the global pandemic crisis. The pandemic caused previously unknown turbulence as the mutating virus *de facto* changed the paradigm not only in economy, industry, and business but also in the behavior and habits of society. This was reflected in publications on an unprecedented scale in almost every scientific discipline. How persistent and invasive the economic and social effects of this pandemic will be? – it is certainly too early to be unequivocally assessed. The pandemic continues, research is underway, the results of which we will gradually learn after their publication.

The article aims to show an interdisciplinary research review, including the identification of solutions in response to the COVID-19 crisis at the level of the economy, industries and business, as well as the areas for further research in this field based on the latest selected bibliographic sources. This review allowed the grouping of research into four interrelated areas, which, in fact, prove how the economy, society, and functioning economic entities are interconnected. These areas show the importance of COVID-19 for the functioning of the electronic, automotive, textile, water industries, value and supply chains, the service sector, with particular emphasis on tourism and hospitality, entrepreneurship, employee management, and many others listed in the following sections (3–6). Thanks to this literature and narrative reviews, the primary solutions by individual governments, businesses, and research directions, may inspire other researchers to discover and identify research gaps.

2. Methodological approach

To capture the impact of COVID-19 on the economy, industry, and business, the latest publications between 2020–2021, indexed in the Scopus database, were used. To this end, two approaches were used: a literature review, especially in terms of source selection, and a narrative review. The first step was to select sources from the Scopus database to determine whether the scientific literature on research results, empirical evidence, identified solutions, and research directions related to COVID-19 exist. The quantitative bibliometric analysis was made on October 10, 2021, and the main filtering criterion in the search was the phrase: “COVID-19” in the title of the article, which gave 142,521 results. Subsequently, within these results, the Title/Abstract/keywords were searched for the following keywords: “Economy,” “Industry,” and “Business” which gave 144 results. Finally, Subjects Areas were filtered by: Business, Management and Accounting (44); Social Sciences (36); Environmental Science (19); Economics, Econometrics and Finance (18); Energy (9); Agricultural and Biological Sciences (4); Engineering (4); Arts and Humanities (3); Earth and Planetary Sciences (3); Decision Sciences (2); Multidisciplinary (2) and the results were reduced to the following sections: All Open Access articles, published between 2020 and 2021 (in fact, most of them were published at that time); Document Type: article; Source Type: journal; Language: English creating the final result including 63 articles, and 43 of them were reflected in the References section and Table 1.1. Articles that dealt with COVID-19 from a financial perspective, such as insurance, were omitted as well as articles that did not fit the general thematic areas listed in Table 1.1.

The selection and literature review was limited to journal articles only (conference proceeding, book series, book was omitted) in order to reach for the results of complete, scholarly, and peer-reviewed studies that were published in scientific journals, the quality of which is confirmed by the Scopus database. Other databases (e.g., Web of Science) were excluded, because the literature review is preliminary; it is the introduction to another literature review, much more advanced, covering not only the subject areas mentioned in this article, but also the comparison of research methods and variables. Consequently, the literature review allowed for assigning all 43 articles to the following subject areas that emerged from the review: economy and industry; value chains; tourism and hospitality; business and management (Table 1.1).

Table 1.1. Thematic areas of articles on COVID-19

Thematic areas	Authors (as mentioned in the text)
Economy and industry	Dean et al. (2021); Tudorache et al. (2021); Renukappa et al. (2021); Chang and Wu (2021); Kanupriya (2021); Kaur (2021)
Value chains	Liu et al. (2020a); Liu et al. (2020b); Vasiev et al. (2020); Santacreu et al. (2021); Boehme et al. (2021); Al-Doori et al. (2021); Fountain (2021); Karunarathne et al. (2021)
Tourism and hospitality	Quang et al. (2020); Fang et al. (2021); Bourghelle et al. (2021); Xue et al. (2021); Florido-Benítez (2021); Adinolfi et al. (2021); Quang et al. (2020); Dube (2021); Sucheran (2021); Ocheni et al. (2020); Khalid et al. (2021); Janjua et al. (2021); Prideaux et al. (2020); Hemmington and Neill (2021); Liu et al. (2021); Lee et al. (2021); Sucheran (2021)
Business and management	Caiazza et al. (2021); Baryshnikova et al. (2021); Liao et al. (2021); Jiang et al. (2020); Akpan et al. (2020); Bretas and Alon (2020); Zimon et al. (2021); Acciarini et al. (2021); Nowacki et al. (2021); Ford and Ward (2021); Holder et al. (2021); Baum et al. (2020); Dalton et al. (2021); Williams and Kayaoglu (2020)

Source: based on the Scopus search.

As indicated, among others, by Coombes and Nicholson (2013), the selection of articles in terms of keywords and abstract is insufficient. Marking a phrase in the title of an article leads to a greater probability that the article will cover selected topics. The choice of a narrative review relating to the study of empirical and theoretical research is supported by the scope of freedom that a researcher gains in applying a critical approach to analysis (c.f., Gancarczyk & Ujwary-Gil, 2021; Florek-Paszowska et al., 2021). The narrative review allows the researcher to capture qualitative differences between studies, combine different concepts and indicate the context of the problem, which is the advantage of this method over the systematic literature review (c.f., Miller, Engel-Enright, & Brown, 2021). The main reason for analyzing and interpreting data through these two approaches was to triangulate the data to gain a multidimensional perspective (Foster, 1997) and to make a new contribution to form original conclusions, which indicate areas for further exploration.

3. The impact of COVID-19 on the economy and industry

Strategically revitalizing the manufacturing sector after the COVID-19 pandemic and developing the debate about the future of government intervention in Australia's manufacturing and industrial policy with

an emphasis on renewable energy has been the subject of research by Dean et al. (2021). Australia has the natural resources and investment wealth to switch to renewable energy while strengthening its strategically important, and socially beneficial manufacturing sector. Citing the South Korean government, the vision for sustainable economic development after the COVID-19 pandemic highlights \$ 135 billion of investment in renewable energy, microgrids, and green production. The European Union has taken a similar direction with a EUR 1.8 trillion recovery plan focusing on green technologies, an accelerated transition to renewable energy, and the Just Transition Fund. Canada's post-COVID-19 recovery plan includes large investments in renewable energy, a complete energy phase-out of coal by 2030, subsidies to produce electric vehicles, and support for innovation clusters to increase added value to research and production.

Other authors such as Tudorache et al. (2021) examined the impact of the COVID-19 shock on the development of the EU industry between January 2018 and November 2020, focusing on industrial confidence (the EU industry confidence index fell by 12.862 points of deviation) and industrial production. They reaffirmed the need for appropriate policies to stimulate an industrial sector that is highly uncertain and dependent on the speed of vaccination in each country. As in the services sector, government restrictions also affected industrial production, causing it to decline by an average of 8.156 percentage points per month, revealing the low economic resilience of European countries. Countries such as Italy, Slovakia, Romania, and Hungary recorded the largest decline in industrial production, while Latvia, Malta, Finland, and the Netherlands had moderate drops (Tudorache et al., 2021). Direct government support for key sectors increased the chances of survival of economic entities. The authors also observed a positive correlation between confidence in the industrial sector and consumer confidence as falling demand constrains producers' supply.

The COVID-19 pandemic also negatively affected the water industry, the implementation of projects in this sector, and organizational practices (Renukappa et al., 2021). At the same time sharpening the importance of the water industry to public health during a pandemic. Increased domestic water consumption challenged the water sector to adapt new ways of working by maintaining social distancing and personal hygiene, new ways of working remotely and improving health and safety systems at construction sites. In this sense, COVID-19 has contributed to the advancement of engineering projects in the water sector by accelerating the modernization of ICT and remote working.

The impact of COVID-19 on the global market economy has also increased operational risk for companies in the semiconductor industry with high operational and financial risks. Chang and Wu (2021) examined

the impact of financial flexibility on enterprise risk-taking in the Taiwanese semiconductor industry during the COVID-19 pandemic. The results indicate that the Taiwanese semiconductor industry should maintain flexible funding and liquidity risk management for long-term added value, even after the COVID-19 pandemic. Moreover, the impact of flexible financing on enterprise risk management differs depending on the semiconductor companies using an asset-heavy or asset-light business model.

In turn, Kanupriya (2021) analyzed the Indian textile sector, which plays a key socio-economic role alongside the country's agricultural industry. Travel restrictions and difficulties related to planning business trips, regular disinfection of the workplace, maintaining social distance among employees, and staff safety, are the main areas of activity within textile entrepreneurs in the COVID-19 era. The COVID-19 pandemic does not leave this sector without its impact on consumer demand. The supply side of production networks, engaging government, industry, and citizens to develop innovative measures to minimize and protect against the negative effects of this pandemic crisis. Kaur (2021) argued that the business problems faced by Indian entrepreneurs due to COVID-19 include a radical impact on the company's working capital, employment, digitization, future marketing campaigns to seek new orders, health problems, or goods in transit. Interestingly enough, most of the companies in this industry are digitized, which allowed them to use their production capabilities to produce N95 masks and personal protective equipment. These problems were directly related to the stress level of entrepreneurs in the textile industry in India. As a result, many of the previously reserved orders of the textile traders were canceled or postponed at the time of the blockade.

4. The impact of COVID-19 on the value chains

The supply chain is a network of organizations that, due to globalization, are deeply interconnected. COVID-19 has disrupted more than one organization, which has disrupted the supply system as well. Iqbal et al. (2021) studied the construction industry as it has a significant impact on the economy in many countries, and COVID-19 has forced the development of safety practices and a crisis management framework in construction processes. These practices include maintaining social distance among employees, one employee – one task, monitoring the workplace using innovative technologies, ongoing disinfection of tools and equipment after work. COVID-19 caused many construction projects to be delayed, production capacity contracted, slowing economic growth. This study suggests that for the construction industry's supply chain to function smoothly during COVID-19, the supply chain must be made more flexible. Advanced technology, such as machine learning,

artificial intelligence, block chain in conjunction with 5G technology, allow you to effectively calibrate the supply chain operations adequately to the supply forecasts in the construction industry.

In the context of the fight against COVID-19, Liu et al. (2020a) pointed to the importance of resilience, strategic agility, and entrepreneurship in the Asian economy on the example of China, South Korea, and Singapore. The authors highlighted the importance of global supply chains and value chains, which have changed in the last two decades, along with global enterprise development strategies based on de-internalizing less critical business activities. China is at the forefront of an industrial production system based on networks of suppliers, component manufacturers, and distributors. Taking into account the value chain, adjustment measures were observed in the electronics and automotive industries. The production of electronics (e.g., semiconductors) has been temporarily shut down, affecting shortages of materials, components, and final products such as consumer electronics and cars. In the automotive industry, the disruptions in the value chain slowed down Korean producers due to the lack of auto parts (e.g., wiring harness) imported from China. This also affected suppliers and related companies, which also had to stop production. COVID-19 has made it necessary to rethink China's supply chains and consider relocating strategic manufacturing operations outside China.

The COVID-19 pandemic has had a number of consequences for the Chinese logistics industry. Problems include a sharp decline in demand for coordination services, disruptions to the logistics network, shortage of transport capacity, a shift in service mode, and a rise in operating costs causing losses to entrepreneurs (Liu et al., 2020b). As a consequence, COVID-19 has accelerated two trends: separating from Chinese supply chains and shifting strategic manufacturing operations outside China. China was the first country to deal with the COVID-19 coronavirus pandemic, where economic activity is gradually recovering thanks to government support. Due to falling oil and other commodity prices, China is expected to buy assets in the Russian Federation, which will promote Chinese culture and business standards, as noted by Vasiev et al. (2020). In the future, relations between China and Russia will gradually strengthen, successively eliminating the slowdown or disruption of value chains in other Asian and European countries.

On the other hand, Santacreu et al. (2021) examined the role of global value chains in the decline of employment and production in the US factories during COVID-19 and the impact of diversification or re-nationalization of global value chains (e.g., excluding countries such as China) on mitigating the exposure of the economy to foreign shocks. The authors calculated that if raw materials were purchased domestically during the pandemic, not in China, the US would lose 23,000 fewer industrial jobs, saving 2.4% of all industrial jobs.

In addition, the US would experience a lower fall in GDP of production by \$ 45.5 billion, reducing GDP losses during a pandemic by about 6%. Santacreu et al. (2021) believe that while global value chains played a significant role during COVID-19, they find no evidence that restructuring global value chains could help mitigate this impact. This is due to the global nature of the shock: diversifying or renationalizing global value chains would have limited success in protecting the US producers from the virus as all countries were affected by the virus, and most of them implemented restrictive policies to contain them.

In other studies, Boehme et al. (2021) studied a geographic cluster that used additive manufacturing to increase the supply and flexible production of PPE in response to a supply chain disruption in Australia due to COVID-19. The cluster was transformed into a commercial and profitable entity capable of responding quickly to production and trade challenges. Delivering revenue streams that will create and deliver value to investing organizations and end-users is a challenge for clusters in terms of infrastructure supporting information flow, project transfer, and performance management. Information flow is important for supply chain managers as they investigate the resilience of global chains and the benefits of reducing manufacturing risk through collaboration and resource coordination.

The supply chain has an impact on the economy and society, especially in the event of disruptions in the food supply chain and a lack of resources in developing countries such as Iraq. Al-Doori et al. (2021) found that leadership, supplier role, lean practices, quality information analysis, and customer focus promote organizational innovation. Moreover, the interest rate and the inflation rate are the main factors influencing the performance of the food supply chain organization in the Iraqi food industry, which in turn affects the country's economy. Nevertheless, developed countries also suffered from COVID-19, which negatively impacted the inflation rate and human development index, which ultimately blocked economies and food supply chains. Singapore's main problem is its food supply, as 90% of its food products are imported from 170 countries (Al-Doori et al., 2021). Morocco, Peru, Singapore, Korea, Turkey, and the United Kingdom are committed to maintaining global linkages, such as transport and supply chain connections, and reducing tariffs. This means global collaboration through close two-way and multilateral communication to mitigate disruptions and respond to COVID-19.

In other interesting studies, Fountain (2021) explored the role of food and drink in stabilizing New Zealand's food and tourism sector after the COVID-19 pandemic. He identified three trends: "back to basics," "local and regional appreciation," and "food for well-being" for the regenerative, fair, and inclusive future of tourism. As the authors point out, the food and food value chain

contributed significantly to the pandemic of many New Zealanders. Looking to the future, food tourism may become more prominent in New Zealand's tourism. As a result, these experiences will have a global trend in sustainability and shortening food supply chains. As these trends develop, an innovative culinary culture will be available to domestic tourists and returning overseas visitors. Karunarathne et al. (2021) focused their research on protecting the health and safety of both the supplier and consumer of Sri Lanka's tourism sector and the need to develop contingency plans. They also noted that smarter and more innovative product development and delivery mechanisms are required at all levels of the tourism value network along the entire value chain.

5. The impact of COVID-19 on tourism and hospitality

COVID-19 has caused turbulence in the tourism sector on a global scale, resulting in border closures, travel bans, forcing travel companies to launch rescue plans, or suspending operations for a specified period. The pandemic caused an economic crisis that affected travel, especially recreational tourism, by reducing the wages of a significant part of the population. As noted in the previous section, value chains are also observed in the tourism sector. The findings of Quang et al. (2020) indicate that Vietnam's tourism sector had support from government authorities and tourism companies. By encouraging domestic tourism with the program "Vietnamese Travel to Vietnam" has stimulated the sector's economic recovery. The Vietnam Tourism Association has launched a program focused on producing and promoting a variety of affordable tourism products based on collaboration at different levels of the tourism supply chain. This study suggests active stakeholder involvement and a strategic response to future crises in tourism entrepreneurship.

The COVID-19 pandemic has forced government interventions and combating public health, which can be seen as an external shock to the economy, especially in the tourism, leisure, and recreation industries where human mobility is high. Fang et al. (2021) used data from 131 countries and regions between February-May 2020, which indicates that a decline in the share of recreation and leisure by 9.2 percentage points occurs in countries with stringent interventions. It takes about seven weeks for this industry to regain relative balance. However, only after thirteen weeks, engagement in leisure and recreation returns to 70% of pre-pandemic levels when government intervention was in place and stops at around 40% where these restrictions were not applied. Interventions in the field of public health show a clear impact on the functioning of the tourism sector of a given country, in which there is a constant dilemma, how long these restrictions should last, considering

economic losses and future benefits, especially in terms of protecting the health of the society.

The tourism industry and air transport are intertwined. The COVID-19 pandemic negatively impacted the oil industry by causing a demand shock (reducing global oil demand) and increasing economic uncertainty and recession in most developed and emerging countries. The pandemic in this sector also caused a supply shock due to the trade war between Saudi Arabia and Russia, causing investors' anxiety and thus oil price volatility (Bourghelle et al., 2021). Xue et al. (2021) studied air transport in China (major airports in Beijing, Shanghai, Guangzhou, and Wuhan), which collapsed in February 2020 (total flight volume decreased to 67.8%). Airlines have dramatically reduced the number of flights and switched to smaller, more fuel-efficient aircraft types to reduce financial losses. The authors investigated the short and medium-term effects of COVID-19 on the number of flights, aircraft use, fuel consumption, and aircraft emissions from commercial flights. As a result, due to COVID-19 reduced air travel, aircraft fuel consumption and emissions in the first half of 2020 were reduced to ~ 0.38; the index rebounded to ~ 0.85 in the second half of 2020. In another study, Florido-Benítez (2021) considered the impact of COVID-19 on the aviation and tourism industries, including airlines, airports, and destinations in Andalusia. Also, in Andalusia, the closure and reduction of the frequent air routes resulted in the bankruptcy of some airlines. The fall in flight frequencies at Andalusia's airports during COVID-19 resulted in an average decrease of 65% in passenger arrivals, which translated into a loss of 23 million tourist arrivals. This forces airports to develop new short and medium-term strategies for activating Andalusian tourism. Regional ports, which are an integral part of local communities, are most at risk. Closing these ports, shortening routes, and dismissing workers, led to increasing unemployment in this area, and the costs were adjusted to the existing demand.

Adinolfi et al. (2021) explored South Africa's (South Africa) tourism sector and the potential opportunities to open tourism to its poor people, considering aspects such as resident savings, pace-paying options, and travel culture. The authors point out, like Quang et al. (2020) that, one of the strategic directions for the development of the tourism sector is the promotion of domestic tourism due to the short-term effects of government travel restrictions, the increase in the cost of long-distance travel and individual concerns about the health safety of travelers. Dube (2021) indicated another equally important aspect of inhibiting the development of the tourism sector due to COVID-19, namely the suspension of conservation works of the RSA's cultural heritage. In addition, some public and private airlines have been suspended, taken under business administration, or shut down with far-reaching consequences for various destinations. This will impact the African tourism industry that

is gradually starting to recover thanks to the demand for fast, efficient, and sustainable transport. Loss of jobs in this sector increases poverty in the region, threatening the progress made so far in the sector's contribution to job creation over the years. COVID-19 has caused business losses across the tourism value chain. South Africa's tourism sector also includes excursion tourism and cruise tourism, which has also experienced shock by COVID-19, causing health risks to passengers and crew members. In this industry, the employment revolution was particularly evident, as Sucheran (2021) noted, pointing to the loss of 2,500 jobs due to the suspension of sea cruises every day, and with every 1% decrease in the number of sailings, 9,100 jobs are lost worldwide, and the global impact will be \$ 64 billion and 428,000 job losses.

Ocheni et al. (2020) discussed the impact of COVID-19 on jobs, person-hours, income, income, and livelihoods of workers and owners in the tourism industry. Discussions also took place on how the impact of the pandemic on the tourism industry translates into global GDP and foreign exchange income in countries whose economy has a significant impact on tourism. The study found that with the protracted lockdown, the tourism industry will continue to experience a slowdown. Khalid et al. (2021), using data from 136 countries, examined whether the size of the tourism sector affects the response of economic policy to the COVID-19 pandemic. Thus confirming that the larger the tourism sector, the greater the economic stimulus package (using fiscal and monetary policies) introduced by governments around the world to protect the tourism sector from destabilization. The authors indicate that the direct contribution of travel and tourism to GDP, foreign spending, business tourism spending, and tourist arrivals as measures of the size of the tourism sector are positively related to the economic stimulus package offered by a given country (e.g., interest rate cuts). Additionally, as indicated by Khalid et al. (2021) countries dependent on tourism should create the necessary conditions for the domestic tourism sector to serve as a buffer for the entire industry as soon as the COVID-19 epidemic stops. This is because the domestic tourism sector will be easier to get started once the COVID-19 pandemic is contained in the destination country compared to the international tourism sector.

Also, in Thailand, the tourism sector plays a key role and has a large share of Thailand's GDP. Janjua et al. (2021) predicted that the influx of international tourists to Thailand would decrease significantly due to COVID-19, which would have repercussions on the Thai economy. On the other hand, the authors emphasize that the decrease in tourist arrivals will reduce air pollution in Thailand thus far have a positive impact on the quality of the environment, increasing the use of renewable energy, ecological and logistic efficiency in the Thai tourism sector. Especially that the tourism industry is also facing the challenges of transforming the global economy,

taking into account carbon neutrality, adopting a circular economy model to reduce greenhouse gas emissions in economic production systems (Prideaux et al., 2020). This model can offer the tourism industry the opportunity to turn a high resource consumption model into an environmentally friendly and resource-neutral model.

Tourism is also the hotel industry. Hemmington and Neill (2021) studied the impact of the COVID-19 pandemic on the hotel industry in New Zealand. The hotel industry has seen financial losses while giving impetus to technology-driven strategic innovation (social media used to create innovative marketing approaches and new ways of delivering services). Also, having direct customer contact in the hotel industry (non-contact delivery) supported by government wage subsidies and business loans. The COVID-19 pandemic has also affected the Macao hospitality industry, becoming an opportunity for the city, as indicated by Liu et al. (2021). Macao is overly dependent on the gambling industry, creating an unsustainable industrial structure based on tax revenues and employment. However, the competence of the Macao government during COVID-19 showed its centralized and political power leading to immediate action in a crisis and coordination of various industries for the sake of the well-being and safety of the inhabitants, exploring the potential of industrial diversification, regional integration for future development. The production of personal protective equipment has become a growing area of activity as the wearing of masks has become mandatory in the public spaces of countries such as Macao, Taiwan, South Korea, and Hong Kong, which has effectively influenced the control of COVID-19 transmission.

Lee et al. (2021) assessed the relationship between the COVID-19 outbreak, macroeconomic fluctuations, and returns from hotel resources in China. The shift in the COVID-19 explosion is pushing up exchange rates and lowering returns from the stock market and the hotel industry. On the other hand, a positive change in the return rates from the stock exchange is associated with a decline in exchange rates and an increase in return rates from the hotel industry. Understanding these relationships is essential for implementing effective policies to stabilize the stock markets and supporting investors in their investment strategies in the hotel industry. In Sucheran study (2021), he explored the extremes of the tourism system in terms of too many and too few tourists during the COVID-19 period to achieve more sustainable tourism. On the one hand, too much tourism causes imbalances, the concentration of capital, and inequality. Also, too little tourism is detrimental to the quality of life in each place. These trends make it necessary to develop new assumptions of the tourism sector focused on slow tourism, responsible and transformative travel.

6. The impact of COVID-19 on business and management

Supply and value chains, business models, and consumption patterns have been affected by the COVID-19 pandemic in industry and multi-sector services. As rightly noted by Caiazza et al. (2021), SMEs have the largest share of employment in market economies, so any discussion of the economic impact of COVID-19 is incomplete without the SME sector. The authors studied the prospects of implementing systems based on the absorption capacity of the COVID-19 pandemic for SMEs, thus recognizing that the more policy-makers remain open to innovation, the more knowledge gained from the pandemic will represent the absorption capacity to deal with future crises. In turn, Baryshnikova et al. (2021) analyzed the impact of the COVID-19 pandemic on changes in the economic behavior of enterprises, business practices in the field of adapting functional strategies to new threats and determining the directions for the transformation of functional strategies. The pandemic forced a change in marketing strategies (e.g., current trends in the sphere of consumption), production (e.g., digitization and robotization of production, restructuring of supply chains), personnel management (e.g., remote work, digitization of processes and tasks). On the one hand, the authors conclude that the pandemic highlighted the problems related to the ability of companies to learn quickly in a rapidly changing environment, but on the other hand, the COVID-19 pandemic is becoming a unique opportunity for development.

Liao et al. (2021) studied the Taiwanese government's budgetary responses to COVID-19 and focused on special budgets designed to contain the virus, take rescue measures, and provide economic incentives. In 2020, the Taiwanese government developed targeted rescue plans for industries most affected by the pandemic and created triple stimulus cards to boost the economy. Free vouchers for low-income people were intended to both stimulate spending and promote social equality. As argued by Jiang et al. (2020), state support for Chinese SMEs was effective and helped avoid a sharp drop in production. The survival and recovery of SMEs is crucial for future development, not only in the Chinese economy, but any other economy where SME participation is dominant.

The COVID-19 pandemic has accelerated the development of advanced technologies and innovations needed to streamline business operations and redesign processes in SMEs in emerging markets to improve operational efficiency and create a sustainable competitive advantage (Akpan et al., 2020). Technologies (much more common in developed countries): such as cloud computing, big data, predictive analytics, computing, the Internet of Things required to develop new business models, reduce overheads, increase competitive advantage, and digitize business operations remain in SMEs of

emerging economies unused. Consequently, causing business operations to close during COVID-19. Bretas and Alon (2020) examined the technology, collaboration, flexibility, and strategies adopted by Brazilian franchisees, believing that during the COVID-19 and recovery period, customers will be primarily concerned with basic needs. This belief is reflected in the change or adaptation of their business models to the new reality. Online sales, omnichannel marketing, and mobile technology have become indispensable components of the continuous operation of Brazilian companies. In addition, collaboration, teamwork, communication has become more widespread, and relationships are more horizontal than vertical.

Zimon et al. (2021) noted that SMEs in Poland have problems with running a business resulting from border blocks and quarantine in the value chain (supply systems and inventory management process). However, as the authors note, inventory management in Polish SMEs has changed during the COVID-19 pandemic. Companies operating in purchasing groups use the scale effect, which means that the level of inventories may exceed the demand for the area which is profitable in the long term and has a positive effect on their financial security. During COVID-19, Polish companies decided to increase their inventory levels, which resulted in an increase in the share of inventories in current assets and an increase in financial liquidity.

In turn, Acciarini et al. (2021) examined how large companies operating in multimedia, media, communications, investment banking, and mobile telecommunications in Italy are responding to the COVID-19 pandemic. The authors concluded that the role of digital technologies is critical in developing effective responses to COVID-19 and firms' resilience to crisis and the ability to distinguish short-term actions from long-term decisions to capture potential environmental opportunities. Thus, government or institutional financial support and asset protection become essential in a crisis.

Along with the functioning of the business in a pandemic period, specific problems related to employment and employee management emerge. Nowacki et al. (2021) became interested in occupational risk management, proving that the effectiveness of measures to protect the health of employees and the production capacity of enterprises in a crisis is related to the size of the plant, and this may be indirectly related to the organization of occupational health and safety services in the country. This service should specify information about the epidemic situation and the necessary, recommended measures to protect workers' health. Occupational risk management in the COVID-19 era is the basis for further, methodical activities in enterprises aimed to protect the health and life of employees, which directly translates into the production capacity within the company. However, this is the domain of large enterprises that have developed management systems for ongoing analysis of work safety.

Such systems are less common in the SME sector. This certainly affects the quality and speed of measures to protect employees in a crisis.

Much research has been devoted to the effects of the COVID-19 pandemic on the labor market. Ford and Ward (2021) studied the impact of the pandemic on the legal protection of labor and union rights in economies that have a strong export orientation towards labor-intensive industries and weak institutions of industrial relations such as Indonesia, Cambodia, and Vietnam. These countries are of different sizes and have different political cultures. The disruptions in their economies and societies served to recreate the existing patterns of state-work relations, not to overthrow them. The disruptions caused by the COVID-19 pandemic provide opportunities to explore different governments' responses to employment in times of crisis. Interestingly, the measures are taken to protect employment, workers' wages, and working conditions had little in common with the economic context or type of regime.

Black women, facing job segregation in the US, in the lowest-paid jobs in the healthcare, social services, hotels, restaurants, and retail industries, are particularly affected by job losses due to COVID-19. Over the month, the unemployment rate increased by ten percentage points (Holder et al., 2021). Also, Baum et al. (2020) addressed the topic of professional exclusion affecting mainly young people and women during COVID-19. This exclusion led to a reduction in demand for accommodation, the closure of schools, kindergartens, and hotels. Thus, they confirmed that the hotel industry is an industry where there is rapid recruitment and reduction of staff, the use of low barriers to leave for work, and uncertain employment contracts are observed. Dalton et al. (2021) found that establishments paying the lowest average wages and the lowest-earning workers saw the sharpest decline in employment and experienced the most sustained losses due to the COVID-19 pandemic. Among companies that reduced employment, low-wage companies were much less inclined to pay some of the premiums for employee health insurance. Low-wage establishments were also less likely to pay workers who were banned from working. The pandemic has increased economic inequality over the months observed to the extent that unemployment results in long-term cuts in wages, a decline in savings, and a loss of human capital.

COVID-19 has led to job closures and movement restrictions, with governments offering temporary financial support to businesses and workers bypassing undeclared work primarily in the hospitality, retail, and personal services sectors in Europe, as studied by Williams and Kayaoglu (2020). The authors pointed to the problems related to the actual state of people excluded from government support and the government initiating incentives to disclose undeclared work without sanctions, giving employees and employers a chance to exit the so-called gray economy.

7. Directions of solutions and further research

The most important lesson from the COVID-19 pandemic is that national governance arrangements vary hugely across the globe. Moreover, a unique, effective model does not exist as it is highly dependent on the local characteristics of a given country. Despite these differences, it is essential to integrate collective actions such as social responsibility, communication, and the adoption of technology. Public disclosure of planned blockages and restrictions will allow organizations and clients of every industry to prepare properly. To achieve economic equilibrium during COVID-19, governments can improve debt management based on flexible budgets, offer support to families through cash payments, and extend unemployment benefits. However, in the post-COVID-19 period, manage expenditure cuts taking into account the participation of citizens in the budget cuts process.

The review of the above studies shows that the tourism industry is most often the subject of research by scientists around the world. The protection of the tourism industry should include, on the one hand, support from governments through subsidies encouraging tourism, travel, and accommodation, but on the other hand, offering subsidies to the health sector to enable the recovery of the sick. The governments of individual countries should develop sanitary norms and standards for the safe operation of the tourism sector, and the adoption of unified standards would allow the sector to function efficiently for the safety and health of tourists. These standards are a key issue as COVID-19 has created safety concerns among tourists. This concern should be accompanied by formalized guidelines for the health safety of travelers, including an extensive vaccination program covering the largest possible population on which to base marketing activities, creating a tourist brand and customer trust. Tourism enterprises face the challenge of offering tourists their services in the least invasive way possible. Ideas are emerging such as automating customer registration, keeping distance and safe distance, contactless service, encouraging participation in domestic tourism through vouchers to be used for shopping in local places, online ordering, and take-away services. So, businesses will be more geared towards developing technological skills, data management, creativity, and innovation. The development of digital technology and its application in tourism marketing will find more and more common applications.

In the tourism industry, a well-designed financial aid package reducing fees and taxes that could lower the prices of air tickets and other tourism products seems to be one of the directions of support for this sector. On the other hand, government assistance should protect the workplaces of people who are particularly vulnerable to professional exclusion and discrimination based on sex and race. This group includes women, young people, and workers

from developing countries who perform the lowest-paid jobs, not only in the tourism sector. Government lines of credit should include employee wage payments and coverage of fixed costs.

Downtime in flights for tourism purposes allows aviation authorities to assess the environmental impact of aircraft emissions and to develop assumptions for a green and sustainable air transport system in the future. In addition, countries should focus on the green economy, renewable energy in general logistics operations, and improve environmental performance by reducing emissions. Environmental efficiency is negatively correlated with expenditure on public health. In addition, the conversion of passenger planes into cargo planes in times of crisis, such as the COVID-19 pandemic and the use of less fuel-efficient vehicles per passenger. Unification of management at airports and airlines regarding security measures, controls, and hygiene of the services offered would allow for their efficient handling. All these solutions require examining the needs and behavior of consumers, understanding, and weighing barriers that may also hinder the functioning of the tourism sector. Future research should focus on analyzing the impact of COVID-19 on tourism and the aviation sector in various regions where tourism is the main economic activity. Moreover, how airlines that receive financial aid from governments cope with tourist destinations and whether they are accessible to travelers.

The challenge during COVID-19 is business problems with working capital and liquidity, asset protection for both SMEs and large companies. The government can help entrepreneurs by offering a loan support package, stimulating day-to-day fundraising, tax and VAT deferrals, and digital investment incentives. It cannot be ruled out that offering long-term low-interest or zero-rate loans will be the key to the survival of companies. These activities would support companies in obtaining alternative orders or shortening supply chains. There is a shift from a traditional management system to a digital IT system supporting business processes of enterprises, including the use of blockchain technology to promote product traceability or employee sharing, which not only solves short-term labor shortages but also alleviates the pressure on employment in society. Companies have shifted to online shopping and delivery, investment in omnichannel marketing, and digitizing sales. It can be assumed that digitized companies using digital supply chain management did much better in the market during COVID-19. For example, improving vaccine supply chain management and investigating the role of logistics platforms in emergency inventory shipping, also digital banking, payments, and marketing. Technical infrastructure related to smartphone applications (e.g., for detecting people who have close contact with COVID-19 cases), telecommunications, mass processing, and data transmission are the directions concerning solutions for the enterprise

sector of every industry. Despite their limited financial resources, SMEs can take advantage of the cloud computing option that is now easily available under various IT system platform operators. It is an affordable option and can be implemented by enterprises with limited technical knowledge. Each business has its specific characteristics; however, as a result of COVID-19, an acceleration of the digital transformation in business is observed. For companies exporting their goods to the international market, the government can offer a comprehensive financial package that includes concessions to exporters in the form of remission of duties or taxes on export products. It can also include the development of cross-border e-commerce, directing the transfer of export products to the domestic market, expanding a diversified international market, and encouraging innovation in foreign trade.

Equally significant changes are observed in the workplace and education. Remote work and education are becoming the “new norm” with all its advantages and disadvantages. Maintaining social distancing, measuring body temperature, wearing masks, managing sick employees, sanitary stations, disinfecting public spaces, limiting public transport, activities in shopping centers, suspending classes is conducive to creating flexible working conditions and distance learning through online platforms offering virtual teamwork, webinars, and more. These actions will force developing country governments to invest in building the necessary infrastructure to enable the use of digital platforms in education.

The COVID-19 pandemic and its social and economic impacts require the attention and analysis of researchers around the world. The research results will allow us to predict potential threats that may destabilize or even paralyze the global economy. The impact of COVID-19 on the economy, business, and governance requires further research and attention from researchers worldwide. This impact is de facto related to three interrelated areas: market interaction, technology, and public policy. Knowing how governments and businesses behave in one crisis does not necessarily mean they will act the same in others. This situation will likely depend on how policymakers interpret the effectiveness of their interventions using administrative, fiscal, and monetary policies. Future research should focus on digital and green transformation, social inclusion, health systems and education, which are important drivers of socio-economic resilience to the crisis. This resilience, both at the organizational and country level, is understood as the ability to approximate, avoid, and adapt to external shocks. Public-private cooperation should also be assessed whether it creates the possibility of taking advantage of significant opportunities and reducing risk in the event of a crisis. To accurately define the set of potential risks for socio-economic resilience to the crisis, decision-making at governmental and organizational levels needs to be redefined,

considering critical functions and services, important values, and resource reallocation potentials. Future analyzes can provide a complete picture of the impact of COVID-19 by capturing the effects on retail and resource planning as needed. In such a complex crisis resulting from COVID-19, advanced business analytics based on big data is coming to the fore, so it would be worth investigating whether big data can increase the resilience and protection of a country's socio-economic systems.

Enterprises and societies face new difficulties and challenges in terms of the resumption of production and work, economic and social development. Future research should relate to identifying ways to overcome the challenges hindering the adoption and implementation of digital technologies that seem to be the most pressing need for the survival and development of the modern world. However, above all, study the short and long-term effects, the intensity of changes, the positive and negative consequences of COVID-19 and its impact not only in business but also in the society and economy of individual countries.

8. Conclusion

COVID-19 affects the economic, social, and business aspects with a scale and dynamics of changes that have never been seen before. There were factors and challenges related to social distancing, health protocols, and economic lockdowns that had not been considered before. Therefore, new business practices are being developed, more or less universal or standardized, adequate to the functioning of the industries to manage the COVID-19 pandemic effectively. This review was not intended to systematically, while maintaining methodological rigor, compare the presented research in terms of research problems and variables, theoretical approaches, or applied research methods. Instead, the focus was on research areas in the context of COVID-19 that have interested researchers in two disciplines: economics/finance, and business/management around the world. The review is preliminary, initiating further research, with more articles and an extended choice of keywords for the abstract section. A research review of the proposed solutions in the COVID-19 era, as well as the indication of research directions, may inspire researchers to undertake wider research in this field and identify research gaps.

References

- Acciarini, C., Boccardelli, P., & Vitale, M. (2021). Resilient companies in the time of COVID-19 pandemic: A case study approach. *Journal of Entrepreneurship and Public Policy*. <https://doi.org/10.1108/JEPP-03-2021-0021>
- Adinolfi, M. C., Harilal, V., & Giddy, J. K. (2021). Travel stokvels, leisure on lay-by, and pay at your pace options: The post COVID-19 domestic tourism landscape in South Africa. *African Journal of Hospitality, Tourism and Leisure*, 10(1), 302–317. <https://doi.org/10.46222/AJHTL.19770720-102>
- Akpan, I. J., Udoh, E. A. P., & Adebisi, B. (2020). Small business awareness and adoption of state-of-the-art technologies in emerging and developing markets, and lessons from the COVID-19 pandemic. *Journal of Small Business and Entrepreneurship*. <https://doi.org/10.1080/08276331.2020.1820185>
- Al-Doori, J. A., Khmour, N., Shaban, E. A., & al Qaruty, T. M. (2021). How COVID-19 influences the food supply chain: An empirical investigation of developing countries. *International Journal of Technology*, 12(2), 371–377. <https://doi.org/10.14716/ijtech.v12i2.4391>
- Baryshnikova, N., Kiriliuk, O., & Klimecka-Tatar, D. (2021). Enterprises' strategies transformation in the real sector of the economy in the context of the COVID-19 pandemic. *Production Engineering Archives*, 27(1), 8–15. <https://doi.org/10.30657/pea.2021.27.2>
- Baum, T., Mooney, S. K. K., Robinson, R. N. S., & Solnet, D. (2020). COVID-19's impact on the hospitality workforce – new crisis or amplification of the norm? *International Journal of Contemporary Hospitality Management*, 32(9), 2813–2829. <https://doi.org/10.1108/IJCHM-04-2020-0314>
- Boehme, T., Aitken, J., Turner, N., & Handfield, R. (2021). COVID-19 response of an additive manufacturing cluster in Australia. *Supply Chain Management*, 26(6), 767–784. <https://doi.org/10.1108/SCM-07-2020-0350>
- Bourghelle, D., Jawadi, F., & Rozin, P. (2021). Oil price volatility in the context of COVID-19. *International Economics*, 167, 39–49. <https://doi.org/10.1016/j.inteco.2021.05.001>
- Bretas, V. P. G., & Alon, I. (2020). The impact of COVID-19 on franchising in emerging markets: An example from Brazil. *Global Business and Organizational Excellence*, 39(6), 6–16. <https://doi.org/10.1002/joe.22053>
- Caiazza, R., Phan, P., Lehmann, E., & Etzkowitz, H. (2021). An absorptive capacity-based systems view of COVID-19 in the small business economy. *International Entrepreneurship and Management Journal*, 17(3), 1419–1439. <https://doi.org/10.1007/s11365-021-00753-7>
- Chang, B.-G., & Wu, K.-S. (2021). The nonlinear relationship between financial flexibility and enterprise risk-taking during the COVID-19 pandemic in Taiwan's semiconductor industry. *Oeconomia Copernicana*, 12(2), 307–333. <https://doi.org/10.24136/OC.2021.011>

- Coombes, P. H., & Nicholson, J. D. (2013). Business models and their relationship with marketing: A systematic literature review. *Industrial Marketing Management*, 42(5), 656–664. <https://doi.org/10.1016/j.indmarman.2013.05.005>
- Dalton, M., Groen, J. A., Loewenstein, M. A., Piccone, D. S., Jr., & Polivka, A. E. (2021). The k-shaped recovery: Examining the diverging fortunes of workers in the recovery from the COVID-19 pandemic using business and household survey microdata. *Journal of Economic Inequality*. <https://doi.org/10.1007/s10888-021-09506-6>
- Dean, M., Rainnie, A., Stanford, J., & Nahum, D. (2021). Industrial policy-making after COVID-19: Manufacturing, innovation and sustainability. *Economic and Labour Relations Review*, 32(2), 283–303. <https://doi.org/10.1177/10353046211014755>
- Dube, K. (2021). Implications of COVID-19 induced lockdown on the South African tourism industry and prospects for recovery. *African Journal of Hospitality, Tourism and Leisure*, 10(1), 270–287. <https://doi.org/10.46222/AJHTL.19770720-99>
- Fang, Y., Zhu, L., Jiang, Y., & Wu, B. (2021). The immediate and subsequent effects of public health interventions for COVID-19 on the leisure and recreation industry. *Tourism Management*, 87. <https://doi.org/10.1016/j.tourman.2021.104393>
- Florek-Paszowska, A., Ujwary-Gil, A., & Godlewska-Dzioboń, B. (2021). Business innovation and critical success factors in the era of digital transformation and turbulent times. *Journal of Entrepreneurship, Management, and Innovation*, 17(4), 7–28. <https://doi.org/10.7341/20211741>
- Florido-Benítez, L. (2021). The effects of COVID-19 on Andalusian tourism and aviation sector. *Tourism Review*, 76(4), 829–857. <https://doi.org/10.1108/TR-12-2020-0574>
- Foster, R. L. (1997). Addressing epistemologic and practical issues in multimethod research: A procedure for conceptual triangulation. *Advances in Nursing Science*, 20(2), 1–12.
- Fountain, J. (2021). The future of food tourism in a post-COVID-19 world: Insights from New Zealand. *Journal of Tourism Futures*. <https://doi.org/10.1108/JTF-04-2021-0100>
- Gancarczyk, M., & Ujwary-Gil, A. (2021). Entrepreneurial cognition or judgment: The management and economics approaches to the entrepreneur's choices. *Journal of Entrepreneurship, Management and Innovation*, 17(1), 7–23. <https://doi.org/10.7341/20211710>
- Hemington, N., & Neill, L. (2021). Hospitality business longevity under COVID-19: The impact of COVID-19 on New Zealand's hospitality industry. *Tourism and Hospitality Research*. <https://doi.org/10.1177/1467358421993875>

- Holder, M., Jones, J., & Masterson, T. (2021). The Early Impact of COVID-19 on Job Losses among Black Women in the United States. *Feminist Economics*, 27(1–2), 103–116. <https://doi.org/10.1080/13545701.2020.1849766>
- Iqbal, M., Ahmad, N., Waqas, M., & Abrar, M. (2021). COVID-19 pandemic and construction industry: Impacts, emerging construction safety practices, and proposed crisis management framework. *Brazilian Journal of Operations and Production Management*, 18(2). <https://doi.org/10.14488/BJOPM.2021.034>
- Janjua, L. R., Muhammad, F., Sukjai, P., Rehman, A., & Yu, Z. (2021). Impact of COVID-19 pandemic on logistics performance, economic growth and tourism industry of Thailand: An empirical forecasting using ARIMA. *Brazilian Journal of Operations and Production Management*, 18(2). <https://doi.org/10.14488/BJOPM.2021.001>
- Jiang, M., Hu, Y., & Li, X. (2020). Financial support for small and medium-sized enterprises in China amid COVID-19. *Finance: Theory and Practice*, 24(5), 6–14. <https://doi.org/10.26794/2587-5671-2020-24-5-6-14>
- Kanupriya. (2021). COVID-19 and the Indian textiles sector: Issues, challenges and prospects. *Vision*, 25(1), 7–11. <https://doi.org/10.1177/0972262920984589>
- Karunaratne, A. C. I. D., Ranasinghe, J. P. R. C., Sammani, U. G. O., & Perera, K. J. T. (2021). Impact of the COVID-19 pandemic on tourism operations and resilience: Stakeholders' perspective in Sri Lanka. *Worldwide Hospitality and Tourism Themes*, 13(3), 369–382. <https://doi.org/10.1108/WHATT-01-2021-0009>
- Kaur, K. (2021). The early impact of COVID-19 on textile industry: An empirical analysis. *Management and Labour Studies*, 46(3), 235–247. <https://doi.org/10.1177/0258042X21991018>
- Khalid, U., Okafor, L. E., & Burzynska, K. (2021). Does the size of the tourism sector influence the economic policy response to the COVID-19 pandemic? *Current Issues in Tourism*. <https://doi.org/10.1080/13683500.2021.1874311>
- Lee, C.-C., Lee, C.-C., & Wu, Y. (2021). The impact of COVID-19 pandemic on hospitality stock returns in China. *International Journal of Finance and Economics*. <https://doi.org/10.1002/ijfe.2508>
- Liao, W.-J., Kuo, N.-L., & Chuang, S.-H. (2021). Taiwan's budgetary responses to COVID-19: The use of special budgets. *Journal of Public Budgeting, Accounting and Financial Management*, 29(6), 24–32. <https://doi.org/10.1108/JPBAFM-07-2020-0128>
- Liu, M. T., Wang, S., McCartney, G., & Wong, I. A. (2021). Taking a break is for accomplishing a longer journey: Hospitality industry in Macao under the COVID-19 pandemic. *International Journal of Contemporary Hospitality Management*, 33(4), 1249–1275. <https://doi.org/10.1108/IJCHM-07-2020-0678>

- Liu, Y., Lee, J. M., & Lee, C. (2020a). The challenges and opportunities of a global health crisis: The management and business implications of COVID-19 from an Asian perspective. *Asian Business and Management*, 19(3), 277–297. <https://doi.org/10.1057/s41291-020-00119-x>
- Liu, W., Liang, Y., Bao, X., Qin, J., & Lim, M. K. (2020b). China's logistics development trends in the post COVID-19 era. *International Journal of Logistics Research and Applications*. <https://doi.org/10.1080/13675567.2020.1837760>
- Miller, N. J., Engel-Enright, C., & Brown, D. A. (2021). Direct and moderation effects on U.S. apparel manufacturers' engagement in network ties. *Journal of Entrepreneurship, Management and Innovation*, 17(3), 67–113. <https://doi.org/10.7341/20211733>
- Nowacki, K., Grabowska, S., Łakomy, K., & Ociecek, W. (2021). Occupational risk management at production plants in Poland during the COVID-19 epidemic. *Management Systems in Production Engineering*, 29(3), 193–202. <https://doi.org/10.2478/mspe-2021-0024>
- Ocheni, S. I., Ogaboh Agba, A. M., Agba, M. S., & Eteng, F. O. (2020). COVID-19 and the tourism industry: Critical overview, lessons and policy options. *Academic Journal of Interdisciplinary Studies*, 9(6), 114–129. <https://doi.org/10.36941/AJIS-2020-0116>
- Prideaux, B., Thompson, M., & Pabel, A. (2020). Lessons from COVID-19 can prepare global tourism for the economic transformation needed to combat climate change. *Tourism Geographies*, 22(3), 667–678. <https://doi.org/10.1080/14616688.2020.1762117>
- Quang, T. D., Tran, T. C., Tran, V. H., Nguyen, T. T., & Nguyen, T. T. (2020). Is Vietnam ready to welcome tourists back? Assessing COVID-19's economic impact and the Vietnamese tourism industry's response to the pandemic. *Current Issues in Tourism*. <https://doi.org/10.1080/13683500.2020.1860916>
- Renukappa, S., Kamunda, A., & Suresh, S. (2021). Impact of COVID-19 on water sector projects and practices. *Utilities Policy*, 70. <https://doi.org/10.1016/j.jup.2021.101194>
- Santacreu, A. M., Leibovici, F., & Labelle, J. (2021). Global value chains and U.S. economic activity during COVID-19. *Federal Reserve Bank of St. Louis Review*, 103(3), 271–288. <https://doi.org/10.20955/r.103.271-88>
- Sisson, P., and Ryan, J. J. C. H. (2017). A knowledge concept map: Structured concept analysis from systematic literature review. *Journal of Entrepreneurship, Management and Innovation*, 13(3), 29–69. <https://doi.org/10.7341/20171332>
- Sucheran, R. (2021). Global impacts and trends of the COVID-19 pandemic on the cruise sector: A focus on South Africa. *African Journal of Hospitality, Tourism and Leisure*, 10(1), 22–39. <https://doi.org/10.46222/AJHTL.19770720-84>

- Tudorache, M.-D., Nae, T. M., and Jianu, I. (2021). COVID-19 pandemic and its effect on the EU industry. *IBIMA Business Review*. <https://doi.org/10.5171/2021.545696>
- Vasiev, M., Bi, K., Denisov, A., & Bocharnikov, V. (2020). How COVID-19 pandemics influences chinese economic sustainability. *Foresight and STI Governance*, 14(2), 7–22. <https://doi.org/10.17323/2500-2597.2020.2.7.22>
- Williams, C. C., & Kayaoglu, A. (2020). COVID-19 and undeclared work: Impacts and policy responses in Europe. *Service Industries Journal*, 40(13–14), 914–931. <https://doi.org/10.1080/02642069.2020.1757073>
- Xue, D., Liu, Z., Wang, B., and Yang, J. (2021). Impacts of COVID-19 on aircraft usage and fuel consumption: A case study on four Chinese international airports. *Journal of Air Transport Management*, 95. <https://doi.org/10.1016/j.jairtraman.2021.102106>
- Zimon, G., Babenko, V., Sadowska, B., Chudy-Laskowska, K., & Gosik, B. (2021). Inventory management in smes operating in polish group purchasing organizations during the covid-19 pandemic. *Risks*, 9(4). <https://doi.org/10.3390/risks9040063>

Biographical notes

Anna Ujwary-Gil, Ph.D. Hab., is professor at the Institute of Economics, Polish Academy of Sciences in Warsaw, Poland. She received her Ph.D. and habilitation in economics and management from the Warsaw School of Economics. She is the Editor-in-Chief of the Journal of Entrepreneurship, Management and Innovation (JEMI), also expert of the Network Analysis Laboratory. She is founder and president of the Cognitione Foundation for the Dissemination of Knowledge and Science. Her research interests include social (organizational) network analysis, knowledge management, intellectual capital, resource-based views, and dynamic approaches to organization and management. She published her works in Library & Information Science Research, Electronic Markets, Journal of Business and Industrial Marketing, or Economics & Sociology.

Bianka Godlewska-Dzioboń, Ph.D., is assistant professor at the Cracow University of Economics (UEK) in the Department of Public Policies, Faculty of Public Economy and Administration. Moreover, she is the Vice-Rector for Cooperation and Development of the Podhale State Vocational University in Nowy Targ, Poland. Expert and trainer in research and implementation projects in the field of promoting academic entrepreneurship and competence development. Founder of the UEK Dialogue Laboratory, an initiative

connecting the university community: students, research, and teaching staff with the business community and local government.

Citation (APA Style)

Ujwary-Gil, A., & Godlewska-Dzioboń, B. (2021). Solutions and research directions to the COVID-19 pandemic at the economy, industry and business levels: A literature review. In A. Ujwary-Gil & B. Godlewska-Dzioboń (Eds.), *Challenges in Economic Policy, Business, and Management in the COVID-19 era* (pp. 15–39). Warsaw: Institute of Economics, Polish Academy of Sciences.

SCDS spreads and the level of public debt in Poland during the COVID-19 pandemic

Maria Czech¹

Abstract

The purpose of this article is to study the relationship between the size of public debt and the level of SCDS spreads during the COVID-19 pandemic. The study hypothesized that the increase in the level of public debt caused by the outbreak of the COVID-19 pandemic determined changes in assessment of the country's credit risk. The study uses source literature analysis and quantitative research. The literature analysis made it possible to explain the essence and application of SCDS spreads and to indicate their relationship to changes in the level of credit risk. In the quantitative research, linear regression analysis and dynamics analysis were used. Based on the linear regression analysis, the correlation of public debt with the level of SCDS spreads was examined. The dynamics analysis enabled the study of changes in the debt level and changes in SCDS spreads both before and during the COVID-19 pandemic. The research results did not confirm the hypothesis. The research has shown that the increase in the level of public debt during the COVID-19 pandemic did not affect the level of changes in the country's credit risk assessment. Based on the research results, it was found that SCDS spreads were not sensitive to changes in the level of public debt during the COVID-19 pandemic. This study is part of the current research on the use of SCDS spreads as a country credit risk assessment tool. Since the study covered the period of the COVID-19 pandemic (during its course), the conclusions resulting from the study may constitute an introduction to broader considerations, such as the study of the determinants of SCDS spreads in the Polish economy, also during different crises. Based on the analysis of the literature, a research gap was identified in terms of the impact of public debt on the assessment of Poland's credit risk during the COVID-19 pandemic. This study will contribute to the knowledge on the relationship between SCDS spreads and public debt. The study also

¹ Maria Czech, Assistant Professor, Department of Banking and Financial Markets, University of Economics in Katowice, ul. 1 Maja 50, 40-287 Katowice, Poland, e-mail: maria.czech@ue.katowice.pl (ORCID: 0000-0003-3572-6891).

This is an open access article under the CC BY license (<https://creativecommons.org/licenses/by/4.0/legalcode>).

contributes to the discussion on the ability of SCDS spreads to reflect economic fundamentals during crises.

Keywords: *sovereign credit default swap, SCDS, public debt, pandemic, COVID-19, credit risk, Poland.*

1. Introduction

The outbreak of the COVID-19 pandemic has caused significant economic and social disruption. The pandemic affects not only the activities of economic entities but also influences the financial decisions of governments. Government authorities are forced to undertake activities related to ensuring the health and financial security of citizens. Such activities include, above all, increased purchases of medical equipment, the implementation of assistance systems aimed at protecting the economy and preventing unemployment. Consequently, the country's borrowing needs are increasing while, at the same time, budget revenues are decreasing. As a result of numerous restrictions and limitations in the functioning of market entities, a fall in the value of GDP has been observed, with a simultaneous increase in public debt. Unfortunately, the long-term effects associated with the disruption of supply chains or the closure of individual sectors of the economy are currently unknown. The duration of the pandemic is also unknown, which leads directly to increased uncertainty and generates the risk of accretion of public debt.

Public debt in this study is defined as the total gross debt at nominal value, occurring at the end of the year and consolidated for all sectors of public authority (European Union, 2008, Art. 2). According to the position of the European Union, total public debt consists of government sector debt, local government sector debt, and social security sector debt (Table 2.1).

Therefore, the structure of public debt is heterogeneous, which means that many independent factors may affect its growth. Increasing the level of indebtedness determines the increase in the macroeconomic instability of the country, and as a result, has a negative impact on the assessment of country risk.

One country risk measure is the level of sovereign credit default swap spreads (SCDS). SCDS contracts belong to the group of credit derivatives whose underlying instruments are government bonds. They are used to transfer credit risk resulting from the possibility of a country defaulting on its obligations. Transferring credit risk involves the payment of a spread, which depends on the financial condition of the state.

Table 2.1. Public debt structure. Sectoral approach

Sectors of public authority	Debt structure in sectors of public authority
Government sector	Debt of the State Treasury and State Special Purpose Funds with legal personality Debt of state universities and research and development units as well as state cultural institutions of the Polish Academy of Sciences Debt of independent public health care institutions Debt of other state legal persons
Local government sector	Debt of local government units and local government special purpose funds with legal personality Debt of independent public health care institutions Debt of local government cultural institutions Debt of other local government legal persons
Debt of the social insurance sector	Debt of the Social Insurance Institution and funds managed by ZUS Debt of the Agricultural Social Insurance Fund. Debt of the National Health Fund

Source: European Union (2008, Art. 2), Ministry of Finance (2021).

There is ample evidence, supported by research results, that the level of CDS spreads reflects information and events affecting the ability to settle liabilities and/or the possibility of bankruptcy of a given country (e.g., Czech, 2019; Grodzicki, 2012; Kocsis, 2014; Adt-Sahalia, Laeven, & Pelizzon, 2014). An increase in the level of SCDS spreads indicates an increase in negative macroeconomic events and an increase in the level of country credit risk. In contrast, a decline in SCDS spreads is interpreted as an improvement in the country's macroeconomic situation and a reduction in credit risk.

The aim of this article is to study the relationship between the size of public debt and the level of SCDS spreads during the COVID-19 pandemic. The article hypothesizes that the increase in the level of public debt caused by the outbreak of the COVID-19 pandemic determines changes in the assessment of the country's credit risk. Quantitative methods were used in the research. Based on linear regression analysis, the influence of public debt on the level of SCDS spreads was examined. Then, changes in the level of Treasury debt in relation to changes in SCDS spreads in both the pre-pandemic period and the COVID-19 pandemic period were examined using dynamic analysis.

2. Literature review

The literature study followed a two-pronged approach. It included a study of the impact of public debt on the economy and a study of the level of SCDS spreads as indicators capable of assessing the scale of the risk of a country's creditworthiness. There is a large volume of published studies describing

the role of public debt as a determinant of a country's economic growth. Research confirms that excessive public debt (e.g., above 90% of GDP) weakens economic growth (e.g., Asteriou, Pilbeam, & Pratiwi 2021; Minea & Parent, 2012; Panizza & Presbitero, 2012; Reinhart & Rogoff, 2010). In contrast, other studies have shown that the relationship between GDP growth and the level of public debt is limited, especially in an environment of low interest rates (Blanchard, 2019). Numerous studies also indicate a non-linear relationship between public debt and GDP growth. This applies to the statement that low debt positively affects economic growth, while a high level of debt negatively affects the level of GDP (Rzońca, 2007; Pattillo, Poirson, & Ricci, 2004; Cohen, 1993). Much of the current literature pays special attention to the correlation of public debt with various economic categories. It has been shown that “high-debt countries experience larger increases in interest rates in response to an unexpected decline in domestic output and an increase of global volatility” (Lian, Presbitero, & Wiriadinata, 2021). Other studies have considered the relationship between public debt and the level of investment, and they have shown that high levels of public debt harm the rate of return on investment and consequently reduce the level of investment (Pattillo & Ricci, 2003). Pattillo and Ricci (2003) also point to the negative correlation of public debt with total factor productivity growth.

The second strand of the literature study examined the level of SCDS spreads as indicators capable of assessing a country's creditworthiness risk. Much of the current literature confirms the ability of SCDS spreads to reflect economic fundamentals (e.g., Czech, 2019; Dieckmann & Plank, 2012; Eichengreen et al., 2012; Piotrowski & Piotrowska, 2013). This is due to the correlation of SCDS spreads with macroeconomic factors and with global factors. However, studies show that the extent of this correlation varies. For example, Ma, Deng, Ho and Tsai (2018) showed that in a period of economic turmoil, global factors (e.g., US stock index return) have a stronger impact on SCDS spreads, while in a period of stability, macroeconomic factors (e.g., exchange rates, local stock index return, or rating change) have a stronger impact on SCDS spreads. The different influence of global factors on the level of SCDS spreads is also shown by Czech (2019) and Kocsis (2014). Czech (2019) studied the impact of both macroeconomic and global factors on the level of SCDS spreads in twenty countries. This showed that Chinese SCDS spreads do not correlate with macroeconomic factors but are related to global factors. In contrast, SCDS spreads in the remaining countries were susceptible to both macroeconomic and global factors, with the impact varying across countries. Similar results were obtained by Chi, Chiu, Hsiao, and Tsai (2021), who studied the impact of positive and negative macroeconomic news from the US on SCDS spreads in emerging markets. Their findings reveal that good

US macroeconomic news announcements contribute to reducing the level of SCDS spreads, while bad news contributes to an increase in the level of the investigated spreads in emerging markets. A number of studies have found that SCDS spreads correlate with the level of public debt in relation to GDP (Pyka & Czech, 2018; Yuan & Pongsiri, 2015) but do not correlate with the level of the risk-free interest rate (Fontana & Scheicher 2016). In addition, there is a large volume of published studies describing the relationship of SCDS spreads with other macroeconomic values, such as the inflation rate (Aizenman, Hutchison, & Jinjarak, 2013), exchange rates (Czech, 2019; Kliber, 2019; Wang & Ji, 2017; Liu & Morley, 2012), stock market indices (Longstaff et al., 2011), or the VIX index (Camba-Méndez & Serwa, 2016; Alper, Forni, & Gererd, 2013; Heinz & Sun, 2016). The research presented thus far provides evidence that SCDS spreads are a tool for assessing a country's creditworthiness and thus provide an insight into a country's credit risk. Collectively, these studies provide important insights into the relationship of government debt to the level of SCDS spreads.

Given all that has been mentioned so far, one may suppose that the increase in debt will determine the change in the level of SCDS spreads. Based on the literature analysis, a research gap has been demonstrated in terms of the impact of public debt on the assessment of Poland's credit risk during the COVID-19 pandemic. This study will therefore contribute to the knowledge on the relationship between SCDS spreads and public debt. The study also contributes to the discussion on the ability of SCDS spreads to reflect economic fundamentals during crises and their usefulness in assessing country credit risk.

3. Research methods

The implementation of the study was based on a critical analysis of the source literature and quantitative research. The literature studies made it possible to explain the essence and application of SCDS spreads and to indicate their relationship with changes in the level of credit risk. Two research methods were used in the quantitative research: linear regression analysis and dynamics analysis. Given the main goal of the study, the linear regression analysis was carried out in the period from March 1, 2020, to March 31, 2021, on a sample of 104 observations. The purpose of the linear regression analysis was to indicate the sensitivity of SCDS spreads to the level of public debt during the COVID-19 pandemic. The dynamics analysis was used in a 24-month research period from March 1, 2019, to March 31, 2021. This period was divided into two sub-periods: the pre-pandemic period (March 2019 - February 2020) and the pandemic period (March 2020 - March 2021). The purpose of the

breakdown of the research period was to indicate changes in the level of SCDS spreads and the level of public debt during the COVID-19 pandemic in relation to the period immediately preceding the pandemic.

The research period is determined by the duration of the pandemic and the availability of statistical data. The pandemic outbreak in Poland dates to March 2020, when the first case of COVID-19 disease appeared. However, the end of the pandemic is yet unknown, as the Sars-CoV-2 virus responsible for COVID-19 is subject to continuous mutations. Moreover, the Polish population has not yet achieved herd immunity, which favors an increase in the incidence of the disease. Such a situation causes difficulties in determining the upper limit of the study due to the disproportional frequency of the publication of individual statistical data. At the time of the research, the most current statistical data was closed in March 2021. Therefore, the research period covering the period of the COVID-19 pandemic was defined as from March 1, 2020 to March 31, 2021.

3.1. Linear regression analysis

In the quantitative research, linear regression analysis conducted in the Statistica 13 program was used first. The aim of the analysis was to examine the correlation between the level of SCDS spreads based on five-year treasury bonds and the level of public debt during the COVID-19 pandemic. The dependent variables are SCDS spreads, while the independent variables (predictor variables) are as follows:

- 1) Government debt:
 - a. debt of the State Treasury and state special purpose funds with legal personality;
 - b. debt of state universities and research and development units as well as state cultural institutions of the Polish Academy of Sciences;
 - c. debt of independent public health care units;
 - d. debt of other state legal entities.
- 2) Debt of the local government sector.
- 3) Debt of the social insurance sector.

Data on individual variables was taken from the database of the Ministry of Finance and the Reuters Eikon database. In the linear regression analysis, the progressive stepwise regression method was used. In building the model, all the indicators mentioned above were considered, but only those that were statistically significant were entered into the model. Statistical significance was assessed using the t-test, assuming a maximum 5% probability of error

in the conclusions. Thus, those variables whose value was higher than the critical value resulting from the Student's t-distribution at the alpha level < 0.05 were considered statistically significant. Then, after including all statistically significant variables in the model, the linear significance for the entire constructed model was tested using the F test statistic.

The estimated linear regression model was described by the equation:

$$\hat{Y} = b_0 + b_1x_1 + b_2x_2 + b_3x_3 \pm \zeta \quad (1)$$

where: b_i - partial regression factors, model parameters representing independent variables affecting SCDS spreads based on 5-year treasury bonds.

The application of the linear regression model allowed the question to be answered whether the level of SCDS spreads changes due to the influence of changes in public debt caused by the outbreak of the COVID-19 pandemic.

3.2. Analysis of dynamics

The dynamics analysis examined the direction of changes in the level of SCDS spreads and debt levels, and the dynamics of these changes. For this purpose, a linear multiplicative time series model was built, then using the analytical method, the main trend was determined, which was described by the formula:

$$\hat{Y} = b_1 * t + b_0 \quad (2)$$

where: \hat{Y} – trend; b_0 and b_1 – model parameters; t – time

The trend function determines the change in the level of SCDS spreads with respect to the time variable. The trend model parameters (b_0 and b_1) were estimated using the least squares method (LSM):

$$b_1 = \frac{n \sum_t^n yt * t - \sum_t^n yt * \sum_t^n t}{n \sum_t^n t^2 - (\sum_t^n t)^2} \quad \frac{n \sum_t^n yt * t - \sum_t^n yt * \sum_t^n t}{n \sum_t^n t^2 - (\sum_t^n t)^2} \quad (3)$$

$$b_0 = \bar{y} - b_1 \bar{t}$$

where: yt – level of SCDS spreads / level of public debt in Poland in period t , t - number of consecutive units of time, \bar{y} - average level of SCDS spreads / average level of public debt in Poland in period t , \bar{t} - average value of time units.

The trend of changes was estimated in relation to the time variable and was shown to determine the direction of changes in SCDS spreads and the changes in public debt in the period before the outbreak of the pandemic and during the COVID-19 pandemic. On the other hand, the dynamics of changes in SCDS spreads and the dynamics of changes in the level of public debt in Poland were examined using the average rate of change:

$$\frac{y_n - y_1}{\sqrt{Y_1}} \frac{y_{n-1} - y_1}{\sqrt{Y_1}} \quad (4)$$

where: y_1 – level of SCDS spreads / level of public debt in Poland in period 1; y_n – level of SCDS spreads / level of public debt in Poland in period n; $n-1$ – the number of observations minus 1 (which results from the construction of chain indices).

Based on the dynamics analysis, the rate of changes in the level of SCDS spreads and the level of public debt in Poland in the period before and during the COVID-19 pandemic were determined.

4. Results

4.1. Linear regression analysis results

Based on the level of government sector debt, local government sector debt, and social security sector debt, a study of the impact of government debt on the level of SCDS spreads during the COVID-19 pandemic period was carried out. On the basis of the results obtained, it was found that during the COVID-19 period, government sector debt had the greatest impact on changes in the level of SCDS spreads. The linear regression equation for the period March 1, 2020 to December 31, 2020 is as follows:

$$\text{SCDS spreads} = -94.75 + 0.0001 * \text{government sector debt} \pm 1.60$$

The constructed regression model is linear and statistically significant, which is confirmed by the statistic value $F = 20.88$ and $p < 0.04$. The correlation coefficient $R = 0.9553$ is significantly different from zero and means that there is a very strong linear relationship between the dependent variable and the independent variables. The coefficient of determination is 0.9126, which means that the model explains 91.26% of the changes in the level of SCDS spreads. The standard error of the evaluation of the intercept in relation to its value is low and amounts to 1.60.

The results of the survey show a positive correlation between the debt of the government sector and the level of SCDS spreads: along with an increase in the debt of the government sector by PLN 1 million, the level of SCDS spreads increases by 0.0001 bp, while a decrease in the debt of the government sector by PLN 1 million causes a decrease in the level of SCDS spreads by 0.0001 bp.

The research was then deepened and the correlation between individual components of the government sector and the level of SCDS spreads were examined. A linear regression model was built in which the dependent variable was the level of SCDS spreads during the COVID-19 pandemic, while the independent variables were:

- debt of the State Treasury;
- debt of state special purpose funds with legal personality;
- debt of state universities and research and development units as well as state cultural institutions of the Polish Academy of Sciences;
- debt of independent public health care units;
- debt of other state legal entities.

Based on the research results obtained in the COVID-19 period, a correlation was demonstrated between the level of SCDS spreads and the debt of the State Treasury. The linear regression equation for the period from March 1, 2020 to March 31, 2020, is as follows:

$$\text{SCDS spreads} = -95.08 + 0.0001 * \text{Treasury Debt} \pm 1.58$$

The constructed regression model is linear and statistically significant, which is confirmed by the statistic value $F = 21.39$ and $p < 0.04$. The correlation coefficient of $R = 0.9563$ is significantly different from zero and means a very strong linear relationship between the dependent and independent variables. The coefficient of determination is 0.8717, which means that the model explains 87.17% of the changes in the level of the SCDS spreads. The standard error of the evaluation of the intercept in relation to its value is low and amounts to 1.58.

The results of the survey show a positive correlation between the debt of the Treasury and the level of SCDS spreads: along with an increase in the Treasury Debt by PLN 1 million, the level of SCDS spreads increases by 0.0001 bp, while a decrease in the Treasury Debt by PLN 1 million causes a decrease in the level of SCDS spreads by 0.0001 bp. The results of the study

clearly indicate that increasing the level of indebtedness is not a significant factor in determining the level of SCDS spreads.

The impact of domestic and foreign Treasury debt on SCDS spreads was also examined. For this purpose, a linear regression model was built in which the explained variable was the level of SCDS spreads during the COVID-19 pandemic, while the explanatory variables were the domestic debt of the State Treasury and the foreign debt of the State Treasury. The linear regression model for the period from March 1, 2020, to March 31, 2020, has the following formula:

$$\text{SCDS spreads} = 106.50 - 0.0002 * \text{Treasury foreign debt} \pm 2.68$$

The constructed regression model is linear and statistically significant, which is confirmed by the statistic value $F = 6.62$ and $p < 0.025$. The correlation coefficient of $R = 0.61$ is significantly different from zero and means that there is a very strong linear relationship between the dependent variable and the independent variables. The coefficient of determination is 0.3190, which means that the model explains 31.90% of the changes in the level of SCDS spreads. The standard error of the evaluation of the intercept in relation to its value is low and amounts to 2.68.

The results of the survey show a negative correlation between Treasury foreign debt and the level of SCDS spreads: along with an increase in the Treasury foreign debt by PLN 1 million, the level of SCDS spreads increases by 0.0002 bp, while a decrease in the Treasury foreign debt by PLN 1 million causes a decrease in the level of SCDS spreads by 0.0002 bp.

Taking into account the debt of the State Treasury in terms of currency, the correlation between SCDS spreads and debt in terms of currency was examined. In the constructed multiple linear regression model, the dependent variable was SCDS spreads, while the explanatory variables were the debt of the State Treasury expressed in PLN, EUR, and USD. The regression model equation is as follows:

$$\text{SCDS spreads} = 102.52 - 0.0002 * \text{State Treasury debt in EUR} \pm 2.37$$

The constructed regression model is linear and statistically significant, which is confirmed by the statistic value $F = 11.54$ and $p < 0.005$. The correlation coefficient of $R = 0.72$ is significantly different from zero and means a very strong linear relationship between the dependent and independent variables. The coefficient of determination is 0.4677, which means that the model explains 46.77% of the changes in the level of SCDS spreads. The

standard error of the evaluation of the intercept in relation to its value is low and amounts to 2.37.

The results of the survey show a negative correlation between State Treasury debt in EUR and the level of SCDS spreads: along with an increase in State Treasury debt in EUR by PLN 1 million, the level of SCDS spreads increases by 0.0002 bp, while a decrease in State Treasury debt in EUR by PLN 1 million causes a decrease in the level of SCDS spreads by 0.0002 bp. The results of the study clearly indicate that increasing the level of indebtedness is not a significant factor in determining the level of SCDS spreads.

Using linear regression analysis, the correlation between SCDS spreads and the indicators of the government response to the pandemic situation in Poland was also examined. A linear regression model was built in which the dependent variable was the level of SCDS spreads during the COVID-19 pandemic, while the explanatory variables were:

- government restrictiveness reaction rate;
- health protection index;
- restrictiveness index;
- economic support index.

The Government Response Index is the most aggregate measure and is based on 16 indicators related to pandemic containment policies (e.g., school and workplace closures, face-covering), economic policy (e.g., household financial support, fiscal measures, and international support), and healthcare policies (e.g., testing policy, contact tracing, vaccination policy, and testing policy). The second important indicator is the Health Protection Index. This is an aggregate measure based on fourteen indicators of the political response to COVID-19. These include school and workplace closures, travel bans, contact tracing, face-covering, testing, and vaccination policies. The range indicator is from 0 to 100, with zero being the mildest and 100 being the most stringent. The Restrictiveness Index is similarly constructed. This index is based on 9 indicators, including mainly restrictions relating to the closure of schools and workplaces, as well as restrictions on movement and covering the face. The scale for this index is analogous to the health protection index. The lowest number of indicators are included in the Economic Support Indicator. This contains only two indicators, including financial support and the suspension of loan payments to households.

Based on the research results obtained in the COVID-19 period, it was found that there is no linear relationship between the level of SCDS spreads and the indicators of the government's response to the pandemic in Poland.

4.2. Dynamics analysis results

First, the share of the government sector, the local government sector, and the social security sector in the total public debt was examined. It was shown that the highest level of debt occurs in the government sector (over 92%). In order to deepen the analysis, the share of individual components affecting the debt of the government sector was examined, and it was shown that the highest level of debt (over 99%) is characterized by the Treasury (Figure 2.1).

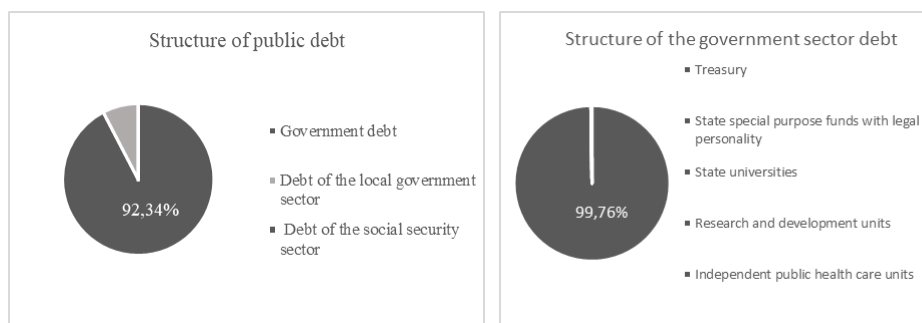


Figure 2.1. The structure of public debt during the COVID-19 pandemic

Source: based on the Ministry of Finance.

Based on the above results and the linear regression analysis results, the dynamics and direction of changes in the level of State Treasury debt were examined in relation to the level of SCDS spreads in the two research periods - in the period before the outbreak of the COVID-19 and during the pandemic. In the period preceding the outbreak of the COVID-19 pandemic, Treasury debt remained stable, on average PLN 998,445.50 million. The value of this debt ranged from PLN 984,313.50 million to PLN 1,001,190.90 million and followed a moderate downward trend. Only as a result of the trend-cycle component (without a seasonal and a remainder component), the debt of the State Treasury decreased by PLN 362.18 million month-to-month, as shown by the results of the analysis. The good condition of the state, which favored a reduction in the country's credit risk in the run-up to the COVID-19 pandemic, was reflected in the level of SCDS spreads. During this period, the level of SCDS spreads was subject to dynamic declines averaging -0.49 bps from week-to-week, ultimately with a reduction from the level of 70 bp to 46.9 bp (Figure 2.2).

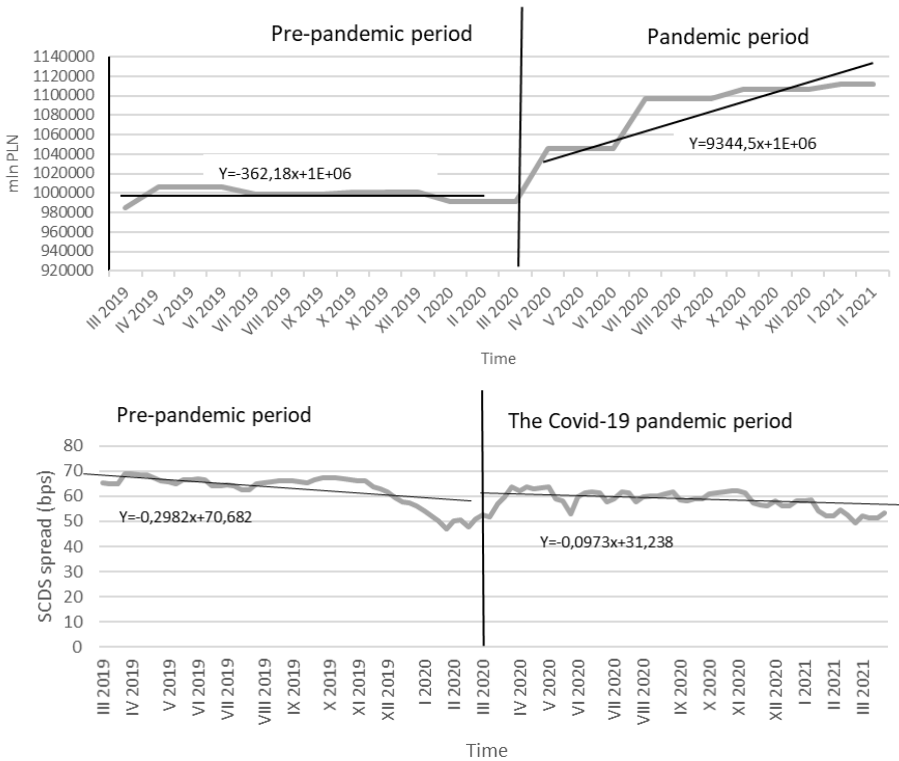


Figure 2.2. State Treasury debt and the level of SCDS spreads in the period before and during the COVID-19 pandemic

Source: based on the Reuters Eikon database and the Ministry of Finance
<https://www.gov.pl/web/finanse/zadluzenie-skarbu-panstwa>.

Figure 2.2 shows that the outbreak of the COVID-19 pandemic had a significant impact on the level of Treasury debt. From March 2020, this debt increased by more than 12% over the calendar year, from less than PLN 991 million to more than PLN 1,111 million (on average, which is 1.05% month-to-month). The analysis of the trend showed that because of the trend-cycle component, the debt of the Treasury increased month-to-month by over PLN 9,344 million. After the outbreak of the pandemic, there was an urgent need to mitigate its effects, which increased the state's borrowing needs. The increase in indebtedness was dictated by an increase in unplanned expenses resulting from the introduction of extraordinary measures, such as the anti-crisis shield, the purchase of specialized personal protective equipment, or the purchase of vaccines against Sars-Cov-2, which causes the COVID-19

disease. At the same time, the results of the analysis showed that the increase in indebtedness of the Treasury did not significantly affect the level of SCDS spreads. An intense increase in the examined spreads was observed only at the beginning of the pandemic, between March 2020 and May 2020. During this time, the level of SCDS spreads increased an average of 0.98% week on week, quickly reaching a level close to the pre-pandemic period, i.e., 64 bp. The reason for the dynamic increase in the SCDS spreads was the uncertainty and fear caused by the appearance of a new, unknown pathogen (Norman, Bar-Yam, Taleb, 2020). From June 2020, the first dynamic decrease in the level of SCDS spreads was observed, with a subsequent continuation of the downward trend. The trend analysis showed that over the entire period of the COVID-19 pandemic, due to the trend-cycle component, SCDS spreads decreased by an average of -0.0973 bp week-to-week, and the average rate of decline was -0.12% from week-to-week. The results obtained indicate that SCDS spreads are not sensitive to sovereign debt levels.

Based on the analysis of the time series, the level of spreads in relation to the indicators of the government's response to the pandemic in Poland was also examined. The results of the analysis show that as the restrictions increase, the SCDS spreads decrease, and the easing of the restrictions entails an increase in SCDS spreads (Figure 2.3).

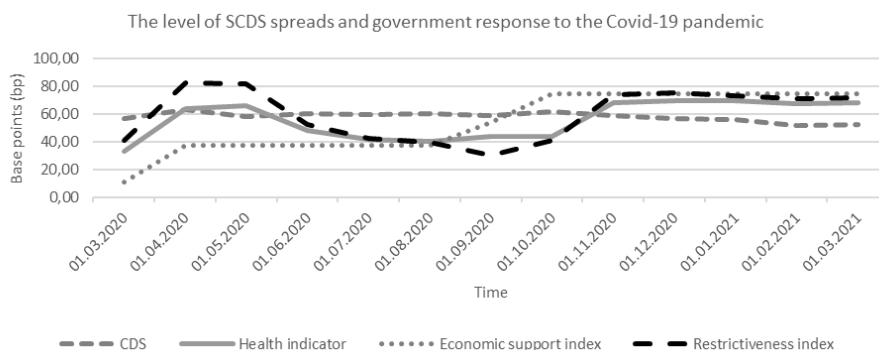


Figure 2.3. Level of SCDS spreads and indicators of the government response to the pandemic in Poland

Source: Based on Reuters Eikon.

The results of the analysis show that the largest decrease in SCDS spreads occurred during the second and third waves of the pandemic, i.e., in October and November 2020 and in February and March 2021. During this period, the number of new cases of COVID-19 increased significantly, and the number of

hospitalized people also increased (Serwis Rzeczypospolitej Polskiej, 2021; Commonwealth Service, 2021). As a result, restrictions were introduced by the government on social mobility, including the closure of schools, hotels, shopping malls, cultural centers including, theaters, cinemas, and museums. Also, restrictions reached sports facilities, including swimming pools, fitness clubs, gyms, and ski slopes. In addition, face coverings and observing social distancing became mandatory. The primary purpose of the restrictions on social activity was to combat the surge in COVID-19 transmissions and halt the pandemic's spread. The observed coincidence in the timing of the phenomena under study with the increase in number of cases and introduced restrictions suggests that the market assessed the introduction of restrictions on social activity as not threatening the ability to settle liabilities, which was reflected in a reduction in the level of SCDS spreads.

5. Discussion

The research is part of the discussion on the ability of SCDS spreads to assess a country's credit risk. The analysis of the literature has shown the ability of these instruments to reflect the economic fundamentals of a country. One of the macroeconomic factors affecting the level of SCDS spreads indicated in the literature is the level of public debt (Pyka & Czech, 2018; Yuan & Pongsiri, 2015). As the correlation between SCDS spreads and macroeconomic factors varies according to previous studies, this research extends the knowledge on the relationship between SCDS spreads and public debt during periods of rising uncertainty.

The aim of this study was to examine the relationship between the size of public debt and the level of SCDS spreads during the COVID-19 pandemic. The research objective was achieved, as the study involved both analysis of the dynamics of SCDS spreads and public debt, as well as analysis of the interdependence between these two variables. The verification of the research hypothesis answered the question of whether an increase in public debt affects the credit risk assessment of Poland. The linear regression model showed that among the three components of public debt, only the level of government debt correlates very little with the level of SCDS spreads. The regression analysis also showed that only the debt of the State Treasury contributed negligibly to changes in SCDS spreads (a change in the State Treasury debt by PLN 1 million contributes to a change in the level of SCDS spreads by 0.0001 bp). The findings observed in this study mirror those of the results of the dynamics analysis, in which the share of indebtedness of individual sectors in public debt was examined. The evidence from this study suggests that the main component of public debt is Treasury debt (over 99%). Contrary to expectations, this study

did not find a significant correlation between government debt and SCDS spreads. It is surprising that although the COVID-19 pandemic negatively affects the country's economic processes and GDP growth, this is not reflected in the assessment of the country's financial condition. However, the present findings are consistent with other research, which found that the relationship between GDP growth and government debt levels is limited (Blanchard, 2019).

Returning to the hypothesis posed at the beginning of this study, it is now possible to state that it has been verified negatively. The hypothesis assumed that the increase in the level of public debt caused by the outbreak of the COVID-19 pandemic has determined changes in the country's credit risk assessment. The results of the study showed that the increase in the level of public debt during the COVID-19 pandemic does not affect the level of changes in the country's credit risk assessment. On this basis, it was concluded that SCDS spreads are not sensitive to changes in the level of public debt. These results match those observed in previous studies, which showed that in times of economic turmoil, macroeconomic factors are much less important compared to global factors (Ma et al., 2018).

6. Conclusion

This article examines the relationship between the size of public debt and the level of SCDS spreads during the COVID-19 pandemic. Given that public debt consists of three components (government sector debt, local government sector debt, and social security sector debt), the correlation analysis examined the individual components of public debt against the level of SCDS spreads based on five-year Polish Treasury bonds during the COVID-19 pandemic. The following conclusion can be drawn from the present study: the increase in the level of public debt caused by the outbreak of the COVID-19 pandemic does not affect the level of SCDS spreads in Poland. The results of the study showed no correlation between the level of indebtedness of the local government sector and the social security sector and the level of SCDS spreads in Poland during the COVID-19 pandemic. However, there was a positive correlation between government sector debt and the level of SCDS spreads. At the same time, it was proved that the correlation between the analyzed categories was very small (0.0001 bp).

The results of the dynamics analysis also confirm that SCDS spreads are not sensitive to changes in the level of Treasury debt. It has been shown that during the COVID-19 pandemic, Treasury debt increased dynamically (by over 12%) compared to the pre-pandemic period. In contrast, the level of SCDS spreads in the entire period under study, i.e., both before and during the COVID-19 pandemic, was characterized by a downward trend. An exception

was the period from March to May 2021, when there was an upward adjustment of SCDS spreads. The obtained results confirm the results of the analysis of the source literature. The researchers' attention was focused on the problem of the accumulation of public debt but, so far, no clear position has been developed regarding the impact of this debt on the economy. Overall, the inconsistency of the argument seems to disturb the correct assessment of a country's credit risk.

One of the more significant conclusions of this study is that during the COVID-19 pandemic, SCDS spreads were sensitive to the level of restrictions imposed. The results obtained confirm that as the restrictions increased, the level of CDS spreads decreased. This is quite a surprising discovery, as restrictions limiting the population's mobility and the closing of workplaces have a negative impact on tax revenues and often generate additional budgetary outflows (e.g., state financial aid). On the other hand, restrictions have a pandemic-reducing effect and contribute to economic growth in the long term.

It should be noted that the results obtained should be interpreted with some caution. This is because the dataset covers a relatively short time frame. This is primarily due to limitations related to the availability of statistical data on the evolution of both public debt during the COVID-19 pandemic, as well as data on changes in SCDS spreads during the pandemic. It is worth considering that the COVID-19 pandemic is an unprecedented phenomenon whose course and effects are still unknown. Therefore, this study is only an introduction to broader research on the Polish economy and other European economies - not only during the COVID-19 crisis but also during earlier crises. Future research focusing on the correlation between debt and SCDS spreads over a longer period and in different countries could be of interest and would contribute to a better understanding of the CDS market and thus the factors affecting the pricing of a country's credit risk during crises.

Acknowledgments

I would like to express my thanks for the funding provided for this article. The work was carried out as part of an individual research project funded by the University of Economics in Katowice.

References

- Adt-Sahalia, Y., Laeven, R., & Pelizzon, L. (2014). Mutual excitation in Eurozone Sovereign CDS. *Journal of Econometrics*, 183(2), 151–167. <https://doi.org/10.1016/j.jeconom.2014.05.006>

- Aizenman, J., Hutchison, M., & Jinjarak, Y. (2013). What is the risk of European sovereign debt default? *Journal of International Money and Finance*, 34(C), 37–59.
- Alper, E., Forni, L., & Gererd, M. (2013). Pricing of Sovereign Credit Risk: Evidence from advanced economies during the financial crisis. *International Finance*, 16(2), 161–188. <https://doi.org/10.1111/j.1468-2362.2013.12028.x>
- Asteriou, D., Pilbeam, K., & Pratiwi, C. (2021). Public debt and economic growth: Panel data evidence for Asian countries. *Journal of Economics and Finance*, 45, 270–287.
- Blanchard, O. (2019). Public debt and low interest rates. *American Economic Review*, 109(4), 1197–1229.
- Camba-Méndez, G., & Serwa, D. (2016). Market perception of sovereign credit risk in the euro area during the financial crisis. *The North American Journal of Economics and Finance*, 37, 168–189.
- Cohen, D. (1993). Low investment and large LDC debit in the 1980's. *American Economic Review*, 83, 437–449.
- Czech, M. (2019). *Credit Default Swap w Transakcjach Średnioterminowych na Globalnym Rynku Finansowym*. Warszawa: Difin.
- Czech, M., & Pyka, I. (2018). Kontrakty CDS w roli nowoczesnego parametru oceny ryzyka kredytowego kraju. *Współczesne Finanse. Studia Ekonomiczne. Zeszyty Naukowe Uniwersytetu Ekonomicznego w Katowicach*, 356, 124–145.
- Dieckmann, S., & Plank, T. (2012). Default risk of advanced economies: An empirical analysis of Credit. *Review of Finance*, 16(4), 903–934. <https://doi.org/10.1093/rof/rfr015>
- Eichengreen, B., Mody, A., Nedeljkovic, M., & Sarno, L. (2012). How the subprime crisis went global: Evidence from bank credit default swap spreads. *Journal of International Money and Finance*, 31(5), 1299–1318. <https://doi.org/10.1016/j.jimonfin.2012.02.002>
- European Union. (2008). Dz.U.UE C z dnia 9 maja 2008 r. *Protokół w sprawie procedury dotyczącej nadmiernego deficytu*. Retrieved from <http://eur-lex.europa.eu/>
- Fontana, A., & Scheicher, M. (2016). An analysis of euro area sovereign CDS and their relation with government bonds. *Journal of Banking & Finance*, 62(C), 126–140.
- Grodzicki, M. (2012). Kredytowe instrumenty pochodne w dobie kryzysu finansowego. *Bank i Kredyt*, 4, 23–28.
- Heinz, Y. S. (2016). Sovereign CDS spreads in Europe: The role of global risk aversion, economic fundamentals, liquidity, and spillovers. *Working Articles, International Monetary Fund*. Retrieved from <https://www.imf.org/en/Publications>

- Kliber, A. (2019). The Sovereign Credit Default Swap market – Is there anything to be afraid of? A comparison of selected central and western European economies. *Argumenta Oeconomica*, 2(43), 137–167.
- Kocsis, Z. (2015). Global, regional, and country-specific components of financial market indicators. *Acta Oeconomica*, 64(S1). <https://doi.org/10.1556/AOecon.64.2014.S1.3>
- Lian, W., Presbitero, A., & Wiriadinata, U. (2021). Public debt and r-g at risk. *International Monetary Fund. Working Article*. Retrieved from <https://doi.org/10.5089/9781513550794.001>.
- Liu, Y., & Morley, B. (2012). Sovereign credit default swaps and the macroeconomy. *Applied Economics*, 19(2), 129–132. <https://doi.org/10.1080/13504851.2011.568390>
- Longstaff, F., Pan, J., Pedersen, L., & Singleton, K. (2011). How sovereign is sovereign credit risk? *American Economic Journal: Macroeconomics*, 3(2). <https://doi.org/10.1257/mac.3.2.75>
- Ma, J., Deng, X., Ho, K., & Tsai, S. (2018). Regime-switching determinants for spreads of emerging markets sovereign credit default swaps. *Sustainability*, 10(8). <https://doi.org/10.3390/su10082730>
- Mayordomo, S., Peña, J., & Schwartz, E. (2014). Are all credit default swap databases equal? *European Financial Management*, 20(4), 677–713.
- Minea, A., & Parent, A. (2012). Is high public debt always harmful to economic growth? Reinhart and Rogoff and some complex nonlinearities. *Working Article. No. 201218*. Retrieved from <https://ideas.repec.org/p/cdi/warticle/1355.html>
- Ministry of Finance. (2021). *Zadłużenie*. Retrieved from <https://www.gov.pl/web/finanse/zadluzenie>
- Norden, L., & Weber, M. (2009). The co-movement of credit default swap, bond and stock markets: An empirical analysis. *European Financial Management*, 15(3), 529–561. <https://doi.org/10.1111/j.1468-036X.2007.00427.x>
- Norman, J. B.-Y., & Taleb, N. (2020). Systemic risk of pandemic via novel pathogens – coronavirus: A note. *New England Complex Systems Institute*. Retrieved from https://jwnorman.com/wp-content/uploads/2020/03/Systemic_Risk_of_Pandemic_via_Novel_Path.pdf
- Panizza, U., & Presbitero, A. (2014). Public debt and economic growth: Is there a causal effect? *Journal of Macroeconomics*, 41, 21–41.
- Pattillo, C., Poirson, H., & Ricci, L. (2004). What are the channels through which external debt affects growth? *IMF Working Article*. Retrieved from <https://doi.org/10.5089/9781451843293.001>
- Piotrowski, D., & Piotrowska, A. (2013). Notowania CDS a dostęp do kapitału w okresie kryzysu finansów publicznych. *Zeszyty Naukowe Uniwersytetu Szczecińskiego. Finanse, Rynki Finansowe, Ubezpieczenia*, 768(63), 391–405.

- Poirson, H., & Ricci, L. (2003). Through what channels does external debt affect growth? *Brookings Trade Forum*, 229–258. <https://doi.org/10.1353/btf.2004.0013>
- Reinhart, C., & Rogoff, K. (2010). Growth in a time of debt. *National Bureau of Economic Research. Working Article, No. 15639*. Retrieved from <http://www.nber.org/articles/w15639>
- Rzońca, A. (2007). *Czy Keynes się Pomylił? Skutki Redukcji Deficytu w Europie Środkowej*. Warszawa: Wydawnictwo Naukowe Scholar.
- Serwis Rzeczypospolitej Polskiej. (2021, July). Retrieved from <https://www.gov.pl/web/koronawirus>
- Wang, W., & Ji, K. (2017). Sovereign credit risk, macroeconomic dynamics, and financial contagion: Evidence from Japan. *Macroeconomic Dynamics*, 21(8), 2096–2120.
- Yin, C., Chiu, J., Hsiao, Y., & Tsai, W.C. (2021). The effects of us macroeconomic surprises on the term structure of emerging-market sovereign credit default swaps. Retrieved from <https://www.sfm.url.tw/php/Articles/CompleteArticle/009-1121360588.pdf>
- Yuan, C., & Pongsiri, T.J. (2015). Fiscal austerity, growth prospects, and sovereign CDS spreads: The eurozone and beyond. *Journal of International Economics*, 141, 50–79. <https://doi.org/10.1016/j.inteco.2014.12.001> strony 50–79.

Biographical note

Maria Czech (Ph.D.) is a research and didactic worker at the Department of Banking and Financial Markets at the University of Economics in Katowice. In her research, she focuses on issues related to financial markets, financial innovation, and the extensive use of credit default swaps in financial and non-financial institutions. She conducts classes on financial innovation, banking, and financial markets.

Citation (APA Style)

Czech, M. (2021). SCDS spreads and the level of public debt in Poland during the COVID-19 pandemic. In A. Ujwary-Gil & B. Godlewska-Dzioboń (Eds.), *Challenges in Economic Policy, Business, and Management in the COVID-19 Era* (pp. 41–60). Warsaw: Institute of Economics, Polish Academy of Sciences.

The impact of the COVID-19 crisis on the Czech luxury fashion industry

Radka MacGregor Pelikánová¹

Abstract

The COVID-19 crisis has a global dimension while affecting every business in the EU, including businesses from industries reputable for their stability, perpetuity, and abundant resources, such as the luxury fashion industry. It is relevant to explore and assess the impact the COVID-19 crisis has had on top businesses from the Czech luxury fashion industry based on their declarations posted on their websites in January 2021 and in July 2021. A longitudinal deeper case study involves websites of the 20 Czech luxury fashion businesses with the largest turnover while researching how they report about COVID-19 in January and July 2021. The Meta-Analysis takes advantage of the content analysis performed by the expert panel employing the manual Delphi approach along with glossing and Socratic questioning. Websites of the top Czech luxury fashion businesses provide a highly relevant message about the passive and backward-looking approach making the COVID-19 crisis a threat than an opportunity with only two businesses opting for a pro-active approach and using COVID-19 as an opportunity for more social responsibility and inventiveness. This message from January 2021 was reinforced in July 2021. These findings follow theoretical propositions about crises impacts based on their perception. Czech luxury fashion businesses have declined to follow recommendations offered by the theory and they have paid the price for it, even the ultimate price. This is a pioneering endeavor to explore and assess how COVID-19 is perceived in the luxury fashion industry via the Internet websites belonging to the twenty top Czech businesses, particularly what they decided to post about themselves during the COVID-19 crisis.

Keywords: COVID-19, corporate social responsibility, CSR, luxury fashion, sustainability

¹ Radka MacGregor Pelikánová, JUDr., Ph.D., LL.M, MBA, Academic researcher, Department of International Business, Metropolitan University Prague, Dubečská 900/10, 100 00 Prague 10, Czech Republic, e-mail: radkamacgregor@yahoo.com (ORCID: 0000-0001-9628-71461).

This is an open access article under the CC BY license (<https://creativecommons.org/licenses/by/4.0/legalcode>).

1. Introduction

The current global society must reconcile available and often diminishing resources with the requirements of the constantly increasing and demanding world population (Meadows et al., 1972). Consequently, businesses are expected to be both profitable and altruistic under the auspices of the sustainability command resting on three pillars – economic, environmental, and social (MacGregor Pelikánová, 2019). Therefore, businesses need to be internally, vis-à-vis their shareholders and employees as well as externally, vis-à-vis their other stakeholders, responsible (Schüz, 2012). They need to achieve long-term profitability while contributing to sustainability via their Corporate Social Responsibility (CSR) (MacGregor Pelikánová, 2021).

Currently, the sustainability command has been strongly shaped by the instrument of International public law issued by the United Nations (UN), especially the UN resolution from 2015 Transforming our World: the 2030 Agenda for Sustainable development (UN Agenda 2030), which brought with it its 17 Sustainable Development Goals (SDGs) and 169 associated targets (MacGregor Pelikánová & MacGregor, 2020). Boldly, sustainability with its SDGs is not feasible without the effective and efficient engagement of businesses via their CSR (Balcerzak & MacGregor Pelikánová, 2020), and this is realized via the multi-stakeholder model and cross-sector partnership (Van Tulder et al., 2016; Van Tulder & Keen, 2018). To put it differently, without the support of the entire global society, sustainability is unrealistic and futile (Bali & Fan, 2019; Turečková & Nevima, 2020). There are even stronger voices to make the sustainability commitment via CSR legally binding, i.e., to move from responsibility to liability.

Various patterns and trends are detected in different jurisdictions (Sroka & Szántó, 2018). Regardless of that and the ongoing discourse about the responsibility, v. liability of businesses do more than mere profit-maximizing, it is well established that a higher level of such a responsibility (or perhaps even liability) regarding sustainability has traditionally been extended to businesses strongly underlying their financial strength and commitment to ethics and values, such as luxury fashion businesses (Cerchia & Piccolo, 2019; MacGregor et al., 2020; MacGregor Pelikánová et al., 2021). These expectations are shared both by their customers (Olšanová et al., 2018), as well as their investors and other stakeholders (MacGregor Pelikánová & MacGregor, 2020).

Furthermore, luxury fashion businesses are expected not only to be lavish, opulent and support their values but to be stable and constant – Fifth Avenue in New York, Champ Elysee Boulevard in Paris, Piazza di Spagna in Rome or Pařížská Street in Prague were, are and shall remain as addresses for luxury fashion businesses. Indeed, the luxury fashion industry has been heavily

using mottos, labels, and trademarks, including words such as “eternity” or “forever.” Many empirical studies confirmed that luxury fashion businesses are, or at least in a convincing manner, pretend to be, rooted in the past, linked to elites, serious about ethics, and bringing benefits to all (MacGregor et al., 2020a; MacGregor Pelikánová et al., 2021). Often, the luxury fashion industry, aka slow fashion industry, is contrasted to the fast fashion industry with its reckless drive for “cost reduction at any cost” which has devastating social and environmental impacts (Niinimäki et al. 2020), see e.g. the fast fashion over-production of cotton clothes leading to the drying up of Aral Sea, because one shirt can use up to 2 700 liters of water! (Hoskins, 2016).

A crisis is a phenomenon challenging the prior setting, making it unstable and leading to situations perceived as dangerous. Due to a crisis, businesses are called on to (re)consider and re(state) their identity and priorities (Kovoor-Misra, 2009). Arguably, Einstein stated, “...it is crisis that brings progress. It is in crisis that inventiveness, discovery and great strategy are born” (D’Adamo & Lupi, 2021). The emergence of COVID-19 in 2019, its rather brutal expansion in the EU in the Spring of 2020, and its status of the world pandemic in 2020 and 2021 have parameters of a massive crisis. Certain industries have been affected more than others, and, undoubtedly, the luxury fashion industry suffered a dramatic drop in sales and profit (MacGregor Pelikánová et al., 2021) as well as in the level of engagement and enthusiasm of its front-line employees (MacGregor et al., 2020b). The COVID-19 pandemic is a threat that shows a myriad of weaknesses of the luxury fashion industry, such as cash flow insufficiency and indebtedness (MacGregor Pelikánová, 2021). However, arguably, each crisis brings both challenges and opportunities, has its winners and losers (D’Adamo & Lupi, 2021). Therefore, it is highly relevant to engage in a deeper study of the top luxury fashion industry in a national jurisdiction of the EU, such as the 20 Czech luxury fashion businesses with the largest turnover, and to pay particular attention to the way how they have been perceiving COVID-19 according to their domain postings. Namely, how have these top 20 addressed COVID-19 on their websites placed on their domains? The President of the European Commission, Ursula von der Leyen, has optimistically declared that COVID-19 is a valuable impulse for businesses to become greener and more sustainable (Valero, 2020). However, a study of the websites of these top 20 performed in January 2021 and in July 2021 provides a different message. Consequently, it is highly relevant to consider what kind of challenge is the COVID-19 crisis for such an industry as the Czech luxury fashion industry. Hence, the purpose is to explore and assess the impact of the COVID-19 crisis on such businesses based on their declarations posted on their websites

in January 2021 and in July 2021. Namely, what they decided to post about themselves during the COVID-19 crisis.

To fully appreciate and explore that, after a Literature review about the luxury fashion industry and the COVID-19 pandemic, a proper method needs to be explained and employed vis-à-vis relevant data, so academically sufficiently robust results can be presented and discussed. The ultimate answer to the question of what kind of a challenge is the COVID-19 crisis for the Czech luxury fashion industry is summarized in conclusions.

2. Literature review

Coronaviruses are part of a large family of viruses that can affect birds and mammals, including humans (Jones & Comfort, 2020). COVID-19 is an infectious disease caused by SARS-CoV-2, a newly discovered coronavirus form (Manojkrishnan & Aravind, 2020), which originally emerged around 2002, causing Severe Acute Respiratory Syndrome (SARS) (Rasool & Fielding, 2010). It has mutated while causing Middle East Respiratory Syndrome (MERS) (Manojkrishnan & Aravind, 2020), which was first reported in South Korea in 2012 (Jones & Comfort, 2020). In 2020, COVID-19 caused a global pandemic (Armani et al., 2020), which led to the largest global economic downturn since the 19th century and an economic crisis with a similar extent as the Great depression taking place 90 years ago (MacGregor Pelikánová et al., 2021). Prior inequalities have expanded (Ashford et al. 2020), capital markets were disrupted (Pardal et al., 2020), and stock markets were shaken (Hasan et al., 2021). The large majority of businesses and business leaders were not prepared for it and suffered dramatic consequences. For example, 94% of the Fortune 1000 companies have suffered serious consequences (McMaster et al., 2020). Undoubtedly, COVID-19 has caused a crisis with a devastating impact on global, regional, and national economies and basically on the entire world population (Jones & Comfort, 2020). According to Kristalina Georgieva, Managing Director of the International Monetary Fund, COVID-19 means “*a crisis like no other*” (World Economic Forum 2020).

Similar to other crises, the COVID-19 crisis can be both a threat and an opportunity. Since, in the threat perspective, individuals will focus on perceptions of “who we are,” the negative feature of COVID-19 goes to those who are passive and rigid. Since, in the opportunity perspective, individuals will focus on “who we could be,” the positive feature of COVID-19 goes to those who are active and flexible. Therefore, it can be argued that the COVID-19 crisis is a challenge which can be perceived either as a threat or as an opportunity based on the capacity, openness, and willingness to change

(Kovoor-Misra, 2009). Considering the correct lack of a strict legal duty with respect to COVID-19 (except for a few preventive measures), it is up to every business to review its foundations, mission and implied economic, legal, ethical, and other responsibility towards all stakeholders (Sroka & Szántó, 2018). The term “responsibility” has Latin roots, see “*respondere*,” and it means that someone has to answer for the effects caused by the person to an authority, and this authority evaluates its damages (Schüz, 2012). Under ethics, i.e., the theory of morality systematizing moral judgments (Sroka & Lörinczy, 2015), every business considers moral principles in the decision-making process to distinguish between good and bad (Sroka & Szántó, 2018). The perception of these moral and other obligations results in the business understanding of its responsibility and the ultimate dilemma whether to go (merely) for profit maximization or (rather and/or as well) for social and environmental demands (Berman et al., 1999; Małecka et al., 2017). It can be argued that the approach of the business to CSR shapes its actions and that this is even magnified during crises when cultural differences play a crucial role (Lim, 2020). To put it differently, it is proposed that businesses have the responsibility towards the entire society and especially to the society during a crisis, because they touch the lives of all – see concepts developed by Howard R. Bowen (Carroll, 2016). However, this new CSR trend is not anonymously accepted and there are still voices supporting the traditional approach, which identifies only the responsibility of businesses to maximize profits while acting honestly and in good faith (Theodore Levitt) and leaves social and environmental issues to the state or other institutions, but not businesses (Milton Friedman). Indeed, Milton Friedman even questions the business responsibility, as such, while proposing that only natural persons can have a responsibility, but not artificial persons such as corporations (Friedman, 2007). This traditionalist stream naturally implies the survival command for business in a crisis era, i.e., the business should focus on its (economic) survival during the COVID-19 crisis. In contrast, the stakeholder/CSR/social responsibility stream insists on value creation, an improvement of the business’s reputation, and branding as keys for the success (Gallardo-Vázquez et al., 2019) and survival of COVID-19.

This discourse is getting even hotter in respect to the industry arguably built on values, the abundance of resources, and lavish exclusivity – the luxury fashion industry (Cerchia & Piccolo, 2019; MacGregor et al., 2020; MacGregor Pelikánová et al., 2021). Luxury fashion businesses are expected to address challenges in a munificent manner, and these high expectations are shared by their managers (MacGregor et al., 2020a) and employees (MacGregor et al., 2020b) as well as customers (Olšanová et al., 2018), investors and other stakeholders (MacGregor Pelikánová & MacGregor, 2020). A noble long-term vision should prevail over current crisis survival panics (MacGregor Pelikánová

et al., 2021). However, is it true? Or at least do luxury fashion businesses believe in it? How can this be reconciled with already published front-line case studies (Cvik & MacGregor Pelikánová, 2021)? Respecting Friedman's objections about the artificiality of the business will (Friedman, 2007), it is relevant to at least check what is e-declared by the decision-makers and spokespersons of luxury fashion businesses from one jurisdiction in the EU – the websites of top Czech luxury fashion businesses.

3. Methodological approach

The materials and methods used are directly determined by the key purpose and chief objective of this article, i.e., to explore and assess what kind of challenge is the COVID-19 crisis for top businesses from the Czech luxury fashion industry. Namely, to analyze the information provided by the Internet websites of the top 20 Czech luxury fashion businesses in January 2021 and in July 2021 in order to determine how these businesses declare their attitudes to COVID-19 and ultimately what they state about the impact of the COVID-19 crisis on them. The selection of the Internet websites is implied by the official businesses reports regarding 2020 are to be expected in the summer of 2021 or even later (MacGregor Pelikánová, 2021). However, their Internet websites are platforms par excellence to instantly post declarations of a business regarding ongoing events. Naturally, such an exploration and assessment call for a dynamic case study involving both a representative and homogenous sample of businesses from an appropriate industry and their Internet websites. Consequently, the Internet websites of the 20 Czech luxury fashion businesses with the largest turnover are to be researched on how they report about COVID-19 in January and July 2021. Such a case study is to be performed with the employment of Meta-Analysis (Silverman, 2013), which takes advantage of the advanced content analysis done by the expert panel, considers a longitudinal aspect (data from January and July 2021), and includes the field observation via news postings and informal open interviews. The selected advanced text analysis complementarily involves content quantitative and qualitative methods and is perhaps the biggest challenge of this project that relies on the synthesis and teleological interpretations (MacGregor Pelikánová, 2019). This methodologic strategy is founded upon the conviction that more information is available than conventionally admitted and realized (Schmidt & Hunter 2014), especially considering the scientific model of both direct and indirect causality (Heckman 2005), and this applies to the study of Internet pages (MacGregor Pelikánová, 2021). The list of the top 20 luxury fashion businesses based on their turnover in 2018 and 2019 is included in Table 3.1.

Table 3.1. Case Study – Twenty Czech fashion businesses and their key parameters

	Type	Origin	2018 or 2019 Turnover in CZK (mln)	Domain – URL
Alpine Pro	Top outdoor	1994, Brno	735	Alpinepro.cz
Bandi Vamos	Men formal	2012, Ostrava	320	Bandi.cz
Blažek Praha	Men formal	1997, Praha	564	Blazek.cz
E Daniely	Formal	1991, Praha	less than 40	Edaniely.cz
E.L. fashion design	Women formal	2000, Praha	42	Elodevysperky.cz
Evona	Underwear	1992, Chrudim	147	Evona.cz
Kama	Knitwear	1989, Praha	40	Kama.cz
Kara Trutnov	Formal leather	1997, Trutnov	351	Kara.cz
Koutný Prostějov	Men formal	1995, Prostějov	435	Koutny.cz
Litex	Sportwear	1991, Litomyšl	Less than 40	Litex.cz
Modestia	Formal	1996, Praha	Less than 40	Modestia.cz
Moira	Underwear	2001, Praha	97	Moira.cz
Pietro Filipi	General fashion	1998, Praha	431	Pietro-filipi.com
Pleas	Underwear	1994, Havlíčkův Brod	1 059	Pleas.cz
Styx	Underwear	1996, Praha	12	Styx-underwear.cz
Timo	Underwear	1992, Praha	120	timo.cz
Tonak	Hats	1990, Nový Jičín	436	tonak.cz
Triola	Underwear	1994, Praha	138	Triola.cz
Verino	Formal	1996, Brno	less than 40	Verino.cz
Volansky Fashion	Formal	1996, Hodonín	55	volansky.cz

Source: prepared by the Author based on her own research of the Internet – domains of businesses and justice.cz

Therefore, the quantitative content analysis based on automatic word scanning is rejected; instead, the qualitative content analysis based on reading via a simplified panel Delphi method (with a manual scoring by a panel of three experts) is used with respect to a large part of the segment of Czech luxury fashion businesses. Three experts on Internet websites posting which have a strong background in law and economics (RKM, EDC, LM), one male and two females, are to conduct the advanced content analysis (Kuckartz, 2014) of these 20 Internet websites while employing the manual Delphi-approach and following the teleological interpretation (MacGregor Pelikánová et al., 2021). The logically pre-selected key words are “COVID,” “COVID-19,” “coronavirus,” and “face masks,” and they need to be appreciated in their context. The used scoring is (+) or (++) or (+++) regarding the opportunity and (-) or (--) or (---) regarding the threat, while the following a universal set of guidelines prepared by the Author. Namely, weak, general and/or not verifiable statements received (+), while moderately concrete and verifiable got (++) and detail-oriented, verifiable, and actionable earned (+++) (Van Tulder

et al., 2016). Thus, their scoring met the expertise expectations, and possible heuristic shortcomings were overcome after cleaning scoring discrepancies in the first and second rounds. Since this was done twice by the same panel, a comparison of January v. July 2021 is possible and further supports glossing (Hyland, 2007) and Socratic questioning (Areeeda, 1996).

4. Results

The Internet website of each of the 20 Czech luxury fashion businesses was approached and the included information was analyzed and scored with respect to the key words “COVID,” “COVID-19,” “coronavirus,” and “face masks” and their context. Namely, declarations regarding the COVID-19 crisis were analyzed to determine what kind of challenge is perceived. This was done twice by the same panel of three experts – in January 2021 and in July 2021. The simplified panel Delphi method, the advanced content text analysis brought highly interesting results offering a pathway for a relevant discussion. Table 3.2 indicates whether and how COVID-19/coronavirus/face masks were mentioned by these Internet websites on January 5th, 2021.

Table 3.2. Information related to the COVID-19/coronavirus/face masks on Internet pages – January 2021

	COVID/coronavirus/face masks	Opportunity	Threat
Alpine Pro	Offering COVID gel – business (CZK 99)	+	
Bandi Vamos	0		-
Blažek Praha	0		-
E Daniely	0		-
E.L. fashion design	Offering face masks – business (CZK 260)	+	
Evona	Offering face masks for FREE (Chrudim) – local charity	+++	
Kama	Offering face masks – business (CZK 160)	+	
Kara Trutnov	0		-
Koutný Prostějov	0		-
Litex	Offering face masks – business (CZK 99)	+	
Modestia	0		-
Moira	Offering face masks – business (CZK 100)	+	
Pietro Filipi	Offering face masks – business (CZK 130)	+	
Pleas	Offering face masks – business (5 for CZK 250)	+	
Styx	Offering face masks – business (4 for CZK 299)	+	

	COVID/coronavirus/face masks	Opportunity	Threat
Timo	Offering face masks – business (CZK 199)	+	
Tonak	0		-
Triola	Offering SPECIAL nano face masks – Czech patent (1 mask + 10 filters = CZK 299)	+++	
Verino	0		-
Volansky Fashion	0		-

Source: prepared by the Author based on her own research of the Internet – domains of businesses and the Panel scoring.

Longitudinal comparative dynamics are facilitated by the same process performed in July 2017. Table 3.3 indicates whether and how COVID-19/coronavirus/face masks were mentioned by these Internet websites on July 17, 2021. Already a cursory overview of the results and Tables 3.2 and 3.3 reveal a set of important implications, such as that there are no massive changes, that COVID-19 is more a threat than an opportunity, and that consequences can be fatal.

Table 3.3. Information related to the COVID-19/coronavirus/face masks on Internet pages – July 2021

	COVID/coronavirus/face masks	Opportunity	Threat
Alpine Pro	Offering COVID gel – business (CZK 99)	+	
Bandi Vamos	0		-
Blažek Praha	0		-
E Daniely	0		-
E.L. fashion design	0		-
Evona	A number of various respirators on sale	+++	
Kama	0		-
Kara Trutnov	At the edge of bankruptcy – hopefully saved		---
Koutný Prostějov	0		-
Litex	Offering face masks – business (CZK 99)	+	
Modestia	0		-
Moira	0		-
Pietro Filipi	Probably bankruptcy and dissolution		---
Pleas	0		-
Styx	0		-
Timo	0		-

	COVID/coronavirus/face masks	Opportunity	Threat
Tonak	0		-
Triola	Offering SPECIAL nano face masks – Czech patent (50 filters for CZK 799 and 10 for CZK 199)	+++	
Verino	0		-
Volansky Fashion	0		-

Source: prepared by the Author based on her own research of the Internet – domains of businesses and the Panel scoring.

Further, such a content analysis overview is complemented by the field observation via news postings and informal open interviews. Namely, the shopping premises of these businesses were contacted and visited by the Author, who engaged in informal discussions about how pertinent insiders perceive COVID-19, its impact, and generally changes recently brought about. These meetings were similar and could be summarized as intimating that COVID-19 means a reduction in sales and the consequent increasing job insecurity, but that, hopefully, it will end, and things will return to how they were before. A partial report about them has already been published and provides a grim message (Cvik & MacGregor Pelikánová, 2021). Consequently, the COVID-19 crisis appears *prima facie* as an ongoing negative challenge for the Czech Luxury Fashion Industry which should end so that things can turn back to normal. These worrisome results call for a discussion and further elaboration.

5. Discussion

The COVID-19 crisis has truly impacted in a negative manner the Czech luxury fashion industry. In January 2021, only two of the 20 businesses studied (Evona and Triola) indicated via their Internet websites how COVID-19 is a positive challenge for them – either to engage more in CSR (Evona) or to engage more in R&D and bring new patented inventions (Triola). It can be argued that for nine of these 20 businesses, COVID-19 was an impulse to slightly modify, or possibly expand, their production, selling face masks, and somehow manage to survive. For the remaining nine, COVID-19 was a mere threat that should not be mentioned very much. Similar to American organizations and their reluctance to engage in a crisis explanation and to apologize for the crisis inconveniences (Lim, 2020), the majority of the top Czech luxury fashion businesses were rather passive *vis-à-vis* COVID-19 in January 2021, and three of them feared the worse without declaring any survival strategies (Blažek, Kara, Pietro Filipi) (MacGregor Pelikánová, 2021).

Sadly, in July 2021, the Internet websites of these businesses have not provided a more positive and pro-active message. Although the Czech society has rejoiced due to the improving COVID-19 status (fewer people in hospitals and more people vaccinated), Czech luxury fashion businesses have not transferred this optimism into their Internet websites, and the number of businesses addressing the COVID-19 crisis as an opportunity for more CSR and inventiveness remains the same – two (Evona, Triola). Even worse, the group of nine businesses at least doing a little (face masks) has shrunk to two businesses (Alpine, Litex). Therefore, in July 2021, Czech luxury fashion businesses were even less inclined to declare COVID-19 as an opportunity than in January 2021, despite the better pandemic status. To make matters even worse, the three businesses fearing the worst have indeed faced it (Blažek, Kara, Pietro Filipi), and currently, it appears that, of these three, Kara has perhaps the best chance at surviving, but still it cannot be ruled out, that all three will disappear due to insolvency. This grim message, conveyed by prior front-line case studies (Cvik & MacGregor Pelikánová, 2021) as well as websites, is confirmed by a passive and resigned attitude implied by the field observation via news postings and informal open interviews. Namely, owners, managers, and even employees of these businesses are inclined to passively wait until COVID-19 disappears so that they can return to the prior manner of operations.

In sum, despite the plethora of academic literature advancing the opportunity features of crises (D'Adamo & Lupi, 2021; MacGregor Pelikánová et al., 2021), the COVID-19 crisis was and remains a negative challenge with threatening parameters for the Czech luxury fashion industry. Hence, despite the special aspects of the luxury fashion industry arguably pre-disposing it to use crises for reinforcement of its value and further progress (MacGregor Pelikánová, 2021), the top Czech luxury fashion businesses have retreated to a passive role and have suffered negative consequences. This complies with the proposition that a crisis is a threat for those who passively hover over “who we are” but becomes an opportunity for those moving towards “who we could be” (Kovoor-Misra, 2009). The COVID-19 crisis and the availability of their Internet websites offers every business the option to declare a positive and pro-active commitment, and ideally, to pursue it. However, only 10% of the studied businesses have done it, and unsurprisingly, they are exiting the COVID-19 pandemic era stronger. Their choice of CSR and inventiveness has proven to be the ticket for the future. This inevitably leads to a simple question - Why have the other 90% not done it? And a perhaps heretical and rhetorical question follows – Do they deserve to survive since they have violated all that we expect from the luxury fashion industry?

6. Conclusions

The COVID-19 crisis has a global dimension while impacting every business in the EU, including businesses from industries reputable for their stability, perpetuity, and abundant resources, such as the luxury fashion industry. Despite high expectations due to the value determination and alleged resources availability of the top Czech luxury fashion businesses, a longitudinal deeper case study revealed a disappointing message. Namely, the top 20 Czech luxury fashion businesses, based on their turnover, indicate via their self-declarations on their Internet websites that COVID-19 is a negative challenge for them, rather a threat than an opportunity. The passivity detected in January 2021 became even stronger in July 2021, while basically, the worst happened for three of these 20 businesses. In contrast, only two of these businesses were and remain pro-active and positively perceived the COVID-19 crisis as an opportunity – to be more CRS and more inventive.

These conclusions follow prior theoretic findings, and so, it is even more surprising that Czech luxury fashion businesses keep ignoring clear academic guidance about how to address crises. At the same time, these conclusions have inherent limitations, and it must be stressed that the sample included only twenty Czech luxury fashion businesses and their Internet websites in January and July 2021. Therefore, it is highly desirable to continue these case studies by expanding the pool of businesses, exploring the information provided by various stakeholders, adding more jurisdictions, and progressing in the timeline.

Acknowledgment

This research and resulting article are the outcomes of Metropolitan University Prague research project no. 87-02 “International Business, Financial Management and Tourism” (2021) based on a grant from the Institutional Fund for the Long-term Strategic Development of Research Organizations. The Author is grateful for the ongoing institutional support arranged by the Centre for Research Support at the Metropolitan University Prague, especially Dr. Tereza Vogeltanzová and Ing. Hana Raková, and highly relevant useful comments and suggestions provided during the peer-review.

References

- Arceda, P. E. (1996). The Socratic method. *Harvard Law Review*, 109(5), 911–922.
- Armani, A.M., Hurt, D.E., Hwang, D., McCarthy, M.C., & Scholtz, A. (2020). Low-tech solutions for the COVID-19 supply chain crisis. *Natural Review Materials*, 5, 403–406. <https://doi.org/10.1038/s41578-020-0205-1>
- Ashford, N.A., Hall, P., Arango-Quiroga, J., Metaxas, K.A., & Showalter, A.L. (2020). Addressing inequality: The first step beyond COVID-19 and towards sustainability. *Sustainability*, 12(13), 5404. <https://doi.org/10.3390/su12135404>
- Balcerzak, A., & MacGregor Pelikánová, R. (2020). Projection of SDGs in codes of ethics – Case study about lost in translation? *Administrative Sciences*, 10(4), 1–18. <https://doi.org/10.3390/admsci10040095>
- Bali, S., & Fan, Y.W. (2019). Achieving sustainable development goals: Predicaments and strategies. *International Journal of Sustainable Development, and World Ecology*, 27, 96–106. <https://doi.org/10.1080/13504509.2019.1692316>
- Berman, S.L., Wicks, A.C., Kotha, S., & Jones, T.M. (1999). Does stakeholder orientation matter? The relationship between stakeholder management models and firm financial performance. *The Academy of Management Journal*, 42, 488–506. <https://doi.org/10.5465/256972>
- Carroll, A.B. (2016). Carroll's pyramid of CSR: Taking another look. *International Journal of Corporate Social Responsibility*, 1, 3. <https://doi.org/10.1186/s40991-016-0004-6>
- Cerchia, R.E., & Piccolo, K. (2019). The ethical consumer and codes of ethics in the fashion industry. *Laws*, 8, 23. <https://doi.org/10.3390/laws8040023>
- Cvik, E.D., & MacGregor Pelikánová, R. (2021). The significance of CSR during COVID-19 pandemic in the luxury fashion industry – A front-line case study. *European Journal of Business Science and Technology*, 7(1), 109–129. <https://doi.org/10.11118/ejobsat.2021.005>
- D'Adamo, I., & Lupi, G. (2021). Sustainability and resilience after COVID-19: A circular premium in the fashion industry. *Sustainability*, 13(4), 1861. <https://doi.org/10.3390/su13041861>
- Friedman M. (2007). The social responsibility of business is to increase its profits. In W.C. Zimmerli, M. Holzinger & K. Richter (Eds.), *Corporate Ethics and Corporate Governance*. Berlin, Heidelberg: Springer. https://doi.org/10.1007/978-3-540-70818-6_14
- Gallardo-Vázquez, D., Valdez-Juárez, L.E., & Castuera-Díaz, A.M. (2019). Corporate social responsibility as an antecedent of innovation, reputation, and competitiveness success: A multiple mediation analysis. *Sustainability*, 11(20), 5614. <https://doi.org/10.3390/su11205614>
- Hasan, B., Mahi, M., Sarker, T., & Amin, M.R. (2021). Spillovers of the COVID-19 pandemic: Impact on global economic activity, the stock

- market, and the energy sector. *Journal of Risk and Financial Management*, 14(5), 200. <https://doi.org/10.3390/jrfm14050200>
- Heckman, J.J. (2005). The scientific model of causality. *Sociological Methodology*, 35, 1–98.
- Hoskins, T. (2014, October 1). Cotton production linked to images of the dried up Aral Sea basin. Guardian–Sustainable business. Retrieved from <https://www.theguardian.com/sustainable-business/sustainable-fashion-blog/2014/oct/01/cotton-production-linked-to-images-of-the-dried-up-aral-sea-basin>
- Hyland, K. (2007). Applying a gloss: Exemplifying and reformulating in academic discourse. *Applied Linguistics*, 28(2), 266–285. <https://doi.org/10.1093/applin/amm011>
- Jones, P., & Comfort, D. (2020) The COVID-19 crisis, tourism and sustainable development. *Athens Journal of Tourism*, 7(2), 75–86. <https://doi.org/10.30958/ajt/v7i2>
- Kovoor-Misra, S. (2009). Understanding perceived organizational identity during crisis and change: A threat/opportunity framework. *Journal of Organizational Change Management*, 22(5), 494–510. <https://doi.org/10.1108/09534810910983460>
- Kuckartz, U. (2014). *Qualitative Text Analysis—A Guide to Methods, Practice and Using Software*, 1st ed. London: SAGE.
- Lim, J.R. (2020). How organizations in different cultures respond to crises: Content analysis of crisis responses between the United States and South Korea. *International Journal of Strategic Communication*, 14(4), 294–316. <https://doi.org/10.1080/1553118X.2020.1812613>
- MacGregor, R.K., Sroka, W., & MacGregor Pelikánová, R. (2020a). A comparative study of the low managers attitude to marketing and innovations in luxury fashion industry: Pro - or anti-CSR? *Polish Journal of Management Studies*, 21(2), 240–255. <https://doi.org/10.17512/pjms.2020.21.2.17>
- MacGregor, R.K., Sroka, W., & MacGregor Pelikánová, R. (2020b). The CSR perception of front-line employees of luxury fashion businesses: Fun or free for sustainability? *Organizacija*, 53(3), 198–211. <https://doi.org/10.2478/orga-2020-0013>
- MacGregor Pelikánová, R. (2019). Corporate social responsibility information in annual reports in the EU - Czech case study. *Sustainability*, 11(1), 237. <https://doi.org/10.3390/su11010237>
- MacGregor Pelikánová, R. (2021). COVID-19 as an impulse for a sustainable, socially responsible and ethical Czech luxury fashion industry? In J. Duháček Šebestová, R. Sperka, P. Suchánek (Eds.), *3rd International Conference on Decision Making for Small and Medium-Sized Enterprises (DEMSME). Conference Proceedings* (pp. 362-370). Karviná: Silesian University in Opava, School of Business Administration in Karviná.

- MacGregor Pelikánová, R., Němečková, T., & MacGregor, R.K. (2021). CSR statements in international and Czech luxury fashion industry at the onset and during the COVID-19 pandemic – Slowing down the fast fashion business? *Sustainability*, 13(7), 3715. <https://doi.org/10.3390/su13073715>
- MacGregor Pelikánová, R., & MacGregor, R.K. (2020). The EU puzzling CSR regime and the confused perception by ambassadors of luxury fashion businesses: A case study from Pařížská. *Central European Business Review*, 9(3), 74–108. <https://doi.org/10.18267/j.cebr.240>
- Małecka, J., Łuczka, T., Šebestová, J., & Šperka, R. (2017). Economic activity and social determinants versus entrepreneurship in SMEs – Selected aspects. *Copernican Journal of Finance & Accounting*, 6(3), 47–61. <https://doi.org/10.12775/CJFA.2017.016>
- Manojkrishnan, C.G., & Aravind, M. (2020). Covid -19 pandemic and its impact on labor force: A new model based on social stress theory and prospect theory. *Scientific Articles of the University of Pardubice, Series D: Faculty of Economics and Administration*, 28(3), 1070. <https://doi.org/10.46585/sp28031070>
- McMaster, M., Nettleton, C., Tom, C., Xu, B., Cao, C., & Qiao, P. (2020). Risk management risk management: Rethinking fashion supply chain management for multinational corporations in light of the COVID-19 outbreak. *Journal of Risk and Financial Management*, 13(8), 173. <https://doi.org/10.3390/jrfm13080173>
- Meadows, D.H., Randers, J., & Meadows, D.L. (1972). *The Limits to Growth*. New York, USA: Universe Books.
- Niinimäki, K., Peters, P., Dahlbo, H., Perry, P., Rissanen, T., & Gwilt, A. (2020). The environmental price of fast fashion. *Nature Reviews Earth & Environment*, 1, 189–200. <https://doi.org/10.1038/s43017-020-0039-9>
- Olšanová, K., Cook, G., Zlatic, M. (2018). Influence of luxury companies' corporate social responsibility activities on consumer purchase intention: Development of theoretical framework. *Central European Business Review*, 7(3), 1–25. <https://doi.org/10.18267/j.cebr.200>
- Pardal, P.D., Dias, R., Šuleř, P., Teixeira, N., & Krulický, T. (2020). Integration in Central European capital markets in the context of the global COVID-19 pandemic. *Equilibrium. Quarterly Journal of Economics and Economic Policy*, 15(4), 627–650. <https://doi.org/10.24136/eq.2020.027>
- Rasool, S.A., & Fielding, B.C. (2010). Understanding human coronavirus HCoV-NL63. *Open Virology Journal*, 58(7), 76–84. <https://doi.org/10.2174/1874357901004010076>
- Schmidt, F.L., & Hunter, J.E. (2014). *Methods of Meta-Analysis—Correcting Error and Bias in Research Findings*, 3rd ed. London: SAGE.
- Schüz, M. (2012). Sustainable corporate responsibility – the foundation of successful business in the new millennium. *Central European Business Review*, 1(2) 7–15. <https://doi.org/10.18267/j.cebr.12>

- Silverman, D. (2013). *Doing Qualitative Research—A Practical Handbook*, 4th ed. London: Sage.
- Sroka, W., & Lörinczy, M. (2015). The perception of ethics in business: Analysis of research results. *Procedia Economics and Finance*, 34, 156–63.
- Sroka, W., & Szántó, R. (2018). Corporate social responsibility and business ethics in controversial sectors: Analysis of research results. *Journal of Entrepreneurship, Management and Innovation*, 14(3), 111–26. <https://doi.org/10.7341/20181435>
- Turečková, K., & Nevima, J. (2020). The cost benefit analysis for the concept of a smart city: How to measure the efficiency of smart solutions? *Sustainability*, 12(7). <https://doi.org/10.3390/su12072663>
- Valero, G. (2020, September 16). Von der Leyen outlines path towards ‘new vitality’ in post-corona world. Euractive. Retrieved from <https://www.euractiv.com/section/future-eu/news/von-der-leyen-outlines-path-towards-new-vitality-in-post-corona-world/>
- Van Tulder, R., Seitanidi, M.M., Crane, A., & Brammer, S. (2016). Enhancing the impact of cross-sector partnerships. Four impact loops for channeling partnership studies. *Journal of Business Ethics*, 135, 1–17. <https://doi.org/10.1007/s10551-015-2756-4>
- Van Tulder, R., & Keen, N. (2018). Capturing collaborative challenges: Designing complexity-sensitive theories of change for cross-sector partnerships. *Journal of Business Ethics*, 150, 315–332. <https://doi.org/10.1007/s10551-018-3857-7>
- World Economic Forum. (2020, April 4). COVID-19: What you need to know about the coronavirus pandemic on 4 April. Retrieved from <https://www.weforum.org/agenda/2020/04/covid-19-what-to-know-about-the-coronavirus-pandemic-on-4-april/>

Biographical note

Radka MacGregor Pelikánová (JUDr., Ph.D., LL.M., MBA) graduated from the Law School at Charles University Prague (J.D., Ph.D.), from the Wayne State University (LL.M.) and from the National American University (MBA) and has passed the Czech Bar Exam and Michigan Bar Exam. She has been practicing law and advising state institutions, including the Ministry for Agriculture, and businesses for over two decades. Since 2011, she has been a senior faculty member at Metropolitan University Prague and Anglo-American University with expertise in the law, economics, management, business and intellectual property. She is a prolific writer, an academic lecturer for a myriad of courses and a lawyer licensed to practice in the EU and USA (Orcid 0000-0001-9628-7146, Researcher ID: G-2601-2018, Scopus ID: 56021587200).

Citation (APA Style)

MacGregor Pelikánová, R. (2021). The impact of the COVID-19 crisis on the Czech luxury fashion industry, In A. Ujwary-Gil & B. Godlewska-Dzioboń (Eds.), *Challenges in Economic Policy, Business, and Management in the COVID-19 Era* (pp. 61–77). Warsaw: Institute of Economics, Polish Academy of Sciences.

Importance of knowledge management in COVID-19 pandemic: A case of small and medium-sized enterprises

Tereza Horáková¹, Kateřina Maršíková²

Abstract

In the last decade, knowledge management (KM) has been a widely discussed phenomenon in the business environment. The chapter maps the knowledge management concept and knowledge sharing behavior, emphasizing small and medium-sized enterprises (SMEs). The chapter is based on the literature review related to the topic in general and specifically for SMEs, which analyses secondary data in this area. The concept is supported by the primary data gained by the authors' qualitative research (in-depth interviews) in Czech SMEs, given the impact of the current pandemic on knowledge sharing. The first part provides a general overview of the literature related to factors and motivation of knowledge sharing and training in knowledge management. Moreover, there were identified factors that affect the knowledge sharing environment in SMEs in connection with the COVID-19 pandemic. The pilot research and secondary data evaluation contributed to knowledge-sharing practices, mapping new challenges, which brought the situation in the last two years. The study identified the main factors facilitating effective knowledge management in SMEs and showed its importance, especially in these turbulent times. The value of the chapter is in linking the concept of knowledge management and sharing in the hybrid world of work and concerning the specifics of SMEs. Based on the findings, implications for SME business owners and leaders were highlighted. Despite some limitations for generalizing the results, it contributes to the up-to-date topic of knowledge sharing from the perspective of SMEs. It gives a space for future quantitative research in KM behavior in SMEs.

1 Tereza Horáková, Ph.D. Candidate, Department of Business Administration and Management, Faculty of Economics, Technical University of Liberec, Studentská 1402/1, Liberec 1, 46017, Czech Republic, e-mail: tereza.horakova3@tul.cz (ORCID: 0000-0002-3025-2554).

2 Kateřina Maršíková, Doc. Ing. Ph.D., Department of Business Administration and Management, Faculty of Economics, Technical University of Liberec, Studentská 1402/1, Liberec 1, 46017, Czech Republic, e-mail: katerina.marsikova@tul.cz (ORCID: 0000-0003-2306-2303).

This is an open access article under the CC BY license (<https://creativecommons.org/licenses/by/4.0/legalcode>).

Keywords: *decision making, knowledge management, knowledge sharing, small and medium-sized enterprises, COVID-19 pandemic, company culture.*

1. Introduction

The organization's performance is mainly attributed to its available knowledge and information. Successful organizations are considered those that can learn and absorb new knowledge and do it quickly (Ramírez et al., 2011). Moreover, in such a turbulent environment as we have been experiencing in the pandemic in 2020 and 2021, learning and development, which supports increasing and sharing knowledge, play a crucial role. Organizations are aware of the importance of managing knowledge as a significant aspect of intellectual and human capital. Many organizations address to benefits of knowledge management. If knowledge is appropriately managed, it can help organizations to improve and maintain their competitiveness. Abzari and Teimouri (2008) stated that society's ability to integrate, transfer and apply new knowledge determines the level of organizational innovation, such as the company's ability to respond effectively and faster to potential challenges or further information. Currently, the company's biggest challenge connected to knowledge management and sharing is probably the transition to remote work and quick adaptation in personnel and equipment areas. Hsieh et al. (2020) mentioned that knowledge management could play a vital role in the ongoing COVID-19 pandemic. The precise implementation of knowledge management could lead organizations to survive during a crisis while supporting the successful performance of the entire once.

The chapter is organized as follows: firstly, the literature review introduces important terms in knowledge management and the knowledge-sharing process. Several studies in knowledge management and knowledge sharing are presented in the literature review, specifically related to SMEs. The methodology describes the secondary and primary data collection and its analysis. The chapter aims to answer both in the literature review and by presenting data to the following research questions: Which factors influence the implementation of knowledge management? What barriers related to knowledge management barriers exist in SMEs? And how does the knowledge-sharing culture look like in the SME environment? Key findings of the primary analysis and the comparison with the existing researches are presented in the results, followed by the discussion part, including limitations and following perspectives of the research.

Topics of knowledge management and knowledge sharing were identified both in the literature review and by experts as crucial elements for maintaining the successful operation of the organization and effective leadership. Moreover, a research gap in knowledge management and sharing in SMEs was identified from the general point of view. Small and medium-sized enterprises (SMEs) play an essential role in the European economy, and in the Czech Republic, they belong to leading employers (AMSP, 2021). On the other hand, SMEs provide a specific environment for knowledge management and face unique challenges that differ from their larger competitors. In the literature, it is often encountered that SMEs implement knowledge management approaches initially developed for larger companies. This procedure involves the risk that smaller companies will lose their typical characteristics or face a lack of capacities or sources.

Secondary data analysis has shown that knowledge management studies conducted in SMEs are often carried out only in a selected sector. There do not exist many general studies that examine knowledge management factors and knowledge sharing behavior of SMEs across various sectors. The primary data source used to introduce knowledge management topics from the authors' point of view is a qualitative data collection obtained during the in-depth interviews with business owners in January, March, and May in 2021 and aim to map the knowledge management situation in various sectors. Based on the secondary data and pilot qualitative survey analysis, the chapter emphasizes the importance of knowledge management implementation in SMEs. It contains possible factors that may affect the performance of knowledge management in SMEs and barriers to implementation and techniques supporting knowledge sharing in the organization. It is crucial to acknowledge the importance of a company's knowledge management culture. Knowledge sharing and knowledge transfer contribute to the benefits of SMEs. Namely, it supports a strategic focus on human resources, support and positive impacts on decision-making, organizational training, customer relationships, creativity, and higher profits (Anand et al., 2021). The key findings from the literature are also proved by the main results of qualitative data gained by the in-depth interviews. Secondary data overview are complemented by current trends and challenges related to the pandemic.

2. Literature review

2.1. Knowledge management and knowledge sharing perspective

Marr et al. (2003) define knowledge management as a collective name for a group of processes and practices used by an organization to increase its

value by increasing the efficiency of its intellectual capital. In other words, knowledge management is a process that facilitates knowledge sharing behavior and introduces learning as a continuous process of the organization (Singh, 2008). Abubakar et al. (2019) state that knowledge management consists of the following operations: knowledge creation, capturing knowledge, knowledge organization, preservation of knowledge, knowledge sharing, and application of knowledge. Based on the existing literature on knowledge management practices, there seem to be two primary sets of such practices widely employed in organizations. One is related to information technology and computer-supported communication, and the other is related to human resource management. Both procedures mentioned above, KM enables managing knowledge effectively (Andreeva & Kianto, 2012).

Furthermore, there are several debates on whether knowledge management and knowledge-sharing practices should be people or technology-driven. Authors of the management discipline usually declare that knowledge sharing is mostly about people and adaptations of the workplace rather than the technology itself (Riege, 2005). However, in the turbulent working environment in last month, it is impossible to imagine knowledge management without technology, and they are an integral part of it. According to Becerra-Fernandez and Sabherwal (2015), knowledge sharing is described as a process when an individual disseminates knowledge (i.e., know-what, know-how, and know-why) to others. Knowledge sharing is not only based on face-to-face communication but also through virtual sharing media such as social media (Arief et al., 2018). The process of knowledge sharing, also known as the knowledge dissemination process, is defined as the transfer of knowledge between individuals, groups, or organizations through various means of communication or communication channels (Alavi & Leidner, 2001; Abubakar et al., 2019). Other authors define knowledge sharing as a behavior set that involves exchanging information or helping others (Connelly & Kelloway 2003; Abubakar et al., 2019). Riege (2005) differentiates knowledge sharing into four modes of knowledge conversion:

- 1) Socialization mode: it begins with skills and experiences shared through imitations and observations. In other words, tacit knowledge is created based on another person's tacit knowledge.
- 2) Externalization mode: means that tacit knowledge is transformed into explicit knowledge by using models, book or manuals concepts, metaphors, dialogues.
- 3) Combination mode: transferring existing explicit knowledge by information analysis and re-organization from one area to another within the organization (with the help of the technology).

4. Internalization: the transformation of the explicit knowledge into the tacit one with the usage of actually gained experience.

Effective knowledge sharing offers an organization a chance to maximize its capacity to meet its needs and solutions that may ensure competitiveness (Ramírez et al., 2011; Ha et al., 2016; Abubakar et al., 2019). Wong (2005) identified factors that could influence the successful knowledge management implementation, and they are as follows: company's culture, the use of IT technology, and leadership. Many managers and professionals are using knowledge management as they are aware of its benefits on decision-making if there are more profound insights and more knowledge at hand (ALAmeri, 2015). For example, Abubakar et al. (2019) stated a direct link between knowledge management and proper decision making because decision-making involves an organizational, group, and individual level as knowledge management does. Nonaka (1991) classified knowledge as tacit and explicit, working independently and leading organizations to success. A company's tacit and explicit knowledge management is essential for effective decision-making (ALAmeri, 2015).

Tacit knowledge is commonly associated with cognitive skills, such as intuition, mental models, or know-how. It could also be defined as a skill acquired by the repetition of practical activities. Thus, it can be said that tacit knowledge is rooted in the various activities we perform, in the procedures we follow, and in the values we share. Tacit knowledge is being used without expressing it verbally as it is often used unconsciously (Nonaka, 1991). There are specific ways to share tacit knowledge, including mentoring, storytelling, prototyping, or using metaphors (Cho et al., 2020). Tacit knowledge can contribute to a sustainable competitive advantage in organizations due to barriers to duplication by a company's competitors (Gamble, 2020). Compared to that, explicit knowledge could be defined as objective or rational knowledge that can be expressed in various forms, e. g. verbally, numerically, or by mathematical formulas (Cho et al., 2020). Explicit knowledge could be easily shared, which could positively acquire and apply knowledge to workers. According to Abubakar et al. (2019), two decision-making styles are being used:

- intuitive decision-making style;
- rational decision-making style.

Intuition strengthens available information and ensures faster decision-making based on data and knowledge gained from previous experience and similar situations (Wray, 2017). In the case of a rational decision-making style, researchers argue that there is a need to accurately identify the object of

research, generate possible solutions, select the solution that is most likely to be implemented, and finally apply the chosen solution and evaluate the result it brought. At the same time, each decision step is influenced by knowledge management, as experts impartially analyze all the available information to decide (Abubakar et al., 2019). ALAmeri (2015), in his study, proved there is a significant association between knowledge management system, its practices and decision-making. Knowledge management systems need time, and organizations should adopt them for internal and strategic decision-making. These elements were further used in the chapter to create the in-depth interview and the analysis of primary data in the case study in the next part.

2.1. Factors and motivation of knowledge sharing

Based on the literature review, critical elements of successful knowledge sharing were identified as follows:

- implementation of knowledge management;
- preparedness of organizations;
- knowledge-sharing culture;
- tools used for knowledge sharing.

Factors influencing the implementation of knowledge management and supporting the company's knowledge sharing behavior could include employees' **willingness to cooperate and share** their knowledge within a work team. Since much of the organizational knowledge lies at the individual level, it is crucial to promote a **knowledge-sharing culture**. However, organizations often tend to adjust their culture to their knowledge sharing practices instead of implementing knowledge sharing practices in a way that would fit their company's culture (Riege, 2005).

Internal collaboration among members within the organization is a natural way to generate organizational knowledge. For example, informal interactions and unplanned encounters, i. e. colleagues talking in the hallway or the kitchen, foster the sharing of tacit knowledge and provide a starting point through which employees collaborate on areas of shared interest. It thereby leads to organizational silos bridging and to more robust social networks. Both tacit and explicit knowledge can be encouraged by a set of collaborative HRM practices as team collaborations allow several individuals' knowledge to be combined, which is essential for creating collective knowledge (Antunes & Pinheiro, 2020). If an individual leaves the company, there is the risk of losing specific knowledge. The knowledge would not stay within the organization as it was not transferred to the organization so

that others could access it as knowledge is the result of learning (Antunes & Pinheiro, 2020; Ipe 2003; Argote & Miron-Spektor 2011). For supporting employee willingness to knowledge-sharing, it is necessary to communicate the benefits of knowledge-sharing and the value of individual and group-based accomplishments (Riege, 2005). As Al-Busaidi et al. (2010) found out, sharing knowledge within the organization brings significant personal benefits, such as improvement of individual's reputation, work status and performance, and knowledge sharing experience.

Knowledge and information usually exist in different individuals, meaning that organizations must consider increasing the capacity of individuals and organizational knowledge enhancers, which will lead the organization to the development of strategic management of people (Antunes & Pinheiro, 2020).

Chugh (2012) mentions the following **factors of motivation** to share knowledge and stay within the organization: employee rewards systems: either compensations or promotions, or providing employees with challenging assignments, better work conditions, and job redesign. Andreeva a Kianto (2012) stated three aspects of human resource management that shape knowledge and people flow:

- employee selection methods: to ensure that newly hired employees have the required knowledge and skills and can adapt to the organization's knowledge and competencies process;
- compensation strategies: tangible and intangible benefits could enhance employee's knowledge sharing behavior.
- career development systems: this aspect contains systematic training and development of the employees and the retention of exceptional employees who possess the crucial tacit knowledge and would weaken an organization when leaving without transferring their knowledge to other employees.

Choi et al.'s (2008) results of the social and technical enablers from a socio-technical perspective points out the following enablers that are associated with knowledge sharing:

- intrinsic rewards, for example, praise and public recognition, and extrinsic rewards, such as bonuses. The extrinsic reward may seem to be relatively easier to acquire compared with the intrinsic ones. Still, based on the study results, the association between intrinsic reward and knowledge sharing is stronger than the association between extrinsic reward and KS;

- trust is another enabler enhancing the knowledge sharing behavior between colleagues. If there is a belief in other employees' expertise and skills, sharing personal knowledge is a more significant intention.

2.3. Role of training and development in knowledge management process

As stated above, systematic **training and development of the employees** could ensure that crucial tacit knowledge would stay within the organization if some of the employees who possess such knowledge leave the company without transferring the knowledge to others. According to Argote & Miron-Spektor (2011, p. 5): "*Organization learning is a change in the organization that occurs as the organization acquires experience.*" The experience could also be called knowledge embedded in individuals, repositories, routines, or memory systems, depending on the type of knowledge. Many authors have emphasized the importance of professional development of individuals to enhance organizational learning and development as acquiring new skills would be beneficial for organizations in knowledge creation, capture, and therefore sharing (Argote & Miron-Spektor, 2011). According to Chugh (2012), based on Evans (2003), the Human Resource department needs to create and cultivate a company's culture that would support knowledge creation and sharing, and value and support employee learning and development. Creation of a work environment where learning and sharing knowledge is a part of the company's culture is in the competence of management (Chugh, 2012). Based on Czarnecka & Daróczy (2017), companies should care about employees' learning and development because employees' knowledge and newly acquired competencies and skills represent the source of the organization's innovation, especially in today's fast-paced environment world. Based on Antunes & Pinheiro (2020), organizational learning is considered a dynamic process based on knowledge. Hislop et al. (2018) suggest companies invest in training with a broader purpose of enhancing learning through experimenting and learning how to conduct critical dialogues. Thanks to learning and development, employees who undertake the training could develop interpersonal relations that may support these people to share knowledge in the future (Monks et al., 2016).

Furthermore, knowledge and learning determine the creation of new knowledge if framed by the company's management. Knowledge is also a valuable source for training and development of the new and current employees; therefore, the knowledge must be searchable and available to serve various organization's needs. For using the knowledge full potential, it is necessary to deploy them in learning offerings of the organizations, i.e. in orientations and employees' training, in knowledge-sharing events with

the third party, and so on. Integration of knowledge-sharing training for the new employees could effectively embed knowledge-sharing habits in the organization. Unless employees are trained in participating and sharing their knowledge, there would be no benefit of knowledge-sharing initiatives (Janus, 2016). According to Wichtowska (2019), knowledge sharing is crucial in developing a learning culture within the organization. Based on her article, these two aspects should be the norm before knowledge sharing takes its place:

- management should think about professional development strategically and should align learning strategy to the business goals and objectives. Leaders should promote learning behaviors through openness to learn new information and ask questions;
- management should provide employees with a range of engaging learning content that could be accessed via online platforms, personal classes, or a blended environment.

According to training and development platforms, various ways of learning can take place in different environments. Some of the training and development options could appear only in online or offline mode. There is also an option of blended training, which means that some part of the training is done virtually, and the other one is done in person. Various forms of online learning gained intensity during the COVID-19 pandemic as it was the only way to share knowledge and develop employees. Days when HR viewed learning only as a classroom-based activity are gone forever. Indeed, this format is still desirable for some learning activities, but thanks to the COVID-19 pandemic and world of work becoming complicated, companies have exponentially broadened the way of learning. Today's world of learning and development is dynamic and technology-driven to adapt to changing needs of organizations as quickly as possible (Schmidt, 2021).

2.4. Barriers of knowledge sharing

Barriers to knowledge sharing can be identified on a personal, organization, or technological level. When a company works with knowledge sharing systematically, it should be included in its culture and strategy and linked to its overall goals (Riege, 2005). It can be given as one example of the barrier that often happens on an organization's level. Several obstacles are directly linked to individuals. One of the possible challenges associated with knowledge sharing on this personal level is the accumulation of knowledge in employees who refuse to share them with others (Postolache, 2020; Moffett, Anand & Walsh, 2019). Knowledge sharing barriers play a significant

role in the success of knowledge management in general and influence the whole process of knowledge sharing. Table 4.1. shows the potential types of knowledge sharing barriers, which could be personal, organizational, and technological (Riege, 2005):

Table 4.1. Potential knowledge sharing barriers

Personal barriers	Organizational barriers	Technological barriers
Lack of time	Integration of KM strategy into the organization's goals	Lack of IT systems and their compatibility between various systems and processes
Fear of job security	Lack of leadership	Lack of technical support
Low awareness of value and benefits of possessed knowledge to others	Not enough formal or informal spaces to share	Technology usage and expectation of employees
Explicit over tacit knowledge dominance in sharing	Lack of transparency in rewarding systems and deficiency in company's resources to motivate employees	Lack of employee training on how to use IT systems
Strong hierarchy	Knowledge sharing practices do not fit the company's culture	Lack of communication regarding the advantage of newly adopted systems
Insufficient communication	Potential leave of highly skilled and experienced staff competitiveness	The reluctance of employees to use IT systems (lack of experience, fear)
Low interaction	Existence of specific directions of communication and knowledge flow (hierarchy)	
Difference in age/gender/education/ experiences or national culture	Production oriented workplaces may restrict effective knowledge sharing	
Lack of social networks	Size of business Culture (processes) not prepared for remote work and knowledge sharing (case of the COVID-19 pandemic)	
Fear of not receiving recognition from management or colleagues (lack of motivation)		
Lack of trust in people or the credibility of knowledge		

Source: own processing based on Riege (2005).

The situation with the COVID-19 pandemic extended the influence of potential barriers on knowledge sharing. Organizations had to adapt to new remote work trends and tools in all three aspects – cultural, personal, and technical. Sharing of knowledge became more complicated than before. Those organizations that had the process implemented already in the strategy and culture could share knowledge in the hybrid world of work. Successful knowledge sharing has begun to place significant demands on leadership

and set up a system of motivation to manage and share knowledge in the hybrid world of work.

Regarding knowledge sharing barriers, it is essential to say that there is no evidence whether and which obstacles are more prominent than others in different business environments regarding their size, i. e., micro, small, medium, or large. Also, there seems to be no specific empirical evidence that compares knowledge sharing barriers in public, private, or non-profit organizations (Riege, 2005).

From the information mentioned above, an organization's knowledge is highly dependent on its people, in other words, on human resources. Because if individuals effectively create, share, and use obtained knowledge, it helps achieve organizational results. Based on the literature review, four key areas of successful knowledge management systems were identified: the implementation of knowledge management and the factors that can influence it, preparedness for the KM implementation, knowledge-sharing culture and remote work, and online tools used for knowledge sharing. These areas can only be prosperous when human resources are consistent with this concept. Human Resource Management (HRM) plays a crucial role in achieving these goals through its possible bearing on employee behavior and skills (Antunes & Pinheiro, 2020).

2.5. Specifics of knowledge management practices in SMEs

As knowledge is considered a crucial intangible asset of an organization, it is in the company's interest to ensure that employees do not keep their knowledge to themselves but share it with others. Research in the field of knowledge management in SMEs shows many differences compared to larger companies. SMEs often have no strategic knowledge management policy and apply knowledge management only at the operational level (Durst & Edvardsson, 2012). The SME sector is formally and systematically less developed than larger companies, which is why most SMEs use a short-term unstructured approach according to learning and knowledge sharing within the organization (Durst & Edvardsson, 2012). If the employees' expertise and knowledge are effectively managed, organizations could have an excellent opportunity to expand their business networks and capabilities, which also applies to the sector of SMEs. SMEs could have a chance to become more competitive. However, compared to larger companies, SMEs are still less efficient in good knowledge sharing (Eze et al., 2013). Nevertheless, due to their size, SMEs that offer closer social relationships among employees, tend to provide a conducive environment for knowledge creation. Another possible advantage of SMEs regarding knowledge sharing may be their often-flatter structures and innovative culture compared to the large organizations (Riege, 2005).

Anand et al. (2021) stated the contribution of knowledge sharing in SMEs in various aspects.

3. Methodology

3.1. Knowledge sharing in SMEs: Data and methods

Based on the literature overview mainly related to knowledge sharing, specifically in the environment of small and medium-sized enterprises, the authors collected qualitative data for further analysis of the knowledge management topic, emphasizing the current aspects and situation in the COVID-19 pandemic. Table 4.2 summarizes the secondary data analysis, including the main findings in knowledge management in SMEs. The analysis shows that SME research is often carried out only in a selected sector, so many studies do not generally exist and examine the factors of knowledge management across various sectors.

Table 4.2. Selected studies in the field of knowledge management and knowledge sharing in SMEs

Author	Year	Respondents	Aim of the study	Key findings
Al-Busaidi et al.	2010	Oman: 104 employees of petroleum company	To examine the most critical factors which could encourage employees to share their knowledge with other colleagues.	The results show that reward policy is critical for motivating employees to knowledge-sharing behavior. Another significant factor was the support of management; on the other hand, people's trustworthiness was not an essential factor.
Eze et al.	2013	Malaysia: 680 SMEs from the manufacturing sector	To identify the factors that influence knowledge sharing between SMEs.	The results show that knowledge technology, employee motivation, an effective remuneration system, trust and encouraging company management are the essential factors in knowledge sharing.

Author	Year	Respondents	Aim of the study	Key findings
Hassan & Raziq	2019	Pakistan: 300 SMEs	To examine the influence of knowledge management dimensions on innovation ability in SMEs.	Research has shown that the adoption of knowledge management would lead to innovation in SMEs, which are currently facing financial or other resource constraints. The study also showed that the benefits of knowledge management implementation are not fully understood by SMEs, as many do not even know the concept.
Yao et al.	2020	China: 457 employees of software SMEs	To examine how knowledge sharing affects the ability of technological innovation in software SMEs.	The results show that culture, organizational structure, and middle management significantly positively affect tacit knowledge sharing. The results show that management and IT support have a significant positive effect on explicit knowledge sharing.
Samir	2020	Egypt: 400 staff responses from SMEs	To investigate the relationship between knowledge management and organizational performance in the context of Egyptian SMEs.	The confirmed positive effect of KM on SMEs performance. Knowledge acquisition, knowledge sharing and knowledge application have statistically significant positive effect on innovativeness.
Cardoni et al.	2020	Italy: 219 medium-sized enterprises	To explore the relationships between knowledge management, organizational performance measurement systems, and SMEs' economic sustainability in knowledge-based sectors.	Data analysis confirmed the positive impact of knowledge management on the economic sustainability of companies. The authors encourage SME owners and managers to design and implement a coherent knowledge management approach, which is the key to developing a competitive advantage.

Source: own processing based on Al-Busaidi (2010), Eze et al. (2013), Hassan & Raziq (2019), Yao et al. (2020) and Cardoni et al. (2020).

3.2. Knowledge management and sharing: Research methodology

In the first part of the chapter, the literature related to knowledge management and knowledge sharing in SMEs helped identify the main factors influencing knowledge management and its sharing in organizations. Based on the secondary data analysis, the research questions were set. As a method of data collection for the pilot research, the authors have chosen in-depth interviews. The authors are aware of the limitations of this method as a small sample size, selection of the sample, the external validity or generalizability of the research. Also, an in-depth interview is a time-consuming method. As in-depth interviews are conducted on a one-to-one basis, they extract ample time of the researcher for the interview, transcribing, analyzing, and reporting the data (Showkat & Parween, 2017). However, despite its limitations, this method has yielded precious and up-to-date results about knowledge management and sharing on a sample of Czech SMEs.

The questions included in the in-depth interview were related to factors influencing the implementation, organizations' preparedness for knowledge management implementation, and company culture. In an in-depth discussion of selected Czech SMEs, these questions were used to collect qualitative data about knowledge sharing. These interviews were carried out with the owners of six anonymized SMEs in 2021; both face-to-face and online, depending on the current pandemic restrictions. The SMEs were selected based on their willingness and accessibility to participate in the given time frame. The authors carried out in-depth interviews consisting of four parts (mentioned below) in January, March, and May 2021. Each section contained three questions related to knowledge management and knowledge sharing practices in the organization. The areas of the in-depth interview were as follows:

- factors influencing the implementation of knowledge management;
- preparedness for organizations to knowledge management implementation;
- organization's knowledge-sharing culture;
- online tools used for knowledge sharing.

To cover the topical aspect and current trends in KM, challenges and trends in the knowledge sharing in the pandemic were a part of the semi-structured interview. There were four main areas and twelve questions used to map the situation in these companies' knowledge sharing and knowledge management. The interviews lasted approximately 40 minutes depending on how in-depth interviews were carried out, i. e. online or face-to-face. All the respondents took part voluntarily, and the results have been anonymized. The authors used

interview questions related to the driving force, influence on implementation, and reasons for success in implementing knowledge sharing. Preparedness of organizations to knowledge management implementation was mapped based on questions focused on the attitude of the questioned SME towards knowledge management issues, possible barriers, and the environment of knowledge storage. As crucial for knowledge sharing in SMEs also the culture was identified. Questions related to this area aimed to determine if companies do any training and development, which techniques they use, and any formal incentives used in the SME. The last part of the interview was related to tools used in questioned companies for communication and knowledge sharing in the light of changes and developments during the pandemic.

The qualitative data was used as a first step in the author's complex research. The authors have been systematically working on the topic, and the qualitative survey was the first part of the complex analysis of knowledge management in the business environment. The collection of quantitative data concerning current developments and the importance of knowledge sharing in organizations concerning decision-making is planned as the next step of the author's research activities.

This chapter brings key findings related to knowledge management and knowledge sharing in selected six SMEs in the Liberec region (Czech Republic) based on a detailed previous literature review and a gap identified in the surveys related to the research of KM in SMEs. The chapter aims to map the situation about knowledge sharing based on the four recognized elements essential for the successful use of knowledge management regarding the current influence of the COVID-19 pandemic. The SMEs chosen for the interviews and the analysis are described below. Respondents and data were anonymized. The details of SMEs are summarized in Table 4.3.

Table 4.3. Respondents of the knowledge management in in-depth interviews

Company	Industry	Size	Year of establishment
Company 1	IT	Small	1990
Company 2	Hardware	Small	2016
Company 3	Engineering	Small	2014
Company 4	Architecture	Small	1991
Company 5	Software and systems	Small	2015
Company 6	Metal	Small	2015

All six companies were small companies, which means the number of employees is up to 50 (according to the EU classification). Company 1 operates in the IT industry. The company was established in 1990, and

it still innovates and grows its business. Last year during the COVID-19 pandemic, the company even established a spin-off company because they invented a specific product that did not belong to their portfolio. There is no organizational challenge as there are 12 employees, but the owner knows that there would be a need for structure with more employees. The owner is responsible for HR activities. The turnover of the employees is low, and most employees have been working there for more than ten years. Knowledge sharing and knowledge management is essential aspect of a company's business. If the company and its employees do not educate themselves and innovate, they will go bankrupt or produce products with low value. The owner is the only person in management and supports knowledge management and tries to encourage and support employees to be the same.

Company 2 develops and produces electronic devices – hardware. The company was established in 2016. The company works as a flexible organization, and currently, it has 15 employees with whom they cooperate for a long time. Last year, due to the COVID-19 situation, the company reduced the number of its employees by three people. Overall, the last year has been successful as the company's turnover increased and the company gained new customers. Due to the pandemic, they had to eliminate the company's expansion to Germany and England because it would be too challenging. The business is better done in person as personal relationships are essential for the business. Management is very supportive of knowledge management as they consider education to be the most important thing for overall success. There is always space for training and development, and management supports each employee to become an expert in their field. There is a given system by which they work with Google Drive and with other know-how sources. Each employee knows how to search for information in a context as there are no folders, only a basic structure.

Company 3 specializes in developing and constructing specialized units from simple machines to producing the whole units and production lines. The company was established in 2014 and currently employs 12 employees. The team is full of young people who are progressive and willing to educate themselves. The company's ideology is to train in trends so that the company will not stagnate on a rigid practice that had been used for 20 years, and nothing has changed since then. They want to be effective. That is why each project is achieved with an emphasis on optimization and reduction of costs while maintaining the maximum functionality of each product.

Company 4 is a limited liability company in architecture. The company was established in 1991 and currently employs 25 people, mainly architects, civil engineers, and designers. The company has more than one owner, and

it is based on a long-time tradition. The culture of the company supports a friendly atmosphere, and employees are open to cooperation.

Company 5 is a part of a German mother company with more than 30-year history offering products, solutions and services in testing, telecommunication network management, and IT management. The Czech branch of the company was established in 2015, and nowadays, it has 35 employees. Within the company, employees are willing to share their knowledge and share their knowledge without thinking about it. The Czech branch cooperates daily with its German parent company, and it adopts guidelines and procedures based on the cooperation. Although the company has 35 employees, its HR department is responsible for all its HR activities, learning, and development.

Company 6 specializes in professional laser welding and cutting tailored to customers' needs. The company was also established in 2015, and during its market presence, it has completed and delivered more than 250 projects and currently has almost 100 customers. The company employs ten employees, and it functions in a very close and friendly environment. The company's culture, the owner, and the whole number of employees contribute to the company's knowledge sharing behavior. However, the company's biggest customer does not allow any space for innovations, and it does not seek innovations from its suppliers. Innovations are mostly made reactively based on the market needs and state requirements.

Primary data listed in both tables below (Table 4.4 and 4.5) show that all organizations support and implement knowledge management and knowledge sharing. Some activities are more formally structured, and some are not. All organizations had a successful year despite the COVID-19 situation. Table 4.4 shows what key factors were identified as those influencing knowledge management in chosen Czech SMEs.

Table 4.5 provides information about the preparedness of six SMEs on knowledge management implementation. There was evaluated the attitude of management to implement systems for managing knowledge and tools used in these SMEs. Moreover, the respondents identified barriers that can delay or stop KM implementation.

All companies are open to sharing their thoughts, ideas, and know-how during company meetings. However, the approach of company 4 to knowledge management is very informal. Employees have space for personal and professional development as companies support knowledge management and intellectual capital growth. It is crucial to follow business trends in their business fields, support new ideas, and innovate services and products provided. In company 4, training in specific programs is related to customers' requirements in big projects. Despite the size of companies, there is primarily an advanced system of knowledge sharing and knowledge transfer.

Table 4.4. Factors influencing the implementation of knowledge management in chosen SMEs

Company	Driving force	Influence on results	Reasons of success
Company 1	Competitiveness of the company and its products – especially in the technology sector, companies must innovate	Competitive advantage, market success, the increased value of intellectual capital, ability to quickly react to unexpected changes (black swan)	Management interest, trust of employees, proper communication
Company 2	Success factors: setting time to pass on some new ideas and interesting content (books, podcasts, video) and talk to each other about that Failure factors: irregular meetings, no time and leadership space	Success: practical testing, applying new ideas and thoughts Failure: „artificially” used knowledge management – it’s only on article, nothing happens	Leadership by example, working groups of the teams – smaller teams, inspiration, a demonstration that new activities work, the celebration of small wins
Company 3	Productivity growth, possibility to create experts in a specific field to distribute knowledge of employees in other departments	Choosing the right people who are interested in educating themselves as well as their team. Increase in the enthusiasm of employees and their work fulfillment	Internal motivation for personal growth, the ability to motivate employees, so they know that knowledge management makes sense to them
Company 4	Individual approach, respect of everyone’s opinion, law regulations Failure factors: no systematic approach to KM, traditional managers, and habits	Competitive advantage, market success, ability to quickly react to unexpected changes Failure: management of multiple owners	Trust of employees, motivation
Company 5	Competitiveness of the company in the future, higher turnover, and sales	People’s openness to share their knowledge with other colleagues, employee substitutability (in case of the holiday season, etc.)	Choosing the right people – their openness and trust, transparent communication within the company
Company 6	Time savings during production and from the managerial point of view – no need to repeat procedures etc. Professional growth of employees	The willingness of employees to listen to what is being told to him/them, a knowledge-sharing culture of the company	The willingness of people to share their knowledge

Source: own processing based on Horáková & Maršíková (2021, p. 236).

Table 4.5. Preparedness of SMEs to knowledge management implementation

Company	Attitude	Knowledge storage	Barriers
Company 1	Trends tracking + sharing tips among each other, support for self-development	Wiki on MS Teams, customer-led folder (technical solutions, training of the employee – one to one)	The unwillingness of management, lack of time
Company 2	Divided the whole week into specific „days” - Monday – meeting day, daily stand-up meetings of developers, „free” Fridays – team do not work on particular tasks, hackathons	Google Drive, „libraries” of technological elements – storage of know-how, meeting minutes	No educational support from the management, distrust of employees, organization without setting boundaries/ anchors/fixed points – only freedom
Company 3	Trends tracking, each employee share their tips on improvements and innovations, support of the company management	Google Docs storage, own software, essential guides on how to use the tools	Employee education - the ability to learn quickly how to operate a new program or product, digital readiness of companies, lack of interest of employees
Company 4	Mutual trust and willingness to help	Particular designer’s programs/software, meeting minutes	Home office work as only a temporary solution due to COVID-19 restrictions, digital readiness of the company, more owners
Company 5	Supportive management, willingness to help	MS Teams, guidelines, meeting minutes, recording of webinars	Insufficient communication within the company, low motivation of employees to share knowledge, home-office, language barriers in the communication with the mother company
Company 6	Supportive management, personal and professional levels of behavior are combined within the company - support of the company’s management to solve personal issues to increase the productivity of the employee, therefore	Employee know-how, MS Teams	The unwillingness of employees to share knowledge who are at the same or similar professional „level” – fear of job security, the attitude of management towards KM

Source: own processing based on Horáková & Maršíková (2021, p. 236).

Selected enterprises are aware of the advantages of knowledge management; the main driving force why companies should adopt KM is a competitive advantage and productivity growth. Owners also listed market success and quick reaction to changes and trends as other essential factors why companies should consider implementing a knowledge management system. As Table 4.6 shows, knowledge-sharing culture is an important aspect. In all companies were identified identified as supportive, based a lot on personal contacts without formal incentives, mainly based on mutual inspiration.

According to online tools used for communication and knowledge sharing, all selected companies shared exciting data. Company 1 uses mainly MS Teams and e-mails to communicate within the company and with the external environment. The intensity of the use of online tools during COVID-19 indeed increased during the last year. The main reasons are more frequent online meetings with potential employees as well as within the company. The company now uses an online and hybrid form of internal meetings. The overall effect of COVID-19 on the company was relatively positive because there was a revolution in their industry caused by the need for online communication and online tools requirements; everyone was somehow forced to digitize.

The company even hired four new employees, namely secretary, accountant, technician, and programmer. The pandemic also resulted in some time savings because there was a possibility of having more meetings in one day, even with people from various regions. Company 2 used the same communication platforms from the very beginning, and it operates mainly Google Drive and all the Google tools and Apple systems. During the pandemic, they started to use teleconference tools more, especially Google Meet, and the usage of the HubSpot CRM system became more popular among potential customers. People are now active in appointment booking via HubSpot. The overall effect of COVID-19 on the company was relatively positive as the turnover increased, and there were some time changes associated with the possibility of online meetings.

The company also noted higher demand for their products. The company initially planned expansion to Germany and more extensive growth to England, but these activities were limited due to the ongoing pandemic and uncertainty in the world. The company was forced to reduce its employees by three people, and it also eliminated publicly funded training. As a lecturer, the owner mentioned that he misses the interaction with the audience during online webinars. As mentioned in Table 4.6, Company 3 uses Google Docs and their internally developed application for data collection and project communication. These tools are used from the very beginning.

Table 4.6. Aspects of knowledge sharing culture in selected SMEs

Company	Training and development	Techniques	Incentives
Company 1	Regular employee training, training from technology suppliers, information sharing	Personal contact, regularity, knowledge database	No financial or beneficial incentives, employees are encouraged and supported by management to specialize in a particular area
Company 2	A business system within which they have set its position, the training support is the 1st place. Management is active in education – lecturer of Czechitas, member of Finnish accelerator Xedu, framework	Open-source attitude is a part of the team’s DNA, workshops and webinars, discussions during Friday, the openness of sharing	No financial or beneficial incentives, mutual inspiration, management connects people, a space for education. Management supports each individual to become an expert in a chosen field
Company 3	Regular employee training, support of training from third-party products (suppliers), unique training plan for employees who have the potential to become „experts” in a particular field	Weekly and shop floor meetings, company-wide meetings once in a month, database in Google Docs for every project, system of colored „traffic lights” – marking priorities of the projects, personal discussions	No financial or beneficial incentives, special support of individual employees who have the potential to become experts in their field
Company 4	Support of training based on customer projects	Company-wide informal meetings once a month, design programs, marking priorities	No financial or beneficial incentives, freedom, and trustful company culture
Company 5	Regular employee training	Employees are aware that they need each other (in case of the holiday season etc.), brainstorming, workshops, and webinars	No financial or beneficial incentives, recognition from the management
Company 6	Support of the training based on the needs of processes and external ones, regular employee training	Informal discussions, workshops	No financial or beneficial incentives, the possibility of co-decision in the production matters – everything arises from a trio: managing director, production director and technologist/logistics

Source: own processing based on Horáková & Maršíková (2021, p. 237).

If there is not enough space to describe a project, then e-mail communication is used as well. For real-time communication, the company uses MS Teams. It is also used for information sharing (e.g., individual employee training) and

collecting service interventions. Each employee has MS Teams on desktop devices as well as on their phones. During the COVID-19 pandemic, the company did not register an increased use of online tools. The only change has been in the way of meetings held in a hybrid format where some employees are in the company, and some are online. The overall effect of COVID-19 on the company was rather negative as the company is dependent on its customers and their investments approval. Due to the pandemic, customers started to speculate, and product orders were postponed, nowadays it takes 3 – 6 months for the contract to be approved, but there is no extension of the original deadline of the project. However, the volume of the projects and the amount of work remained the same as before the pandemic, but most of the work was done during the autumn period. The company also dismissed some employees, but the dismissal of the employees would have taken place even without the pandemic because there was no willingness for professional growth. Company 4 has regular Skype meetings, and most of the employees can work from home due to the pandemic situation. However, this is not a permanent state as the management considers the presence of employees in the workplace as more effective for the knowledge sharing and decision-making process. Company 5 uses mainly Google Docs and MS Teams for the online communication and knowledge-sharing platforms; another tool used is Outlook as an e-mail platform. The usage of online tools has increased by 100 % in the last year. The COVID-19 situation has caused that about 50 % of the whole communication is online. Most of the employees have shifted to home-office. Most of the meetings are now held in an online form.

The company tries to preserve the company's culture by organizing "online beer/online pub," an evening video call at MS Teams where all the employees meet and spend some time together. Company 6 uses mainly Apple devices through which they share information and communicate. They use MS Teams, e-mail, and direct data lines. For informal and more general information, WhatsApp is being used. The company was also partly influenced by the COVID-19 situation as the meetings with customers are being held online through videoconferences.

4. Discussion and limitations

The literature review showed the importance of knowledge management and knowledge sharing for any organization, including small and medium-sized enterprises. SMEs are the core of the business in Europe. The topic of knowledge sharing was identified based on the literature review and discussion with experts as a crucial aspect that influences SMEs' performance. Although SMEs provide a specific background for managing human resources and managing knowledge which people get, keep and share, there is no doubt

that SMEs pay attention to the concept and realize its importance. They also invest in sources (but sometimes limited) and support the knowledge sharing by the company culture and technologies. In the pandemic period, all organizations, including SMEs, were quickly pushed to adapt to the specific working environment and conditions. There was an urgent need to continue with knowledge sharing between employees, even working remotely. All organizations had to be opened to new processes of KM, learn and train employees in new technologies and distant styles of communication.

Various digital tools and platforms increased their importance for knowledge sharing between colleagues who worked, i.e., in different branches, and those who were usually used to working together in the office. Yao et al. (2020) stated that culture, organizational structure, and middle management have a significant positive effect on tacit knowledge sharing and that management and IT systems positively affect explicit knowledge sharing. Based on the secondary data analysis presented in the article and the main results of selected studies on knowledge management in SMEs, the authors made a comparison with primary data results in the chapter. Based on the primary data obtained by in-depth interviews, it could be stated that knowledge-sharing culture, support and encouragement of the management, trust between employees, open communication, and IT support are the main factors that affect knowledge sharing of both tacit and explicit knowledge in these companies. Authors could also agree with Hassan a Raziq (2019) study results which showed that knowledge management would lead to innovations in SMEs. The primary data analysis and the developed case study show that new employees' ideas and thoughts and sharing with all the team members lead to innovations within the company. Another secondary data analysis on SMEs shows that knowledge management could positively impact the economic sustainability of companies (Cardoni et al., 2020). This result was also confirmed by primary data analysis as interviewed companies experienced a successful year despite the COVID-19 situation. For example, companies 1 and 2 acquired new customers, and due to successful usage of knowledge management and knowledge sharing, they have survived difficulties in the last year.

The study conducted by Al-Busaidi (2010) confirmed that management support is one contributing factor that encourages employees to share their knowledge with other colleagues. The primary data analysis also confirmed this secondary data analysis as some of the respondents stated this factor as an important one. Another personal factor influencing the knowledge sharing behavior is trust between employees. Choi et al.'s (2008) results of the social and technical enablers pointed out that trust is one of the enablers enhancing such behavior. This conclusion also corresponds with the primary data of the chapter; according to Andreeva & Kianto (2012), career development systems,

including systematic training and development, shape knowledge flow within the company. The training and development of employees are one of the elements of knowledge-sharing culture as interpersonal relations built during such training could support employees to share knowledge in the future. All the interviewed companies support regular training of the employees, but they also support employee training based on customer projects or third-party requirements. Based on Riege (2005) some types of barriers were observed based on in-depth interviews, namely lack of trust, fear of job security, lack of time, insufficient communication, low interaction, lack of support from management, and barriers in the form of Home-Office. These types of barriers were mentioned the most by the chosen respondents. However, more barriers may exist based on the size of the company and the company's culture.

5. Conclusion

Knowledge management and knowledge sharing have been a topical issue nowadays and have increased importance in connection with the pandemic in the last months. Many authors (such as Taher, 2015; Abubakar et al., 2019 and others) confirm that processes in knowledge management influence the efficiency of an organization's decision-making ability and help employees make quick, informed decisions. The environment of SMEs is specific in many aspects as fewer formal structures and processes and managing of knowledge of their employees. The chapter aimed to examine the knowledge management concept and knowledge sharing behavior in the environment of small and medium-sized enterprises in the Czech context. Literature review and secondary and primary data analysis showed that knowledge management and knowledge sharing have been crucial for existence and success in all organizations, including SMEs. Respondents confirmed that with the pandemic situation, its importance has even increased.

Primary data about six SMEs in the Liberec region introduced in the case study in the last part of the chapter confirmed findings within the literature review and secondary data analysis. Based on the qualitative research, the main factors influencing the implementation of KM in selected SMEs are reacting and making decisions, applying new ideas quickly, a successful recruitment process (onboard only the right people), and accepting possible solutions from employees. On the other hand, based on the findings, the implementation of KM could also be negatively influenced by poor leadership and low engagement of the employees. Some of the barriers which were identified from the primary analysis are the unwillingness of the management regarding the KM implementation, no training and development support, distrust of employees, low motivation of employees, fear of job security, or

digital unpreparedness of the companies. Interviewed managers of three of the interviewed companies confirmed a systematic approach to knowledge management, using various tools to support communication and information transfer, all in their organizations' less formal approach to knowledge sharing. In-depth interviews with the owners/managers also confirmed the importance of knowledge sharing in the decision-making process of SMEs and brought a very up-to-date view on the topic related to the COVID-19 pandemic and its influence on factors and culture of knowledge management and knowledge sharing in SMEs. According to the knowledge-sharing culture of the interviewed SMEs, the main activities to share knowledge are regular employee training and company/department meetings, personal contact between employees, and informal discussions. These often fewer formal activities would encourage employees to share their knowledge as tacit knowledge is due to its nature more prominent in SMEs. Activities such as meetings and informal discussions would ensure that the transfer of tacit knowledge takes place. Employees of the chosen companies are not motivated by any financial or beneficial incentives to share their knowledge as these employees are used to sharing their knowledge with other colleagues.

The conclusions of this chapter could not be generalized as research was conducted on a small group of participants who were accessible and willing to participate in in-depth interviews. Despite the size limitations and impossibility of primary data generalization, these are important and interesting additions to the topic and show the importance of KM for SMEs. They can work effectively with knowledge assets and gain a competitive advantage. Results presented in the chapter showed that SMEs pay attention to this issue, however, often not so systematically. The importance of KM is not sometimes fully understood, and typically, it is limited by the sources, including the financial ones. Owners and managers of SMEs should be systematically supported to design and implement a coherent knowledge management approach and include in the system using sufficient tools for knowledge sharing. Systematic and effective training is an important support for employees in sharing their knowledge. They must be motivated to use the tools and to share their knowledge willingly. If a company succeeds in implementing such a system into its culture, it gains a significant competitive advantage.

The findings presented in the chapter bring up-to-date implications for managers of organizations (and SMEs) and show the direction of further research, which the authors plan to extend to a quantitative data collection on a representative sample of SMEs. The chapter contributes to the up-to-date topic of knowledge sharing from the perspective of small and medium enterprises regarding the current situation. Findings serve as a pilot for conducting

a comprehensive qualitative and quantitative study and give the authors space for further research in the knowledge management practices used by SMEs.

Acknowledgment

This article was supported by the Student Grant Competition of the Technical University of Liberec under project No. SGS-2021-1034 “Knowledge sharing as an important factor in a career preparation and during a professional career.” Based on the article: Horáková, T., & Maršíková, K. (2021). Knowledge sharing as an important factor for decision making in SMEs. *3rd International Conference on Decision Making for Small and Medium-Sized Enterprises. Conference Proceedings* (pp. 231-241). Retrieved from https://demsme.opf.slu.cz/images/DEMSME_2021_Proceedings.pdf

References

- Abubakar, M., Elrehail, H., Alatailat, M. A., & Elci, A. (2019). Knowledge management, decision-making style and organisational performance. *Journal of Innovation & Knowledge*, 4(2), 104–114. <https://doi.org/10.1016/j.jik.2017.07.003>
- Abzari, M., & Teimouri, H. (2008). The effective factors on knowledge sharing in organisations. *The International Journal of Knowledge, Culture, and Change Management: Annual Review*, 8, 105–114. <https://doi.org/10.18848/1447-9524/CGP/v08i02/50530>
- ALAmeri, T. Alb. (2015). Impact of knowledge sharing on decision making and situation analysis. In L. Uden, M. Heričko, & I.-H. Ting (Eds.), *Knowledge Management in Organisations* (pp. 134–145). Germany: Springer International Publishing. https://doi.org/10.1007/978-3-319-21009-4_11
- Alavi, M., & Leidner, D. (2001). Review: Knowledge management and knowledge management systems: Conceptual foundations and research issues. *MIS Quarterly*, 1, 107. <https://doi.org/10.2307/3250961>
- Al-Busaidi, K., Olfman, L., Ryan, T., & Leroy, G. (2010). Sharing knowledge to a knowledge management system: Examining the motivators and the benefits in an Omani organisation. *Journal of Organizational Knowledge Management*, 201(25835), 1–12.
- AMSP. (2021). Vývoj malých a středních podniků v období 2010–2019, resp. 2020. Retrieved from <https://amsp.cz/vyvoj-malych-a-strednich-podniku-v-obdobi-2010-2019-resp-2020/>
- Anand, A., Muskat, B., Creed, A., Zutshi, A., & Csepregi, A. (2021). Knowledge sharing, knowledge transfer and SMEs: Evolution, antecedents, outcomes and directions. *Personnel Review*. <https://doi.org/10.1108/PR-05-2020-0372/full/html>

- Andreeva, T., & Kianto, A. (2012). Does knowledge management really matter? Linking knowledge management practices, competitiveness and economic performance. *Journal of Knowledge Management*, 16(4), 617–36. <https://doi.org/10.1108/13673271211246185>
- Antunes, H. de J.G., & Pinheiro, P.G. (2020). Linking knowledge management, organizational learning and memory. *Journal of Innovation & Knowledge*, 5(2), 140–49. <https://doi.org/10.1016/j.jik.2019.04.002>
- Argote, L., & Miron-Spektor, E. (2011). Organizational learning: From experience to knowledge. *Organization Science*, 22(5), 1123–37. <https://doi.org/10.1287/orsc.1100.0621>
- Barták, J. (2006). Knowledge management: K rozvoji lidských zdrojů v prostředí změn. Praha: Vysoká škola J.A. Komenského. Retrieved from <https://ndk.cz/uuid/uuid:bfed1f10-a280-11e5-8c9e-001018b5eb5c>
- Becerra-Fernandez, I., & Sabherwal, R. (2015). *Knowledge Management Systems and Processes*. New York: Routledge.
- Cardoni, A, Zanin, F., Corazza, G., & Paradisi, A. (2020). Knowledge management and performance measurement systems for SMEs' economic sustainability. *Sustainability* 12(7), 2594. <https://doi.org/10.3390/su12072594>
- Cho, S., Happa, J., & Creese, S. (2020). Capturing tacit knowledge in security operation centres. *IEEE Access*, 8. <https://doi.org/10.1109/ACCESS.2020.2976076>
- Choi, S. Y., Young, S.K., & Lee, H. (2008). The effects of socio-technical enablers on knowledge sharing: An exploratory examination. *Journal of Information Science* 34(5), 742–54. <https://doi.org/10.1177/0165551507087710>
- Chugh, R. (2012). Knowledge sharing with enhanced learning and development opportunities, 5, 100–104. In *International Conference on Information Retrieval & Knowledge Management*. Kuala Lumpur, Malaysia, IEEE.
- Connelly, C., & Kelloway, K. (2003). Predictors of employees' perceptions of knowledge sharing cultures. *Leadership & Organization Development Journal*, 24, 294–301. <https://doi.org/10.1108/01437730310485815>
- Czarnecka, A., & Daróczy, M. (2017). E-learning as a method of employees' development and training. In M. Daróczy, E. Robak, & S. Vinogradov (Eds.), *Management, Organisations and Society*. Budapest: Agroinform. <https://doi.org/10.18515/dBEM.M2017.n01.ch09>
- Durst, S., & Edvardsson, I. (2012). Knowledge management in SMEs: A literature review, 16(6), 879–903. <https://doi.org/10.1108/13673271211276173>
- Evans, C. (2003). *Managing for Knowledge: HR's Strategic Role*. Amsterdam: Butterworth-Heinemann.
- Eze, U., Goh, G., GOH C. Y., & Tan, T. (2013). Perspectives of SMEs on knowledge sharing. *VINE*, 43(2), 210–236. <https://doi.org/10.1108/03055721311329963>

- Gamble, J., R. (2020). Tacit vs explicit knowledge as antecedents for organisational change. *Journal of Organizational Change Management*, 33(6), 1123–1141. <https://doi.org/10.1108/JOCM-04-2020-0121>
- Ha, S., Lo, M-Ch., & Wang, Y-Ch. (2016). Relationship between knowledge management and organizational performance: A test on SMEs in Malaysia. *Procedia - Social and Behavioral Sciences*, 224, 184–189. <https://doi.org/10.1016/j.sbspro.2016.05.438>
- Hassan, N., & Raziq, A. (2019). Effects of knowledge management practices on innovation in SMEs. *Management Science Letters*, 9, 997–1008. <https://doi.org/10.5267/j.msl.2019.4.005>
- Hislop, D., Bosua, R., & Helms, R. W. (2018). Knowledge management in organisations: A critical introduction. Oxford: Oxford University Press.
- Horáková, T., & Maršíková, K. (2021). Knowledge sharing as an important factor for decision making in SMEs. *3rd International Conference on Decision Making for Small And Medium-Sized Enterprises. Conference Proceedings* (pp. 231–241). Retrieved from https://demsme.opf.slu.cz/images/DEMSME_2021_Proceedings.pdf
- Hsieh, H.-C., Nguyen, X.-H., Wang, T.-Ch., & Lee, J.-Y. (2020). Prediction of knowledge management for success of franchise hospitality in a post-pandemic economy. *Sustainability*, 12(20), 8755. <https://doi.org/10.3390/su12208755>
- Ipe, M. (2003). Knowledge sharing in organisations: A conceptual framework. *Human Resource Development Review*, 2(4), 337–59. <https://doi.org/10.1177/1534484303257985>
- Janus, S.S. (2016). *Becoming a Knowledge-Sharing Organisation: A Handbook for Scaling Up Solutions through Knowledge Capturing and Sharing*. Washington: World Bank Group.
- Marr, B., Gupta, O., Pike, S., & Roos, G. (2003). Intellectual capital and knowledge management effectiveness. *Management Decision*, 41(8), 771–781. <https://doi.org/10.1108/00251740310496288>
- Moffett, S., Anand, A., & Walsh, I. (2019). Does humility facilitate knowledge sharing? Investigating the role of humble knowledge-inquiry and response. *Journal of Knowledge Management*, 23(6), 1218–1244. <https://doi.org/10.1108/JKM-06-2018-0353>
- Monks, K., Conway, E., Fu, N., Bailey, K., Kelly, G., & Hannon, E. (2016). Enhancing knowledge exchange and combination through HR practices: Reflexivity as a translation process. *Human Resource Management Journal*, 26(3), 304–320. <https://doi.org/10.1111/1748-8583.12108>
- Nonaka, I. (1991). The knowledge-creating company. *Harvard Business Review*, 85, 162. <https://doi.org/10.1016/B978-0-7506-7009-8.50016-1>
- Postolache, A. (2020). Barriers to knowledge transfer and how to overcome them. *Quandora*. Retrieved from <https://www.quandora.com/5-benefits-knowledge-sharing-organization/>

- Ramírez, A., García-Morales, V., & Martín-Rojas, R. (2011). Knowledge creation, organizational learning and their effects on organizational performance. *Engineering Economics*, 22(3), 309–318. <https://doi.org/10.5755/j01.ce.22.3.521>
- Riege, A. (2005). Three-dozen knowledge-sharing barriers managers must consider. *Journal of Knowledge Management*, 9(3), 18–35. <https://doi.org/10.1108/13673270510602746>.
- Samir, M. (2020) The impact of knowledge management on SMEs performance in Egypt. *Open Access Library Journal*, 7, 1–23. <https://doi.org/10.4236/oalib.1106445>
- Showkat, N., & Parveen, H. (2017). In-depth interview. Retrieved from https://www.researchgate.net/publication/319162160_In-depth_Interview
- Schmidt, J. (2021). 4 talent trends to watch in 2021. Retrieved from <https://trainingindustry.com/articles/strategy-alignment-and-planning/4-talent-trends-to-watch-in-2021/>
- Singh, S. (2008). Role of leadership in knowledge management: A study. *Journal of Knowledge Management*, 12, 3–15. <https://doi.org/10.1108/13673270810884219>
- Taher, A. A. (2015). Impact of knowledge sharing on decision making and situation analysis. In L. Uden L., M. Heričko, & I.H. Ting (Eds.) *Knowledge Management in Organisations*. Berlin: Springer. Retrieved from <https://www.springerprofessional.de/en/knowledge-management-in-organizations/2494164?tocPage=1>
- Wichtowska, S. (2019). Shape your learning culture through knowledge sharing. Retrieved from <https://www.go1.com/blog/post-shape-your-learning-culture-through-knowledge-sharing>
- Wong, K. (2005). Critical success factors for implementing knowledge management in small and medium enterprises. *Industrial Management & Data Systems*, 105(3). <https://doi.org/10.1108/02635570510590101>
- Wray, C. (2017). A proposed new psychological model for judgement and decision-making: Integrating the tri-partite model with hemispheric difference. *Leadership & Organization Development Journal*, 38(4), 549–563. <https://doi.org/10.1108/LODJ-06-2015-0120>
- Yao, J., Crupi, A., Di Minin, A., & Zhang, X. (2020). Knowledge sharing and technological innovation capabilities of Chinese software SMEs. *Journal of Knowledge Management*, 24(3), 607–634. <https://doi.org/10.1108/JKM-08-2019-0445>

Biographical notes

Tereza Horáková (Ing.) is a Ph.D. candidate in the Department of Business Administration, Faculty of Economics, Technical University of Liberec (EF TUL), Czech Republic and also works in the Career Centre of TUL. Her specialisation is in human resource management, and research is related to knowledge management and knowledge sharing both in the business and academic environment. She teaches seminars in human resource (HR) management and management both in Czech and English language. She has been working on the topic of KM also in the international project (Norwegian funds) with NTNU University. She gains her practical experience in HR as an HR assistant in one multinational corporation.

Kateřina Maršíková (doc. Ing. Ph.D.) works as an associated professor at the Department of Business Administration, Faculty of Economics, Technical University of Liberec (EF TUL), Czech Republic and as a Career Counsellor for students and employees in the Career Centre of TUL. Her specialisation is in human resource management (both as an academic and practitioner). She is a lecturer of Human resource (HR) management, management, and other courses at the Faculty of Economics, both in Czech and English language at EF TUL. She gained her experience also by managing human resources as a project manager of several large HR projects (including the international Erasmus+ KA2 project related to HRM in small and medium sized enterprises or Ministry of Education projects). She has also been working on knowledge management in the international project (Norwegian funds) with NTNU University. Also, she has been publishing in human resources for more than 20 years and cooperates intensively on human resources issues with corporations.

Citations (APA Style)

Horáková, T., & Maršíková, K. (2021). Importance of knowledge management in COVID-19 pandemic: A case of small and medium-sized enterprises. In A. Ujwary-Gil & B. Godlewska-Dzioboń (Eds.), *Challenges in Economic Policy, Business, and Management in the COVID-19 Era* (pp. 79–108). Warsaw: Institute of Economics, Polish Academy of Sciences.

Part 2

INDUSTRY AND INTER-ORGANIZATIONAL COOPERATION

Photovoltaic cells industry in China. Industrial policy and revealed comparative advantage in the XXI century

Bogusława Drelich-Skulska¹, Paweł Brusilo²

Abstract

This research aims to evaluate the impact of the industrial policy measures and state interventions on the Chinese photovoltaic cells industry development and revealed comparative advantage in 2000–2019. The theoretical context of the presented research is based on the new structural economics (NSE) doctrine. As part of the literature review, the authors analyzed the NSE assumptions and studied the Chinese policies for the photovoltaic cells industry development during the studied period. Furthermore, the methods applied in this research include analysis of the indicators related to the development of the Chinese solar power sector, calculations of the Balassa's Revealed Comparative Advantage (RCA) index and the analysis of export volumes based on the data sourced from the United Nations COMTRADE database. The research results show that industrial policy measures and state interventions focused on the Chinese photovoltaic cells industry development match the theoretical assumptions of the new structural economics. The industrial policy and strategies implemented by the Chinese authorities significantly evolved over the studied period, showing a wide range of instruments and measures that translated to the dynamic growth of this leading-edge industry. The authorities' multidimensional approach towards photovoltaics and the stimulative market forces resulted in the increasing role of solar power in the Chinese power generation mix. For instance, the electricity generation from solar power increased from only 22 GWh in 2000 up to 223 800 GWh in 2019, accounting for a 3.05% share in the national power generation mix. Moreover, this industry has revealed a significant comparative advantage. The RCA index

¹ Bogusława Drelich-Skulska, Professor, Head of Department of International Business, Wrocław University of Economics and Business, ul. Komandorska 118/120, 53-345 Wrocław, Poland, e-mail: bogusława.drelich-skulska@ue.wroc.pl (ORCID: 0000-0003-0233-1850).

² Paweł Brusilo, PhD candidate, Department of International Business, Asia-Pacific Research Centre, Wrocław University of Economics and Business, ul. Komandorska 118/120, 53-345 Wrocław, Poland, e-mail: pawel.brusilo@ue.wroc.pl (ORCID: 0000-0001-9138-5724).

of the studied industry increased from 0.61977548 up to 3.04388398 in 2000–2019, resulting in a high export specialization in photovoltaic cells on a global scale. In addition, by 2019, the Chinese photovoltaic cells industry had been an inimitable global leader in terms of capacity, production, export, and innovative technology implementation. By comparing the new structural economics postulates and the Chinese industrial policy towards photovoltaics, the research reveals the substantial role of state interventions in shaping the capital-intensive development of the technologically advanced industries related to renewable energy sources. Research findings provide a starting point for discussion and further research that should consider structural changes within the studied industry and how the Chinese photovoltaic cells industry growth impacted the global value chains and global supply chains. Furthermore, the future study should compare the industrial policy towards analyzed industry in Japan and the other Asia-Pacific countries. To the authors' best knowledge, the Chinese photovoltaic cells industry has never been studied before in the context of revealed comparative advantage with theoretical background based on the new structural economics. The research results based on the analyzed industry exemplify the trail for the other countries that consider following the Chinese path in shaping the development of their national leading-edge industries related to renewable energy sources, especially solar power.

Keywords: *China, photovoltaic cells, industry, new structural economics, revealed comparative advantage*

1. Introduction

The energy transition towards renewable energy sources, like solar power, is one of the fundamental challenges faced globally. The mentioned transition is also a capital-intensive and complex problem requiring long-term planning and significant political and financial involvement. However, the energy transition is potentially a great opportunity for the economies to develop brand new industries and establish innovative enterprises (Dangelico et al., 2017). Also, the shift towards increasing electricity generation from renewable energy sources has to be conducted regarding local conditions and the general assumptions of a state's industrial policy. For the last decades, many countries have introduced various energy and industrial policies and implemented strategies to increase renewable energy use. In this context, the People's Republic of China has made one of the fastest progressions on a global scale. This country consistently strives for a higher share

of renewable energy in the total power generation mix. Chinese authorities also apply diverse intervention mechanisms to raise the competitiveness and innovativeness of the national industries related to renewable energy technologies (Brusiło, 2019).

A successful development of the industries takes center stage among politicians and economists, not only in the context of these particular energy sources. Many theories come complete with various postulates towards industrial development. However, one of them, new structural economics, sheds new light on this field of research and deliberations. This economic doctrine, developed at the beginning of the XXI century and based on structural and neoclassical economics postulates, brings new perspectives on industrial policy and emphasizes the crucial role of hidden comparative advantages transformation in shaping industrial development as well as the facilitating role of state interventionism and the market mechanism. Considering the specific model of the Chinese economy, the theoretical context of the presented research is based on the new structural economics assumptions.

This research aims to evaluate the impact of the most significant policies, strategies and instruments implemented by the Chinese central authorities for the photovoltaic cells industry development and export specialization in photovoltaic cells in 2000–2019. The choice of the research subject – the photovoltaic cells industry – is related to the fact that this Chinese industry is very competitive and innovative, and companies from this sector are the leaders on a global scale (Cao et al., 2018). This country's photovoltaic cells (PV³) industry has also dynamically grown over the studied period and was under the influence of particular economic development and industrial policies, strategies and state interventions, which simultaneously impacted its revealed comparative advantage on the global market.

Regarding the authors' best knowledge, comparable analysis has not been conducted yet. This study contributes to a better understanding of how governments (or central authorities in general) can effectively shape the development of innovative industries related to technologies based on renewable energy sources as well as increase their revealed comparative advantage on a global scale. In the light of the increasing importance of the renewable energy industry worldwide and the significance of the energy transition in emerging economies, the research (focused on the efficient industrial policies towards the selected renewable energy industries) should be continuously developed. To contribute to this debate, this research seeks the answers to the following research questions (RQ):

3 The acronym "PV" stands for a type of photovoltaic cells solar panels which are based on highly advanced modern polysilicon technologies.

RQ1) *What are the crucial new structural economics assumptions, especially in the context of the leading-edge industries such as the photovoltaic cells industry?*

RQ2) *What were the most significant policies, strategies, and instruments implemented by the Chinese central authorities in the context of the Chinese photovoltaic cells industry development between 2000 and 2019?*

RQ3) *How has the revealed comparative advantage of the Chinese photovoltaic cells industry developed during the studied period?*

To present a comprehensive evaluation of the Chinese state's impact on the photovoltaic cells industry development and the export specialization in photovoltaic cells, the structure of each section is organized around the research questions, respectively. The article is organized as follows. The first section demonstrates a literature review. The next section presents the methods applied in this research, including the revealed comparative advantage index. The following section includes the research results and discussion that start with presenting the analyses of the past Chinese national policies, strategies, and examples of state interventionism in the theoretical context of the new structural economics postulates. It is followed by analyzing the photovoltaic cells industry development in the People's Republic of China in 2000–2019. The last part of the research results and discussion presents the revealed comparative advantage index calculations. Conclusions and a summary of the research are placed at the end of the research article.

2. Literature review

2.1. New structural economics – an overview of the assumptions

The process of shaping industrial development is a complex issue that requires conceptual, strategic planning, and application of selected detailed policies towards industries. For the last decades, perceiving the catching-up process and a possible governmental impact on industries has significantly changed due to financial and economic crises, ground-breaking technological inventions, globalization, regionalization, demographic changes and other game-changing economic, political, and social changes trends. At the beginning of the XXI century, many economists and politicians question the previous concepts of effective industrial policies.

In 2011, professor Justin Yifu Lin (Chief Economist and Senior Vice President of the World Bank from 2008 to 2011), together with other economists and researchers, blazed the trail with the book titled *New structural*

economics: a framework for rethinking development (Lin, 2012). This publication summarized previous conclusions and presented a new holistic approach to the process of shaping industrial development with significant but legitimate government involvement in middle-income countries. New structural economics (NSE) exemplifies a bridge between structuralism and neoclassical economics with a wide range of interventional instrumentalities to promote an effective catching-up process for developing countries (Lin, 2014).

The starting point for deliberations about the need to rethink development have its origins in difficulties resulting from previously implemented development strategies in various countries and the idea to create a new theoretical background for models of sustainable development in middle-income countries (Berglof et al., 2015). Theoretically, this economic doctrine is called the *third wave* of conceptual thinking about shaping the industrial development of catching-up economies. Looking back in the history of development thinking, from the 1950s till the 1970s, structuralism was the leading economic doctrine for low- and middle-income countries with a desire to catch up with industrialized well-developed economies (Bruno et al., 2015).

These efforts were driven by the ambition of the emerging economies to move from *periphery* to *center* of global economic relations. Structuralists recommended that governments introduce various forms of protectionism towards selected industries (for instance, by domestic currency revaluation, dedicated public supply contracts, acquisition and monopolization of markets by selected enterprises, and other monetary or fiscal policy instrumentality). Unfortunately, this doctrine caused deficits in primary materials markets and considerable inflexibility of industrial branches, which were not advanced enough to satisfy the requirements of national authorities (Lin, 2014).

Structuralism was not successful enough to stand the test of time. In the 1980s, International Monetary Fund experts presented a distinct development model based on neoliberal policy postulates, also known as *the Washington Consensus*. This doctrine recommended a wide range of institutional changes within economies of middle-income countries, such as high budgetary discipline, tax system reforms, central bank autonomy, labor market flexibility, or liberalization of trade and capital movements (Stiglitz, 2001). These rigorous changes were implemented by many governments across the world but mainly in South America. In the late 1990s and at the beginning of XXI century, it was already clear that *the Washington Consensus* had partially failed - most of the countries defrayed larger-than-expected adjustment costs, and due to inability to satisfy the requirements of the consensus, they suffered from political and economic crisis (Williamson, 2002). For the last two decades, economists have been attempting to formulate a new theoretical framework of the economic development of middle-income countries.

New structural economics, the *third wave*, is founded on the assumption that economic development results from perpetual technological and industrial innovation. A country's economic structure is endogenous to its factor endowment structure, and its transformation stimulates economic growth (Gong et al., 2019). To shape industrial development, governments have an essential role in seeking comparative advantages within the country's economy and – by using instruments of industrial policy – trying to turn them into competitive advantages (Lin & Xu, 2018).

The course of action for less advanced country's authorities (after the recognition of potential, hidden in many cases, comparative advantages) is to categorize the nation's sectors and industries: by their importance to the domestic economy, distance to foreign developed economies, competitiveness, and hidden comparative and competitive advantages. As new structural economics postulates, the identification and evaluation of a country's economy should be followed by developing a list of tradeable goods and services that have been produced for the last two decades in highly developed economies. The selected highly developed economies should have GDP *per capita* half as big again than in a studied catching-up economy (Lin, 2010, p. 2). Such in-depth analysis results in the list of industries, which should be prioritized in the country's industrial policy and relevant forms of governmental support.

The ways of encouragement or economic incentives given by authorities to national enterprises operating within the industries ought to be adequate, systematic, and comprehensive – for instance, by special economic zones, direct subsidies, incubation programs, industrial parks, corporate income tax holidays, tariffs, preferential governmental spending, or R&D grants (Lin, 2012). These stimulative governmental actions aim to provide domestic companies with the most business-friendly environment to increase their competitiveness, innovativeness, and development dynamics. NSE recommends various fiscal, industrial, or other policy tools towards specific categories of industries (presented in Table 5.1.).

NSE underlines the role of the authorities in shaping industrial development in the framework of the market mechanism. More importantly, this approach requires highly responsible and well-informed decision-makers to command comparative advantages recognition and the ability to turn them into competitive advantages with simultaneous structural change. This approach to shaping less advanced economies was already introduced in some middle-income countries. One of the examples of a country, which most notably uses NSE postulates, is the People's Republic of China. From the perspective of new structural economics assumptions, this economy holds great potential due to a highly effective combination of an efficient market and facilitating state (Lin, 2017).

Table 5.1. New structural economics recommendations towards industrial policy instruments for individual categories of industries

Catching-up industries	State authorities start with the identification of potential catching-up industries. Then, a state should attract companies' attention from more advanced economies to relocate to the country and strengthen the catching-up industries. Furthermore, the state should support successful companies in new industries and attract domestic and foreign companies through Special Economic Zones. Finally, the state ought to compensate pioneering national firms for the externalities they generate.
Leading-Edge Industries	The instruments that should support advanced modern technologies and product development are fiscal allocations to establish research funds and government subsidies for research institutions and R&D departments. Authorities can also force the pace of returns to scale increase by public procurements, legal regulations, and standardization.
Comparative advantage-losing industries	Companies should be fit with advanced, modern knowledge about design, R&D, and marketing. The state authorities should also establish 'export processing zones' to strengthen firms' knowledge and higher volume of products transferred abroad.
'Corner-overtaking' industries	State authorities can support these industries by investing in the education of related human capital, setting up start-up incubators, reinforcement and protection of property rights, encouraging venture capital, providing preferential taxes, facilitating start-ups run by creative talents at home and abroad, and by using government procurement to support the production of new products.
Strategic industries	For instance, a defense industry. These crucial industries can be assisted with subsidies, R&D grants, or possibly strengthened with products' public procurement. Despite the circumstances, the number of supported companies should be minimal.

Source: own elaboration based on Lin and Nowak (2017, p. 16).

These essential factors result in developing strategies and industrial policies focused on specific industries to increase their competitiveness and innovativeness in the global market. Presenting the NSE postulates and recommendations towards selected industries allows proceeding to the following part of the literature review, which describes the past research related to the Chinese photovoltaic cells industry development in various aspects.

2.2. Chinese photovoltaic cells industry: development, implemented policies and strategies

The analysis of the industrial policy towards the photovoltaic cells industry was the subject of numerous studies in the past (Zhi et al., 2014; Long et al., 2017; Harrison et al., 2017; Yao et al., 2019). Besides, a significant amount of research on policy for the photovoltaic cells industry development in China focuses on evaluating the effectiveness of selected policy instruments.

The crucial analyzed measures are feed-in-tariffs⁴ and renewable portfolio standards⁵, which played a vital role in developing this industry over the last two decades. (Zhang et al., 2016; Ye et al., 2017; Yang et al., 2018; Zhao et al., 2020; Zhang et al., 2021).

Although the mentioned research presents the efficiency of the applied policy measures in a broad, national perspective, some researchers, like Chen (2015), criticizes the implemented policy assumptions, especially in central-local government relations in forming and implementing an industrial policy and regional diversification of competitiveness. On the other hand, the critical analysis of the Chinese policy involves studying the relationship between the renewable energy policy and industrial policy, which was not sufficiently intertwined in the past (Zhang et al., 2013).

The development of the Chinese photovoltaic industry can also be studied from the perspective of the regional distribution of growth and the role of internal and external forces that shaped the Chinese photovoltaics exports. As the recent study shows, the critical Chinese companies exporting photovoltaics are mainly located in the Yangtze River Delta. More importantly, the Chinese policy incentives are crucial in stimulating photovoltaics exports by compensating for the shortage of industrial bases in the central and western regions (Zhu et al., 2021).

The role of subsidies and industrial policy towards the photovoltaic cells industry is also a subject of comparative studies involving China and the USA or Germany (Shi, 2015; Grau et al., 2012). Besides, photovoltaic cells industries and other low-carbon technologies based on renewable energy sources are studied in the context of a nexus between export and patent specialization as well as the increasing correlation between those two factors across countries (Zachmann & Kalcik, 2018).

As it was demonstrated before, the studied industry can be characterized as innovative and technologically advanced. These issues were the subject of the research conducted by Shubbak (2019), who studied the production and innovation system of photovoltaics in China over 1995–2017 by applying three analytical levels: national institutions, market dynamics and innovation to illustrate the interactions between them and their significant impact on shaping industrial sector's growth. Since the studied industry is centrally controlled through the supply-type and environment-type policies implemented at the central level (accounting for 80% of total policy measures), some researchers

4 Feed-In Tariff (FIT) is a commonly used energy policy measure to promote investments in renewable energy sources. It provides the small-scale energy producers from renewable sources with an above-market price for the electricity they deliver to the power grid. These prices are usually fixed and determined by the regulatory institution at the regional or national level.

5 Renewable Portfolio Standard (RPS) is a regulatory mandate and incentive to increase energy production from renewable sources. It obligates the electricity suppliers to provide their customers with a stated minimum share of electricity from eligible renewable resources.

raise the issue of potential future shortages on the demand side on the national market. Such a situation may impact the growth dynamic of the photovoltaics industry despite implemented policy instruments (Zhou et al., 2020).

2.3. The revealed comparative advantage of the Chinese photovoltaics

Development of the renewable energy sectors, including photovoltaics, is one of the priorities of economic policies in many countries. By introducing various significant measures and policy instruments, the central and local authorities try to increase the export specialization of their national economy in this domain. This issue constitutes an area of high trade tensions between countries, leading to international trade disputes, such as WTO trade disputes over photovoltaic products (Hajdukiewicz & Pera, 2020).

Strategic trade policy and new industrial policy, as the concepts of current trade policy and phenomena related to protectionism, were also studied by Drelich-Skulska and Domiter (2018). That research revealed a wide range of protectionist policy tools that stimulate modern industries' development and vary across the countries. However, the research results also proved that the selection of the policy tools is related to the level of economic development and the degree of state interventionism in shaping the industrial and economic development of a country (Drelich-Skulska & Domiter, 2018).

The studies of the revealed comparative advantage (RCA) have a long-standing tradition. This approach was applied in the context of the Chinese photovoltaic cells industry in selected aspects in the past. For instance, recently conducted research, developed by Shuai et al. (2018), focused on photovoltaic products in the Belt and Road Initiative (BRI) context. The researchers, by adopting the constant market share (CMS) and RCA methods, measured the long-term competitiveness of the Chinese photovoltaic cells and the revealed comparative advantage based on the data for the Chinese exports with the world and 65 countries in the seven "Belt and Road" regions in the years 2007–2016 (Shuai, 2018). Although this research brought the wide range of the HS categories, including the relevant photovoltaic cells fixtures and accessories, the studied time-span was limited to a decade and did not cover the first years of the XXI century (before the implementation of the Renewable Energy Law of PRCh, which significantly impacted the development of the entire renewable energy sector). More importantly, the BRI was introduced in 2013, so the studied period not sufficiently covers the time after the initiative was presented. However, this piece of literature is a source of valuable information about the structural changes that occurred in the Chinese photovoltaic cells industry (and beyond).

Undoubtedly, the research focused on evaluating Chinese industrial policy towards developing the photovoltaic cells industry is well recognized in the scientific literature. However, as the authors, we firmly believe that our research will contribute to concurrent studies by relating the implemented policy assumptions to the Chinese export specialization in photovoltaic cells from the perspective of the new structural economics. The methods applied in our research are presented in the next part of this manuscript.

3. Research methods

The concept to measure revealed comparative advantage was presented for the first time by B. Balassa in 1965 (Balassa, 1965). It is based on the *Ricardian comparative advantage theorem*, which assumes that an economy possesses the advantage when it can produce particular commodities or provide services at a lower opportunity (comparative) cost than its trading partners. From the first publication of the RCA index assumptions and formula, this approach becomes one of the key indicators to measure export specialization in given categories of products, resulting from a country's comparative advantages. However, there are various alternatives to calculate the RCA index (Laursen, 2015; Yu et al., 2009).

The classical approach used in this research and applied by the United Nations Conference on Trade and Development (UNCTAD) is founded on the concept that revealed comparative advantage can be measured with a formula presented in Equation 1 below (United Nations Conference on Trade and Development - UNCTAD, n.d.).

$$RCA_{Ai} = \frac{X_{Ai} / \sum_{j \in P} X_{Aj}}{X_{wi} / \sum_{j \in P} X_{wj}} \quad (1)$$

where:

i – is a category of exported product, being a subject of RCA considerations,

j – are all categories of exported products,

P – is the set of all exported products (with $i \in P$ and $j \in P$),

X_{Ai} – is the country A's export of product i

X_{wi} – is the world's export of product i

$\sum_{j \in P} X_{Aj}$ – is the country A's total export (of all products j in P), and

$\sum_{j \in P} X_{wj}$ – is the world's total export (of all products j in P).

The presented comparative advantage index's interpretation is as follows: a country has revealed comparative advantage for a given product category of

exported products when the RCA index exceeds 1.00. When such observation occurs, a country's economy becomes a competitive producer and strong exporter of the commodity's analyzed category. In other words, the higher the RCA index above 1.00 is, the more substantial comparative advantage the studied economy has. On the other hand, when the RCA index value is below 1.00, a country's economy has a comparative disadvantage in the analyzed commodity category. This means that this economy produces and exports that category of goods at or below the world average.

The data used in the RCA index calculations are sourced from the United Nations COMTRADE database using the Harmonized Commodity Description and Coding Systems (HS). Even though 86 countries have already reported their 2020 trade data to the UN by July 2021, the available dataset (compared to previous years) is significantly incomplete to be included in our calculations. For this reason, the research is limited to 2000–2019, where the dataset was complete. The category of considered goods is 854140 (HS): *Classification of photosensitive semiconductor devices, including photovoltaic cells whether or not assembled in modules or made up into panels, Light-emitting diodes*. Besides, we analyzed the trade volumes sourced from the UN COMTRADE (United Nations COMTRADE database, n.d.).

4. Results and discussion

4.1. Identification of NSE assumptions in photovoltaic cells industrial policy

Considering the new structural economics assumptions, as a technologically advanced and newly established industry, Chinese photovoltaics is an example of a *leading-edge industry*. Theoretically, the industrial policy for this industry should be focused on the research and development of new products and technologies conducted by domestic enterprises and supported by dedicated research funds. Additionally, the government of a middle-income country can issue invitations to tender for these technologically advanced products' manufacturers. Such dedicated public procurements are a very efficient way to allow developing companies to scale up production, reduce marginal cost, and increase the companies' global competitiveness. However, governmental actions may accelerate domestic industrial growth and support a global expansion by personnel pieces of training, legal consultations, and promotion via economic diplomacy.

Central governmental institutions and provincial authorities lead the process of shaping progression in the photovoltaic cells industry in China. In this context, it is essential to point out the most crucial actors such as the

National Development and Reform Commission (NDRC), Ministry of Science and Technology (MOST), Ministry of Commerce (MOFCOM), Ministry of Industry and Information Technology (MIIT) and Centre for Renewable Energy Development (CNREC). Local authorities in Chinese provinces restrict themselves to the execution of orders and policies given by central institutions. Nevertheless, they have some flexibility of interpretation and make a final decision about policy implementation (Urban et al., 2018). Additionally, in the field of solar PV cells development, it is worth mentioning organizations and federations of PV technology-based products manufacturers and exporters such as the Chinese Renewable Energy Industries Association in a Photovoltaic Society (CPVS), China Photovoltaic Industry Association (CPIA), or PV Products Branch of China.

Regarding the study presented in 2012 by Urban, Nordensvärd, Zhou (2012) the Chinese National People's Congress is continuously the leading institution that establishes national solar energy regulations or policies and then passes decisions along to State Council. Afterwards, the selected (mentioned before) ministries present detailed sectoral policies and monitor their implementation at the state and provincial levels. The role of research institutions is somewhat different and is consisted of consultation with the National People's Congress, State Council, state-owned and private enterprises, ministries, and local governments. Indeed, the concluding stage is a process of policy implementation towards private operators and industries (Urban et al., 2012). This decision-making process transfers most of the responsibility to public institutions that carefully and extensively formulate industrial policies.

The process of shaping photovoltaic cells industry development went through a few distinct stages determined by breakthrough milestones. For the first time, solar power and other renewable energy sources were considered by the National People's Congress in the *Tenth Five-Year Plan (2001–2005)*. The Plan stated that China could *actively develop new energy and renewable energy such as wind, solar, and geothermal power and promote energy saving and comprehensive utilization of technologies* (Wang et al., 2017, p. 106). Moreover, the *Tenth Five-Year Plan* aimed to enhance the industrial structure and competitiveness of the entire Chinese economy, raise R&D funding to 1.5% of GDP, and strengthen science, technology, and innovation (STI) capabilities. Besides, it led to the adoption of the reduced value-added tax on renewable-energy-based products and, in general, preferential tax policies for renewable energy projects. In addition, this document established goals for the following years in the context of the revolution in China and defined new perspectives for renewable energy sources. Following this document recommendations, in 2006 Chinese Ministry of Finance allocated funds dedicated to supporting research and development projects, improving

production standards, and promoting innovative goods based on renewable energy sources (including solar power).

The importance of renewable energy sources was rising, so the NDRC adopted the *Eleventh Five-Year Plan for Renewable Energy (2006–2010)*, which resulted in additional funds for the growth of popularity and domestic usage of these energy sources. The central authorities issued public procurements to reinforce manufacturers and increase the solar power capacity in national power plants. At the same time, provincial authorities offered guarantees to secure bank loans and planned R&D investments of the national companies. These free or low-interest loans were examples of the most critical supply-side governmental support to the photovoltaic cells enterprises by national banks and financial institutions (Wang et al., 2017). In the time of the Eleventh Five-Year Plan (2006–2010), the development of the renewable energy sector could not be possible without laying legal foundations for the enlargement of the related infrastructure and the growth of Chinese enterprises specializing in PV production. The PRC Renewable Energy Law (2006) and its amendment from 2009 are some of the fundamental legal and political documents on the development path in the last two decades for this industry.

To provide the broader openness in research and development in renewable energy technologies, the authorities established the *International Science and Technology Cooperation Programme for Renewable Energy programme* (2008) and *Thousand Talents Plan: Recruitment Programme of Global Experts* (a strategy scheduled for the year 2008–2018). Moreover, to support the export specialization in photovoltaic cells, the central authorities provided a *Catalogue of Chinese High-Tech Products for Export, including the photovoltaic industry* (2006).

The growth of the photovoltaic industry and popularization of solar PV power was also supported by subsidization programs, including *Renewable Energy Price Subsidies and Cost-sharing Management Pilot Scheme* (2006), *Concession Programme for Large-Scale Solar PV Power Plants* (2009) and *Solar Rooftop Subsidy Programme* (2009). These investment incentives positively influenced the domestic market and industry, primarily when the following programs were presented – *Building-integrated photovoltaics (BIPV)* (2009), and *Golden Sun Demonstration Project* (2010). BIPV (PV panels installed, for instance, on the roofs or building side walls) is one of the most efficient and inexhaustible ways of harnessing solar energy (Peng et al., 2011). Through this project, the authorities aimed to increase the number of such installations by offering direct subsidies for purchases (which was a significant demand-side incentive). On the other hand, between 2009 and 2013, the Golden Sun Demonstration Project promoted building large-scale structures of photovoltaic cells panels and supported such investments

through the 50% subsidies for the following three years after the installation (not only by financing the installation of PV panels but also a production of raw materials and related components).

The *Twelve Five-Year Plan (2011–2015)* adoption was the next phase in developing the photovoltaic cells industry. This document aimed to raise renewable and solar energy generation capacity through the following diverse incentives. The *feed-in tariff* for PV investments or projects, introduced by the Chinese NDRC in August 2011, was the next element that additionally supported the growth of the photovoltaic cells industry – that time, the tariff equaled 1.15 RMB/ kWh (Zou et al., 2017). Although the previous subsidy programs were continued, the subsequent taxation preferential policies for renewable energy-related enterprises were adopted.

To assign special priority to photovoltaics, central authorities simultaneously adopted and implemented the *Twelve Five-Year Plan for Solar Power Development*, which positively influenced market growth in the next years (Yao & Cai, 2019). This plan was associated with adopting the following crucial strategic document and policies - *Several Opinions on Promoting the Healthy Development of the Photovoltaic Industry* (State Council) and *Notice on Playing the Role of Price Leverage to Promote the Healthy Development of the Photovoltaic Industry* (NDRC). These, and other relevant documents, allowed the photovoltaic cells users to apply for 0.42 RMB/kW subsidy for distributed solar energy depending on the capacity (tax included) and to participate in new feed-in tariffs rates – 0.90, 0.95, or 1.00 RMB/kWh depending on a geographical location in one the three subregions (Zou et al., 2017).

Adopting the *Thirteenth Five-Year Plan (2016-2020)* brought changes in the development of Chinese industrial policy for photovoltaic cells. This Plan aimed to increase the share of non-fossil fuel energy to 15% by 2020 and reduce carbon intensity by 18% by 2020 compared to 2015. Since the photovoltaic cells industry was already highly developed, the Chinese authorities decided to decrease the subsidization and public support assigned to photovoltaics and focus on developing public procurements designated to develop solar PV power plants. The exemplification of this approach is visible in the reduction of the feed-in tariffs rates in each subregion by around 10% (in 2016) and by 30% (in 2017) (Shubbak, 2019).

Furthermore, the final phase of Chinese photovoltaic cells industry development is related to a sudden adoption of a new policy towards subsidies made by NDRC on May 31, 2018. The document, well-known as *531 Policy*, underlines the upsurge and territorially unsustainable growth of photovoltaic cells usage and development. Since the access to subsidies and financial support for BIPV and R&D projects was unrestricted during previous stages, it led

to the potential risk of overcapacity. Regarding the previous subsidy system, China is still divided into three geographical categories regarding the value of feed-in tariffs, which currently equal 0.50, 0.60, and 0.70 RMB/kWh, and 0.37 RMB/kW subsidy for distributed solar capacity (tax included). On top of that, no new installation of photovoltaic panels was eligible to apply for subsidies in 2018. All these cuts in the industry supporting activities were consistent with the assumptions of the *13th Five-Year Plan* (2016–2020) and its desire to increase installed capacity of photovoltaic cells infrastructure and concurrently overcome potential risks, equalize the territorial distribution of subsidies and stimulate the market to be less dependent on state support (Bin, 2018).

4.2. Chinese photovoltaic cells industry development in the light of implemented policies and strategies

The discussed evolution of the industrial policy for the Chinese photovoltaic cells industry reflects the changes that occurred in the development of this sector in the years 2000–2019, during which the Chinese energy sector underwent significant changes. The energy transition towards *green* sources like hydro, wind, or solar power sparked off primarily because of the implementation of mentioned policies, rapidly growing global demand for this type of products and the fact that these technologies (based on renewable energy sources) become more efficient, profitable, and eco-friendly. Undoubtedly, the shift towards a higher share of this energy source in the total power generation mix has many advantages for China. Presumably, it will be a chance to increase the Chinese citizens' standard of living and decrease greenhouse gases release and support natural environment preservation. As recent studies show, higher usage of green energy sources positively impacts the country's economic competitiveness and GDP growth (Vasylieva et al., 2019). The structure of the Chinese energy generation sector and the role of renewable energy sources has changed since 2000, which is presented in Table 5.2.

As presented in Table 5.2, the energy generated from fossil fuels is constantly dominant. Still, a growing trend of the total share of renewable energy sources and solar PV power can be observed in 2000–2019. The increasing role of photovoltaics was insignificant until 2006 when the PCR Renewable Energy Law was introduced. From that moment, the role of this renewable energy source (still far less significant than fossil fuels) started growing to reach a 3.05% share in the total power generation mix in 2019.

Table 5.2. Total energy generation by source in China (2000–2019)

Year	Total power generation (TWh)	Nuclear (TWh)	Fossil fuels (TWh)	Renewable energy sources in total (TWh)	Share of renewable energy sources in the power generation mix (%)	Solar PV power (TWh)	Share of solar power in the power generation mix (%)
2000	1,280	16	1,041	223	17.42	0.022	0.001719
2001	1,427	17	1,132	278	19.48	0.031	0.002172
2002	1,584	25	1,271	288	18.18	0.048	0.003030
2003	1,810	42	1,484	284	15.69	0.064	0.003536
2004	2,104	48	1,702	354	16.83	0.076	0.003612
2005	2,373	50	1,925	398	16.77	0.084	0.003540
2006	2,717	52	2,227	438	16.12	0.095	0.003497
2007	3,108	59	2,560	489	15.73	0.114	0.003668
2008	3,297	65	2,623	609	18.47	0.152	0.004610
2009	3,528	66	2,804	658	18.65	0.279	0.007908
2010	3,988	71	3,133	784	19.66	0.699	0.017528
2011	4,466	83	3,590	793	17.76	2.604	0.058307
2012	4,739	93	3,648	998	21.06	6.350	0.133995
2013	5,175	111	3,957	1,107	21.39	15.451	0.298570
2014	5,392	124	3,985	1,283	23.79	29.195	0.541450
2015	5,567	161	4,008	1,398	23.76	44.782	0.804419
2016	5,895	198	4,157	1,540	26.12	75.315	1.277608
2017	6,279	233	4,398	1,648	26.24	131.296	2.091034
2018	6,995	295	4,923	1,777	25.40	176.900	2.528949
2019	7,325	349	5,045	1,931	26.36	223.800	3.055290

Source: own elaboration based on databases of the US Energy Information Administration (www.eia.gov), International Energy Agency (www.iea.org) and China Electricity Council (www.cec.org.cn).

These changes result from policies and strategies implemented by central authorities and the rapidly growing interactions between the stakeholders in the Chinese market (Burandt et al., 2019).

One of the reasons for the shift from fossil fuels to renewable energy sources is related to the fact that China is invariably the most extensive global energy consumer and emitter of *greenhouse* gases (Ye et al., 2019). In 2019, the Chinese economy emitted 10.33 gigatons of carbon dioxide (Gt of CO₂) which accounted for 31.02% of total global emissions and was the highest quantity in the studied period (IEA, 2021). In this context, the Chinese central authorities made an appropriate and suitable decision to start the energy transition at the beginning of the XXI century. Although China's total greenhouse gas

emissions are still tremendous, its global share has been almost constant in the last years (despite the rapid economic growth and development of the national fossil-fuel-based energy sector) (Global Carbon Atlas, 2021). More importantly, it is presumed that the total CO₂ emission will consequentially decline in the following years (Burandt et al., 2019).

The second reason for energy transition and energy sources diversification is related to the unpredictability of fossil fuel markets' situation. Price and availability fluctuations affect the Chinese economic growth, so the energy transition is a step towards providing access to stable, widely available low-carbon energy. From the economic point of view, the transition to technologies based on renewable energy sources is crucial since a recent study shows that both non-fossil and non-hydro power generation positively impact electric energy costs and risk minimization (Zhang et al., 2018).

The final argument regarding the Chinese energy transition towards low-carbon energy sources is founded on the fact that development incentives directed to the enterprises (producing goods and services with renewable-energy-based technologies applied) influenced the quantity of exported goods. A recent study shows that, for example, between 2007 and 2016, the main exported categories of this kind of product were cells, photovoltaic power stations, and photovoltaic lighting equipment. Also, in 2016 the total value of various renewable-energy-based products reached 83.40 billion USD, which was 24.31% of the global export share, ranking first in the world (Cao et al., 2018). This study showed that the photovoltaics industry in China has a lot of potentials. However, electric energy has been generated from solar power for less than two decades in this country. As illustrated in Figure 5.1. solar power is a newly introduced energy source in China.

Figure 5.1 shows a strong increasing trend in the installed capacity of photovoltaic cells in China in the years 2000–2019. This indicator describes a total maximum potential output of electricity that installed PV cells can generate under perfect conditions. Indeed, there are other indicators, such as *electricity generation* or *consumption* (usually presented by source). Still, they are contingent on diverse factors like insolation year-to-year or power demand of private households and industry.

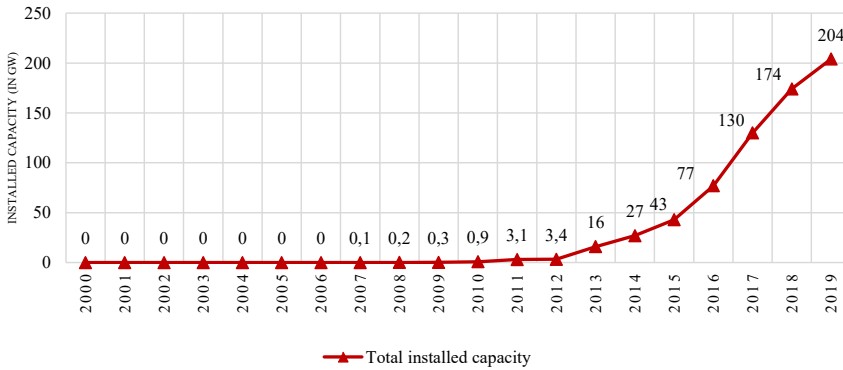


Figure 5.1. Installed electricity generation capacity from PV cells in China 2000–2019 (in GW)

Source: own elaboration based on the databases of the U.S. Energy Information Administration (www.eia.gov), International Energy Agency (www.iea.org), and China Electricity Council (www.cec.org.cn).

Additionally, this selected indicator allows the authors to present the actual changes in the infrastructure because *total capacity* is a complete photovoltaic system potential (under ideal circumstances, normally elusive). Chinese territory holds excellent potential regarding the available conditions because it receives over two thousand hours of sunshine a year (the annual average solar radiation equals 5.02×10^6 kJ/m², equivalent to 1.7×10^{12} tons of coal) (Xu et al., 2020).

As presented in Figure 5.1, China almost did not harness solar energy before 2007, but a significant infrastructure expansion and potential are observed from that moment. The rise of the importance of photovoltaics for electricity generation influenced the associated photovoltaic cells industry and production increment in China in the past years. The development of the Chinese photovoltaic cells industry, stimulated by growing domestic and global demand for such goods, influenced the trade flows presented in Figure 5.2.

The significant development of Chinese exports and imports of solar energy technology components in 2000–2018 is not the only example of the rapid growth in this sector in the studied period. The increasing popularity and profitability of solar power usage also impacted employment within the domestic industry. It is visible in the number of estimated direct and indirect jobs related to PV cells production. In 2018, 2.194 million jobs were offered in China, which accounted for 60.85% of all jobs available at that time in the world in the photovoltaic cells industry (REN21, 2019).

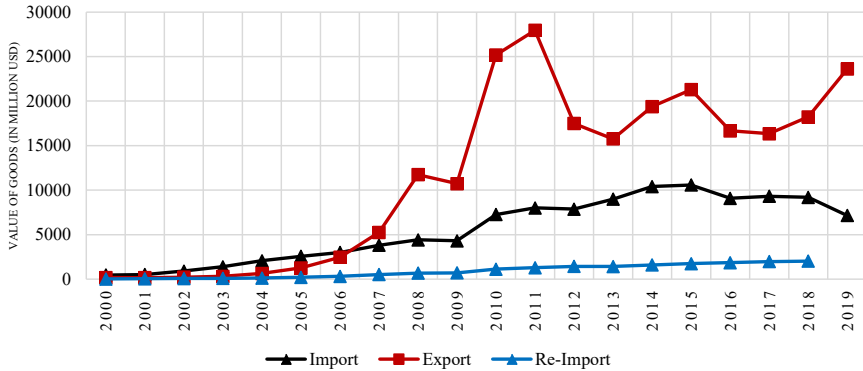


Figure 5.2. Chinese exports and imports of photovoltaics in 2000–2019 (in million USD)

Source: own elaboration based on the United Nations COMTRADE database⁶.

The success of the Chinese photovoltaic cells producers is considered on a global scale. In 2018, for the tenth year in the row, Chinese enterprises dominated the global production of these goods. The top 10 photovoltaic cells producers were as follows: JinkoSolar maintained the lead, followed by JA Solar, Trina Solar, and LONGi Solar. The next in the row was Canadian Solar (China/Canada), Hanwha Q-CELLS (Republic of Korea), Risen Energy, GCL-SI, Talesun, and First Solar (United States). It is also worth mentioning that these top ten companies produced 60% of total photovoltaic cells in 2018. Among them, JinkoSolar, JA Solar, Trina Solar, LONGi Solar, and Telesun were entirely state-owned enterprises (SOEs), or the Chinese central authorities had a dominant position in the ownership structure. The Chinese photovoltaic cells industry is a global leader in sales figures, exports, market share, and applied innovations (REN21, 2019). The substantial role of Chinese SOEs on the global market translates to the national market structure, where the Chinese authorities wholly or partially control the production of photovoltaic cells.

As presented in the recent studies, frontier technological progress in China has grown linear over the last years. It has been a result of the following factors: a fierce competition among the enterprises which stimulates innovative solutions implementation and a cost reduction, photovoltaic technology refinement and R&D progress, the global flow of knowledge, and finally, state actions aimed to provide complex support of this industry (Zhao & You, 2018). The transformation of the Chinese PV cells industry and general characterization

⁶ China did not report the information about the re-import volumes of photovoltaic cells in 2019 to the UN COMTRADE while developing this research article. When published, this data will be available at: <https://comtrade.un.org>.

presented above explicitly show how advanced, competitive, and innovative this business has become within two decades. Furthermore, the fast growth of this industry on a national scale reflects the export specialization in photovoltaic cells presented in the following part of the research results.

4.3. Results of RCA index calculations

The analysis of the export values shows this sector's dynamic growth from the beginning of the XXI century until 2019. The results of the RCA index calculations of the Chinese solar power industry are shown in Table 5.3.

Table 5.3. Chinese PV trade flows and RCA index of the Chinese photovoltaic cells industry in 2000–2019

Year	Chinese exports of 854140 (HS) goods (in billion USD)	Total exports (China-world) (in billion USD)	Total world exports of 854140 (HS) goods (in billion USD)	Total world exports (in billion USD)	RCA index for the Chinese 854140 (HS) goods
2000	0.178	249.203	7.238	6,279.835	0.61977548
2001	0.168	266.098	6.714	6,056.245	0.56878839
2002	0.222	325.596	7.179	6,373.508	0.60613425
2003	0.323	438.228	9.922	7,446.783	0.55284288
2004	0.644	593.326	13.006	9,015.084	0.75262392
2005	1.258	761.953	15.763	10,146.616	1.06238727
2006	2.460	968.936	20.416	11,861.480	1.47483365
2007	5.252	1,220.060	27.329	13,578.143	2.13888798
2008	11.745	1,430.693	44.075	15,646.492	2.91435033
2009	10.721	1,201.647	39.325	12,224.332	2.77349933
2010	25.179	1,577.764	72.407	14,901.646	3.28431347
2011	27.946	1,898.388	74.168	17,899.100	3.55263934
2012	17.483	2,048.782	53.817	17,837.300	2.82838936
2013	15.759	2,209.007	50.296	18,523.721	2.62745453
2014	19.389	2,342.293	54.281	18,459.859	2.81512753
2015	21.291	2,273.468	56.869	16,131.035	2.65637628
2016	16.662	2,097.637	53.121	15,669.571	2.34307346
2017	16.339	2,263.371	52.130	17,239.128	2.38720594
2018	18.219	2,494.230	52.058	18,927.563	2.65575308
2019	23.600	2,498.570	56.425	18,183.161	3.04388398

Source: own elaboration based on the UN Comtrade database.

Over the last two decades, the Chinese export volumes of photovoltaic cells have increased their share in global exports. However, there was a crucial decline in the growing trend related to the trade policy changes introduced by the EU and the USA. In 2012 and 2013, the Chinese photovoltaic cells were officially imposed with antidumping tariffs due to high subsidization for the Chinese national PV cells producers. Interestingly, the decline did not occur due to the trade war between China and the USA in 2018 (where Chinese solar panels were one of the first categories of goods embraced with higher import tariffs). Considering the Chinese and global PV cells' export volumes, the authors calculated the revealed comparative advantage index. The results are presented in Figure 5.3.

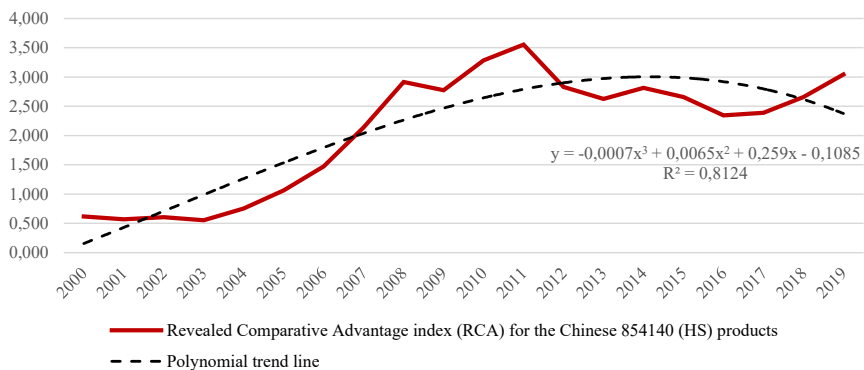


Figure 5.3. Presentation of the Revealed Comparative Advantage index for the Chinese (HS) 854140 products in 2000–2019 with the polynomial trend line

Considering that a revealed comparative advantage of the selected national industries is one of the key determinants and factors of the industrial policy effectiveness, it is essential to acknowledge that regarding the proceeded calculations Chinese photovoltaic cells industry possess a comparative advantage, which was revealed from 2006 (when RCA index exceeded 1.00). Regarding the polynomial trend line and the added equation with the R-squared value (which informs how well the regression model describes the changes of the RCA index), the trend is visible. Despite the growing export specialization in photovoltaic cells, the trend declines, which may be potentially related to the decreasing support offered by the Chinese authorities to the national companies and the photovoltaic sector in general (including the decrease in feed-in tariffs and lowering subsidization year-to-year). These results suggest that declining state interventionism around the

PV cells industry may potentially affect the revealed comparative advantage in the future and the survival of this industry's position in the global market. However, the observed decline is marginal, so this issue should be a subject of future research to find out how the export specialization changed after the announced decrease in state interventionism in the context of solar power development in China.

Nevertheless, The RCA index calculations provided evidence for the effectiveness of the implemented policy and strategy assumptions in the last two decades. From the new structural economics perspective, the combination of facilitating state interventionism and effective market mechanism translated to the Chinese export specialization in the photovoltaic cells.

5. Conclusion

New structural economics sets an example for combining structural and neoclassical economics postulates as a modern promising economic development framework. Additionally, this synthesis is broadened with detailed recommendations towards specific types of catching-up industries in middle-income countries. This new doctrine is also a potential road map for the governments to shape industrial development effectively (if the authorities possess the required competencies and funds).

From the perspective of NSE assumptions, the Chinese photovoltaic cells industry is an example of a *leading-edge* industry. Over the last years, this industry experienced dynamic growth due to various state interventions, stimulative global market forces, and the international pursuit to mitigate climate change. The presented governmental and institutional supportive policies and instruments, focused on the R&D projects development and photovoltaic cells usage increase, translated to the rapid growth of the volume of energy generation from this renewable energy source and the value of international trade volumes. In 2009, when most of the implemented policies started taking effect, electricity generation from solar power reached 0.279 TWh and accounted just for 0.007908% of all generated energy. Ten years later, the share of electricity generation from PV cells amounted to 3.05529% and reached 223.8 TWh (IEA, 2021). However, the growth of this sector could not be possible without international trade relations and the global pursuit for the energy transition, including the popularization of photovoltaics. Furthermore, China is currently an inimitable global leader in capacity, production, export, and innovative technology implementation (REN21, 2019).

The analysis of Chinese policies for photovoltaic cells industry development allows formulating the following conclusions. Chinese authorities have been shaping the development of the studied industry,

assuming that the most efficient way to catch up with more advanced countries within a leading-edge industry is to implement various state incentives like subsidies, dedicated R&D funds, global expansion promotion, and new products and technologies introduction. The impressively successful growth of the Chinese photovoltaic cells industry, which revealed comparative advantage in recent years, sets an example for the other countries which consider following the Chinese development path. In this context, new structural economics may reach out to policymakers with a complete set of instruments and exemplify successful implementation (such as the studied photovoltaic cells industry). On the other hand, the People Republic of China, with its specific centrally controlled socio-economic model, demonstrates the approach that might be hard to implement in the other catching-up economies which do not hold sufficient equity, competencies, and political power to impose effective changes towards their industries.

These findings provide a good starting point for discussion and further research that should consider the potential effects of the economic development policy based on NSE on the entire Chinese renewable energy sector since the photovoltaic cells industry accounts just for its fraction. Moreover, further study is necessary to disentangle these complexities in industrial policy application towards a bigger group of enterprises and specific goods. On the other hand, the future study could focus on the structural changes that occurred within this industry as well as how the industrial policy impacted the global value chains and global supply chains related to the Chinese photovoltaic cells industry. In addition, the future study should compare the industrial policy towards analyzed industry in Japan and the other Asia-Pacific countries. Further analysis could contribute to the studies on new structural economics implementation towards the renewable energy sector development in theory and business practice.

Acknowledgments

The authors emphasize their gratitude to anonymous reviewers and editors for valuable comments on earlier manuscript versions.

References

- Balassa, B. (1965). Trade liberalisation and “revealed” comparative advantage. *The Manchester School*, 33(2), 99–123. <https://doi.org/10.1111/j.1467-9957.1965.tb00050.x>
- Berglof, E., Lin, J. Y., & Radosevic, S. (2015). Transition economics meet new structural economics: Editorial introduction. *Journal of Economic Policy Reform* 18(2), 89–95. <https://doi.org/10.1080/17487870.2015.1013544>

- Bin, L. (August 13, 2018). China's solar industry is at a crossroads. *China Dialogue*. Retrieved on July 8, 2021, from <https://www.chinadialogue.net/article/show/single/en/10775-China-s-solar-industry-is-at-a-crossroads>
- Bruno, R. L., Douarin, E., Korosteleva, J., & Radosevic, S. (2015). Technology choices and growth: Testing new structural economics in transition economies. *Journal of Economic Policy Reform*, 18(2), 131–152. <https://doi.org/10.1080/17487870.2015.1013541>
- Brusilo, P. (2019). Transition towards energy generation from renewable sources in the People's Republic of China. *Economics of the 21st Century*, 2, 85–97. <https://doi.org/10.15611/e21.2019.2.06>
- Burandt, T., Xiong, B., Löffler, K., & Oei, P. Y. (2019). Decarbonizing China's energy system – Modeling the transformation of the electricity, transportation, heat, and industrial sectors. *Applied Energy*, 255, 113820. <https://doi.org/10.1016/j.apenergy.2019.113820>
- Cao, X., Rajarshi, A., & Tong, J. (2018). Technology evolution of China's export of renewable energy products. *International Journal of Environmental Research and Public Health*, 15(8), 1782. <https://doi.org/10.3390/ijerph15081782>
- China Electricity Council. (2020). List of statistical reports of the national electric power industry in 2019. Retrieved on July 8, 2021, from <http://www.cec.org.cn/>
- Chen, T. (2016). The development of China's solar photovoltaic industry: Why industrial policy failed. *Cambridge Journal of Economics* 40(3), 755–774. <https://doi.org/10.1093/cje/bev014>
- Dangelico, R. M., Pujari, D., & Pontrandolfo, P. (2017). Green product innovation in manufacturing firms: A sustainability-oriented dynamic capability perspective. *Business Strategy and the Environment*, 26(4), 490–506. <https://doi.org/10.1002/bse.1932>
- Drelich-Skulska, B., & Domiter, M. (2018) Protectionism in trade policy in XXI century. *Transformations in Business & Economics*, 17(2A (44A)), 353–371.
- Global Carbon Atlas. (2021). Global Carbon Atlas. Retrieved on July 8, 2021, from <http://www.globalcarbonatlas.org/>
- Gong, Q., Lin, J. Y., & Zhang, Y. (2019). Financial structure, industrial structure, and economic development: A new structural economics perspective. *Manchester School* 87(2), 183–204. <https://doi.org/10.1111/manc.12240>
- Grau, T., Huo, M., & Neuhoff, K. (2012). Survey of photovoltaic industry and policy in Germany and China. *Energy Policy*, 51, 20–37. <https://doi.org/10.1016/j.enpol.2012.03.082>
- Hajdukiewicz, A., & Pera, B. (2020). International trade disputes over renewable energy—The case of the solar photovoltaic sector. *Energies* 13(2), 500. <https://doi.org/10.3390/en13020500>

- Harrison, A., Martin, L.A., & Nataraj, S. (2017). Green industrial policy in emerging markets. *Annual Review of Resource Economics*, 9(1), 253–274. <https://doi.org/10.1146/annurev-resource-100516-053445>
- IEA. (2021). Global CO2 emissions in 2019. International Energy Agency. Retrieved on July 8, 2021, from <https://www.iea.org/articles/global-co2-emissions-in-2019>
- Laursen, K. (2015). Revealed comparative advantage and the alternatives as measures of international specialisation. *Eurasian Business Review*, 5(1), 99–115. <https://doi.org/10.1007/s40821-015-0017-1>
- Lin, J. Y. (2010). Six Steps for strategic government intervention. *Global Policy*, 1(3), 330–331. <https://doi.org/10.1111/j.1758-5899.2010.00046.x>
- Lin, J. Y. (2012). *New Structural Economics: A Framework for Rethinking Development and Policy*. The World Bank.
- Lin, J. Y. (2014). Industrial policy revisited: A new structural economics perspective. *China Economic Journal*, 7(3), 382–396. <https://doi.org/10.1080/17538963.2014.949025>
- Lin, J. Y. (2017). Industrial policy and China's economic development: From the perspective of new structural economics. *Fudan Journal of the Humanities and Social Sciences*, 10(4), 419–429. <https://doi.org/10.1007/s40647-017-0201-z>
- Lin, J. Y., & Xu, J. (2018). Rethinking industrial policy from the perspective of new structural economics. *China Economic Review*, 48, 155–157. <https://doi.org/10.1016/j.chieco.2017.11.009>
- Long, R., Cui, W., & Li, Q. (2017). The evolution and effect evaluation of photovoltaic industry policy in China. *Sustainability* 9(12), 2147. <https://doi.org/10.3390/su9122147>
- Nowak, A. Z., & Lin, J. Y. (2017). *New Structural Economics for Less Advanced Countries*. Warsaw: University of Warsaw Faculty of Management Press. <https://doi.org/10.7172/978-83-65402-92-9.2018.wzw.10>
- Peng, C., Huang, Y., & Wu, Z. (2011). Building-integrated photovoltaics (BIPV) in architectural design in China. *Energy and Buildings*, 43(12), 3592–3598. <https://doi.org/10.1016/j.enbuild.2011.09.032>
- REN21. (2019). Renewables 2019 - global status report. UN Environment Programme. Retrieved on July 8, 2021, from <https://www.ren21.net/>
- Shi, H. (2015). Comparison between subsidy policies on photovoltaic industry of China and the U.S.: Based on three-stage sequential game models. *International Business and Management*, 11(1), 32–40. <https://doi.org/10.3968/7287>
- Shuai, J., Chen, C., Cheng, J., Leng, Z., & Wang, Z. (2018). Are China's solar PV products competitive in the context of the Belt and Road Initiative? *Energy Policy*, 120, 559–568, <https://doi.org/10.1016/j.enpol.2018.05.042>
- Shubbak, M.H. (2019). The technological system of production and innovation: The case of photovoltaic technology in China. *Research Policy*, 48(4), 993–1015. <https://doi.org/10.1016/j.respol.2018.10.003>

- Stiglitz, J. (2001). Redefining the role of the state. *World Economics*, 2(3), 46–86.
- United Nations Comtrade Database (n.d.). Retrieved on July 8, 2021, from <https://comtrade.un.org/>
- United Nations Conference on Trade and Development – UNCTAD. (n.d.). Revealed comparative advantage. Retrieved on July 8, 2021, from <https://unctadstat.unctad.org/en/RcaRadar.html>
- Urban, F., Nordensvärd, J., & Zhou, Y. (2012). Key actors and their motives for wind energy innovation in China. *Innovation and Development*, 2(1), 111–130. <https://doi.org/10.1080/2157930x.2012.664034>
- Urban, F., Wang, Y., & Geall, S. (2018). Prospects, politics, and practices of solar energy innovation in China. *The Journal of Environment & Development*, 27(1), 74–98. <https://doi.org/10.1177/1070496517749877>
- Vasylieva, T., Lyulyov, O., Bilan, Y., & Streimikiene, D. (2019). Sustainable economic development and greenhouse gas emissions: The dynamic impact of renewable energy consumption, GDP, and corruption. *Energies*, 12(17), 3289. <https://doi.org/10.3390/en12173289>
- Wang, P., Yuan, L., & Kuah, A. T. H. (2017). Can a fast-expanding market sustain with supply-side government aid? An investigation into the Chinese solar photovoltaics industry. *Thunderbird International Business Review*, 59(1), 103–114. <https://doi.org/10.1002/tic.21771>
- Williamson, J. (2002). *Did the Washington Consensus Fail?* | *PIIE*. Outline of Speech at the Center for Strategic & International Studies Washington, DC. Retrieved from <https://www.piie.com/commentary/speeches-articles/did-washington-consensus-fail>
- Xu, M., Xie, P., & Xie, B. C. (2020). Study of China's optimal solar photovoltaic power development path to 2050. *Resources Policy*, 65, 101541. <https://doi.org/10.1016/j.resourpol.2019.101541>
- Yang, C., & Ge, Z. (2018). Dynamic feed-in tariff pricing model of distributed photovoltaic generation in China. *Energy Procedia*, 152, 27–32. <https://doi.org/10.1016/j.egypro.2018.09.054>
- Yao, M., & Cai, X. (2019). An overview of the photovoltaic industry status and perspective in China. *IEEE Access*, 7, 181051–181060. <https://doi.org/10.1109/ACCESS.2019.2959309>
- Ye, L. C., Lin, H. X., & Tukker, A. (2019). Future scenarios of variable renewable energies and flexibility requirements for thermal power plants in China. *Energy*, 167, 708–714. <https://doi.org/10.1016/j.energy.2018.10.174>
- Ye, L.-C., Rodrigues, J.F.D., & Lin, H.X. (2017). Analysis of feed-in tariff policies for solar photovoltaic in China 2011–2016. *Applied Energy*, 203, 496–505. <https://doi.org/10.1016/j.apenergy.2017.06.037>
- Yu, R., Cai, J., & Leung, P. (2009). The normalised revealed comparative advantage index. *The Annals of Regional Science* 43, 267–282. <https://doi.org/10.1007/s00168-008-0213-3>

- Zachmann, G., & Kalcik, R. (2018). Export and patent specialisation in low carbon technologies. In S. Dutta, B. Lanvin, & S. Wunsch-Vincent (Eds.), *The Global Innovation Index 2018: Energising the World with Innovation*. Geneva, World Intellectual Property Organization.
- Zhang, L., Chen, C., Wang, Q., & Zhou, D. (2021). The impact of feed-in tariff reduction and renewable portfolio standard on the development of distributed photovoltaic generation in China. *Energy*, 232, 120933. <https://doi.org/10.1016/j.energy.2021.120933>
- Zhang, M.M., Zhou, D.Q., Zhou, P., & Liu, G.Q. (2016). Optimal feed-in tariff for solar photovoltaic power generation in China: A real options analysis. *Energy Policy*, 97, 181–192. <https://doi.org/10.1016/j.enpol.2016.07.028>
- Zhang, S., Andrews-Speed, P., Zhao, X., & He, Y. (2013). Interactions between renewable energy policy and renewable energy industrial policy: A critical analysis of China's policy approach to renewable energies. *Energy Policy*, 62, 342–353. <https://doi.org/10.1016/j.enpol.2013.07.063>
- Zhang, S., Zhao, T., & Xie, B. C. (2018). Analysis of power generation mix in China: An evaluation based on portfolio theory. *Energy Procedia*, 145, 163–168. <https://doi.org/10.1016/j.egypro.2018.04.028>
- Zhao, X., Li, P., & Zhou, Y. (2020). Which policy can promote renewable energy to achieve grid parity? Feed-in tariff vs. renewable portfolio standards. *Renewable Energy*, 162, 322–333. <https://doi.org/10.1016/j.renene.2020.08.058>
- Zhao, X., & You, Z. (2018). Technological progress and industrial performance: A case study of solar photovoltaic industry. *Renewable and Sustainable Energy Reviews*, 81, 929–936. <https://doi.org/10.1016/j.rser.2017.08.038>
- Zhou, D., Chong, Z., & Wang, Q. (2020) What is the future policy for photovoltaic power applications in China? Lessons from the past. *Resources Policy*, 65, 101575. <https://doi.org/10.1016/j.resourpol.2019.101575>
- Zhu, X., He, C., & Gu, Z. (2021). How do local policies and trade barriers reshape the export of Chinese photovoltaic products? *Journal of Cleaner Production*, 278, 123995. <https://doi.org/10.1016/j.jclepro.2020.123995>
- Zou, H., Du, H., Ren, J., Sovacool, B. K., Zhang, Y., & Mao, G. (2017). Market dynamics, innovation, and transition in China's solar photovoltaic (PV) industry: A critical review. *Renewable and Sustainable Energy Reviews*, 69, 197–206. <https://doi.org/10.1016/j.rser.2016.11.053>

Biographical notes

Bogusława Drelich-Skulska is Professor of Economics, Head of Department of International Business and the founder and a member of the Asia-Pacific Research Centre at the Wrocław University of Economics and Business (Poland). Her research interests relate to international economic relations and foreign trade, as well as development economics, with particular emphasis on economic policy issues in selected East Asian countries.

Paweł Brusilo (M.A.) is a Ph.D. candidate in Economics and Finance in the Department of International Business and a member of the Asia-Pacific Research Centre at the Wrocław University of Economics and Business (Poland). His research interests include evaluating the renewable energy transition and environmental policy in the USA, EU, Japan and China, as well as studies of economic and trade relations between the Asia-Pacific countries.

Citation (APA Style)

Drelich-Skulska, B., & Brusilo, P., (2021). Photovoltaic cells industry in China. Industrial policy and revealed comparative advantage in the XXI century. In A. Ujwary-Gil & B. Godlewska-Dzioboń (Eds.), *Challenges in Economic Policy, Business, and Management in the COVID-19 Era* (pp. 111–138). Warsaw: Institute of Economics, Polish Academy of Sciences.

The Chinese photovoltaic cells industry and the Belt and Road Initiative: The intra-industry perspective

Paweł Brusilo¹

Abstract

The Belt and Road Initiative (BRI) is one of the most significant infrastructural projects worldwide and a chance for the Chinese photovoltaic cells industry to scale up and expand into new markets. From 2000 to 2019, this industry became a global leader in capacity, export, employment and innovative technology implementation. This study aims to evaluate the Chinese photovoltaic cells industry development in the years 2000–2019 and identify the modern trade patterns and opportunities for this industry alongside the Belt and Road Initiative, especially in the context of intra-industry trade relations. The methods applied in this research include analysing the Grubel-Lloyd trade index and net export volumes, which allowed the author to evaluate and recognise potential trade partners for this technologically advanced industry. The research revealed that the Chinese photovoltaic cells industry underwent substantial changes due to significant state interventionism and implementation of the energy transition policy assumptions. The development of this industry translated to the growth of electricity generation from solar power from less than 1 million MWh in 2000 to over 224 million MWh in 2019. Furthermore, Malaysia, Thailand, and the Republic of Korea accounted for 92.70% of the total imports value of photovoltaic cells in 2019 among the BRI countries. The highest export value of this category of products was associated mainly with the trade relations with the following BRI countries: Republic of Korea, Ukraine, Pakistan, Portugal, Chile and South Africa. Moreover, based on the export data from 2019, the most significant intra-industry trade potential for Chinese photovoltaics was represented by Indonesia, the Philippines, Thailand, the Republic of Korea, Malaysia, Czechia and Singapore. Chinese authorities should accelerate transportation and logistics infrastructure

¹ Paweł Brusilo, Ph.D. candidate in the Department of International Business and a member of the Asia-Pacific Research Center at the Wrocław University of Economics and Business. Address: ul. Komandorska 118/120, Wrocław, 53-345, Poland, e-mail: pawel.brusilo@ue.wroc.pl (ORCID: 0000-0001-9138-5724).

This is an open access article under the CC BY license (<https://creativecommons.org/licenses/by/4.0/legalcode>).

reinforcement (mainly maritime routes through the South China Sea and the Java Sea, and the inland infrastructure). Besides, the Grubel-Lloyd trade index analysis reveals the potential of two-way trade with some EU countries, so the economic and trade cooperation should be tightened and deepened in the export and import of photovoltaic cells between China and the EU. This research article, by the Grubel-Lloyd trade index application, contributes to a better understanding of the potential two-way trade between China and other Belt and Road Initiative countries in the context of the rapidly growing Chinese photovoltaic cells industry.

Keywords: *belt road initiative, photovoltaic cells, intra-industry trade, China, two-way trade.*

1. Introduction

Over the last years, the Chinese energy sector has undergone significant changes towards more sustainable and *green* power generation from renewable energy sources. The dynamic energy transition has been driven and supported by the policy system and legislative framework introduced at the beginning of the XXI century to promote renewable energy development (Liu, 2017). This transition was also an opportunity to establish innovative enterprises and brand new advanced industries. The result of this exceptional development is the Chinese solar photovoltaic cells industry (Buckley & Nicholas, 2017; Zhao & You, 2018).

In this context, Chinese enterprises made one of the fastest progressions worldwide. As recent studies show, they are not only highly innovative and competitive, but they are also undisputed leaders on a global scale (Cao et al., 2018). The rising awareness of consumers, entrepreneurs, and politicians about the harmful effects of global warming and the consequences of greenhouse gas release translate into the growing demand for commodities based on renewable energy sources, including solar photovoltaic (PV)² cells. In China, it resulted in the development of the photovoltaic industry and the usage growth of this particular energy source fueled by local and central authorities and related institutions such as the China National Renewable Energy Centre (Wang et al., 2017).

Moreover, it is worth emphasizing that the energy transition process towards renewable energy sources and its exemplification in the growing demand for photovoltaic cells panels is observed worldwide. From this perspective, the Belt and Road Initiative is one of the best platforms to promote

² The acronym PV stands for a type of photovoltaic cells solar panels, a system based on highly advanced modern polysilicon technologies.

green development and exploitation of insolation to generate clean electric energy (Gu & Zhou, 2020; Geng, 2021).

This study aims to evaluate the Chinese photovoltaic cells industry development in the years 2000–2019 and identify the modern trade patterns and opportunities for this industry alongside the Belt and Road Initiative, especially in the context of intra-industry trade relations. It is worth mentioning that a similar analysis has not been conducted yet regarding the author's best knowledge. The novelty of the presented approach is to adopt the perspective of the intra-industry trade in the studies of the Chinese photovoltaic cells trade relations in the context of the Belt and Road Initiative. The originality of the research results contributes to a better understanding of international trade relations between China and the countries alongside the Belt and Road Initiative (BRI) considering photovoltaic cells. Since the renewable energy sector is gaining significant importance worldwide, the studies of its vital component – photovoltaic cells – is essential and should be continuously developed. Accordingly, this article seeks the answer to the following research questions (RQ):

***RQ1)** How the Chinese photovoltaic cells industry developed between 2000 and 2019?*

***RQ2)** What were the trade patterns in the photovoltaic cells industry between China and the Belt and Road Initiative countries in 2019?*

***RQ3)** What is the potential of the intra-industry trade between China and the Belt and Road Initiative countries, based on evaluating the Grubel Lloyd index values in 2019?*

This article presents a comprehensive study of the industrial development, modern trade patterns, and intra-industry trade opportunities for the Chinese photovoltaic cells industry from the perspective of the Belt and Road Initiative. It is organized as follows: the first part provides a brief literature review and an overview of the Belt and Road Initiative for a better understanding of the research background, the second section explains the methods and data sources used in the research. The third part contains a graphical presentation and suitable research analysis about China's photovoltaic cells industry and its intra-industry trade relations alongside the Belt and Road Initiative countries. Conclusions and a summary are placed in the final part of the article. Finally, data used in research (mainly sourced from the UN COMTRADE database) is placed in the appendix section.

2. Literature review

The Belt and Road Initiative, 一帶一路 (also known as *One Belt One Road Initiative* or *Silk Road Economic Belt and the XXI century Maritime Silk Road*) was proposed in 2013 by the Chinese President, Xi Jinping. The project aims to establish and promote a new framework of international trade relations and political cooperation by using a figurative sense of the ancient *Silk Road* between Asia and Europe. This project focuses on economic and physical infrastructure construction alongside the Road and the Belt regarding the BRI vision and actions. Moreover, it considers building new spiritual and cultural connections between associated countries (Liu et al., 2018). The initiative has five primary goals: *policy coordination, unimpeded trade, facilities connectivity, financial integration, and people-to-people growth* (Belt and Road Forum for International Cooperation, 2017).

The BRI is also a set of international projects – between the years 2013 and 2019 Chinese government spent over 730 billion USD on them in the BRI countries (mainly in energy, transportation, real estate, and metals industries). From the beginning, this initiative has been attracting the attention of many countries and international organizations. By 2019, as shown in Figure 6.1, 130 countries have joined the BRI, and more are planning to sign the *Memorandum of Understanding* (or comparable agreements) about this worldwide initiative (yidaiyilu.gov.cn, 2020). At the same time, Belt and Road Initiative stimulates the growth of the Chinese outward foreign direct investments. From the announcement of this initiative in 2013 until 2019, the value of this type of project increased by 45% (mainly in developing countries and emerging economies) (Yu et al., 2019).

Furthermore, there is evidence that opportunities for trade creation effects are more significant in regions with highly developed transportation infrastructure, which makes connectivity less problematic across the borders between trade partners. For this reason, the Belt and Road Initiative mainly promotes the construction of infrastructural linkages in South-East Asia to strengthen the gravity effects of the Chinese economy (OECD, 2018).

There are many studies about the Belt and Road Initiative's impact on the economic, industrial, or international trade relations (Li et al., 2019; Chen, Hou & Xiao 2018; Cinar, Johnson & Geusz 2016; Song, Che & Yang 2018; Tian et al., 2019). However, this initiative can also be perceived as sustainable growth promotion since the Chinese CPC Central Committee and the State Council passed in 2017 the Guidance on Promoting Green Belt and Road declaration.

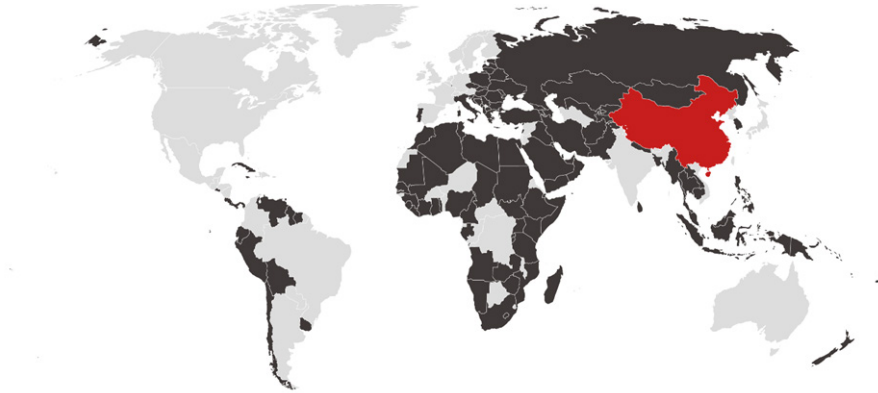


Figure 6.1. Belt and Road Initiative member countries in 2019

Source: own elaboration based on information and list from One Belt One Road Portal (<http://www.yidaiyilu.gov.cn/>).

This document emphasized the need to promote the Green BRI to *share the ecological civilization philosophy and achieve sustainable development, accelerate an essential effort to participate in global environmental governance and promote green development concept, key move to serve and forge communities of shared interests, shared responsibility and common destiny* (Ministry of Ecology and Environment of the People’s Republic of China, 2017). Furthermore, to implement these assumptions, the Chinese authorities, among other crucial actions, appointed a designated committee – The Belt and Road Initiative International Green Development Coalition (BRIGC). Its goal is to *promote international consensus, understanding, cooperation, and concerted actions to realize green development on the Belt and Road, integrate sustainable development into the BRI through joint efforts, and facilitate BRI participating countries to realize SDGs related to the environment and development* (BRIGC, 2019).

These objectives have a reflection in the recent studies. For instance, the research carried by Chen et al. (2019) shows that most of the BRI countries hold great potential for solar energy, so the BRI can be a significant incentive to enlarge photovoltaic power plants’ installed capacity, diversify the electric energy sources, and satisfy the regional electricity demand. The significance of the BRI and its numerous energy sector outward foreign direct investments represent a broad spectrum of opportunities for the Chinese companies to expand into new markets with projects based on renewable energy sources. Moreover, the Belt and Road Initiative has a policy-based impact on greening Chinese investments in the associated countries, mainly in developing ones (Liu, 2020).

Considering the *green* aspect of the Belt and Road Initiative and the facilitation of international trade as the main objective, this initiative is possibly a significant economic and political opportunity, which may accelerate the development of the Chinese solar photovoltaic cells industry shortly. Since the photovoltaic cells industry is highly technologically advanced, its development requires incentives like technology transfer. Some researchers emphasize that since China is a global leader in manufacturing photovoltaic technology-based goods and the number of importers of those products is continuously increasing, the Belt and Road Initiative offers technology transfer on different value chain segments (Jackson et al., 2021).

The existing international trade network patterns will likely undergo vital changes in the following decade due to developing the new trade routes resulting from the Belt and Road Initiative implementation. Besides, the BRI will stimulate by reducing trade barriers and improve economic cooperation alongside newly established routes (Cui & Song, 2019).

However, due to its complicated and not fully formalized status, the implementation of the Belt and Road Initiative may face substantial challenges. As Huang (2016) points out after his research, first of all, there is no explicit coordination mechanism, framework or institution that could entirely facilitate and organize this process. Moreover, there are risks of clashes of political values across countries, which are significantly diversified in political regimes, culture, and economic and legal systems. The next issue is related to the Chinese tension to take advantage of the Belt and Road Initiative and newly established trade relations to export its excess production capacity, especially in heavy industry. Last but not least, the financial sustainability of the cross-country BRI projects may pose a threat to the implementation of the Initiative's assumptions and new trade routes constructions. The potential barriers may result from the fact that most Chinese outward foreign direct investments projects are not profit-driven. Chinese authorities are not experienced in running cross-border projects in the past on such a scale (Huang, 2016).

Based on adopting a constant market share model and a revealed comparative advantage approach, other studies show that the Chinese photovoltaic cells industry holds substantial international competitiveness in the Belt and Road Initiative context. Besides, the temporal fluctuations in export volumes were caused by changes in global demand, which is still in the upward trend. Nevertheless, the key trade partners, who shaped the Chinese photovoltaic cells export directions, were mainly neighboring South-East Asia countries, where demand increased substantially year-to-year. In addition, the Chinese photovoltaic-based products have already revealed the comparative advantage in general, but this factor is diversified among individual components of the PV panels (Shuia et al., 2018).

Based on the literature review and the studies of relevant reports and analysis, it is possible to formulate research hypotheses that match research questions:

H1: *The Chinese trade with photovoltaic cells alongside the Belt and Road Initiative countries was mainly conducted in the Asia-Pacific region in 2019, with the substantial role of the countries in South-East Asia.*

H2: *Thanks to the impressive concurrent growth and the developed trade routes, the Chinese photovoltaic cells industry possesses significant intra-industry trade potential with the surrounding countries in South East Asia and the EU.*

3. Research methods

To provide the most accurate analysis of the current trade relations and patterns between the People's Republic of China and the countries alongside the Belt and Road Initiative, the author decided to review, first of all, the available literature related to the research subject and evaluate the volumes of net exports and intra-industry trade indexes based on the most up-to-date data from 2019.

Net exports are a well-known economic measure that equals the difference between the value of exports and imports of selected goods or the entire nation's international trade. Furthermore, intra-industry trade refers to an international trade relation, which occurs when two countries simultaneously export and import goods within the same industry. This situation is also called a two-way trade and was observed and characterized for the first time in the 1970s (Grubel & Lloyd, 1975).

The intensive intra-industry trade usually occurs between high-income countries with a comparable industrial structure, development level, and relatively close distance. The extent of the two-way trade volume between two countries (A, B) is generally measured by the Intra-Industry Trade (IIT) index (also known as Grubel–Lloyd index), which is specified for an 'i' class product in the following formula:

$$IIT_{i,AB} = \left(\frac{(X_i + M_i) - |X_i - M_i|}{(X_i + M_i)} \right) \quad (1)$$

where:

i – stands for a category of a specific commodity,

X_i – stands for exports value of i type of goods,

M_i – stands for imports value of i type of goods.

This index can take 0% (or 0), as the minimum value, when there is no two-way exchange (same class goods are not imported and exported between country A and B at the same time, or the exchange occurs only one-way), up to 100% (or 1), when entire trade is intra-industry, another word, the value of exports amounts to a value of imports. Regarding relevant studies focused on the international trade indexes (Lima & Alvarez, 2008), a value of the IIT index can be classified as follows:

Class 1:	$IIT_{i,AB} > 33\%$	Intra-industry trade
Class 2:	$10\% \leq IIT_{i,AB} \leq 33\%$	Potential for intra-industry trade
Class 3:	$IIT_{i,AB} < 10\%$	Inter-industry trade

In the IIT context, this study aims to localize countries that either hold intra-industry trade relations with China on a field of photovoltaic cells or have the potential for such an international exchange. Intra-industry trade usually involves two major categories: differentiated (vertically or horizontally) and homogeneous products (Grubel & Lloyd, 1971).

In most of the cases, the IIT is observable within differentiated commodities such as highly substitutable commodities (e.g., wood or wafer board furniture), commodities with similar input requirements but low substitutability in use (e.g., cooper bars or sheets), commodities with similar input requirements and substitutability in respective use (e.g., smartphones from Huawei or Xiaomi) and additionally, the final products or parts which are classified in the same statistical category. In the context of homogeneous products, the IIT occurs as a re-export, border, or periodic trade or trade of strategic commodities under a governmental regulation (Kawecka-Wyrzykowska et al., 2017).

International trade studies using the intra-industry trade index have a long-standing tradition (Lancaster, 1980; Brander, 1981; Balassa, 1986). For instance, this approach, presented by Drelich-Skulska and Bobowski (2021), identifies trade patterns of the automotive industry in the context of the European Union-Japan Economic Partnership Agreement. In that research, the scope was narrowed to individual and significant industry (in terms of its role in shaping GDP, job market, and R&D expenditures) and the international agreement that influences trade liberalization between the partners (Drelich-Skulska & Bobowski, 2021).

Considering all the above diverse types of commodities, it is crucial to select a studied industry carefully because a too broad scope may cause incorrect or irrelevant results. The data used in the following research article were sourced from the UN COMTRADE database. They characterize export and import relations between China and 130 countries, which signed the *Memorandum of Understanding* (or comparable agreements) with China about the Belt and

Road Initiative. The UN COMTRADE database allows selecting categories of commodities (cataloged, in the example, in six-digit Harmonised System codes) that narrow the search scope to the particular type of goods. Since solar photovoltaic cells are final products or parts used in the related equipment, they are classified in the same statistical category and analyzed holistically in the following research article³. Additionally, to present the development to the date of the Chinese photovoltaic cells industry in the years 2000–2019 author used the values of imports and exports. The Chinese solar photovoltaic panels industry growth opportunities were also presented based on information sourced from relevant reports, research, and analysis (mentioned in the reference section).

4. Results and discussions

4.1. Development of the Chinese photovoltaic cells industry in 2000–2019

In the past two decades, the Chinese energy sector underwent a dynamic transition towards renewable energy sources. It resulted in a growth of the share of non-hydroelectric sources in the total energy mix from 0.239% in 2000 to 8.594% in 2019⁴ (Brusilo, 2019). Furthermore, the Chinese photovoltaic cells industry experienced significant changes strictly related to the increasing trend of solar power usage in China. It is essential to acknowledge the fact that Chinese territory holds great potential in this matter because it receives over 2000 hours of sunshine a year (the annual average solar radiation equals 5.02×10^6 kJ/m², which is an equivalent of 1.7×10^{12} tons of coal) (Xu, Xie, & Xie, 2020).

The electricity generation from solar power grew from less than 1 billion kWh in 2000 to over 224 billion kWh in 2019 (China Electricity Council, 2020). This observable and significant change was mainly accelerated by Chinese central authorities, which introduced many diverse political and economic development incentives and direct interventionist mechanisms. The essential strategies and political agendas focused on the growth of the Chinese PV cells industry, and general usage of this energy source was implemented by the National People's Congress and State Council from the beginning of 2006 with the adoption of the *Renewable Energy Law of the PRC* (Urban, Wang, & Geall, 2018).

However, the first breakthrough was an adoption of the Tenth Five-Year Plan (2001–2005), which stated that China could actively develop new energy

3 Harmonised System (HS) code: no. 854140 is the most accurate category for PV panels and PV cells – *Electrical apparatus, photosensitive, including photovoltaic cells, whether or not assembled in modules or made up into panels.* (United Nations COMTRADE database, <https://comtrade.un.org/data>).

4 Chinese infrastructure based on hydropower was already highly developed even at the end of the XX century. In 2000 Chinese hydropower plants generated 220 million MWh, and, twenty years later, this value increased up to 1301 million MWh (17.76% of total generated energy in 2019) (U.S. Energy Information Administration, 2019; China Electricity Council, 2020). For this reason, in the evaluation of the structural changes of the Chinese energy sector, it is more suitable to exclude hydropower and present the energy transition from the perspective of non-hydro renewable energy sources.

and renewable energy such as wind, solar, and geothermal power and promote energy saving and comprehensive utilization of technologies (Wang, Yuan, & Kuah 2017, p. 106). For the subsequent years, Chinese authorities were introducing the following projects and initiatives, such as Eleventh Five-Year Plan for Renewable Energy (2006–2010), which translated into vast public procurements for renewable energy products, guarantees to secure bank loans, and R&D investments for companies in the renewable energy sector.

The following examples like feed-in-tariffs for PV corporate investments, Building-Integrated Photovoltaic Project (BIPV is one of the most efficient and inexhaustible ways of harnessing solar energy and the project introduced direct subsidies for BIPV purchases), and Golden Sun Demonstration Project (50% costs defrayal of investment in large-scale structures of solar panels) scaled up the growth of PV cells industry considerably (Zou et al., 2017).

Finally, the last stimulants were adopted in 2018, including *531 Policy* (a new depleted feed-in-tariffs system which partially limited the growth) and the 13th Five-Year Plan (2016–2020) with its desire to increase installed capacity of solar (PV) cells infrastructure and concurrently overcome potential risks. They also equalized the territorial distribution of subsidies and stimulated the market to be less dependent on state support (Bin, 2018). These mentioned actions significantly impacted the international trade volume and Chinese PV cell manufacturers' position. Figure 6.2 presents the development and fluctuations of the total global value of exports and PV cells' imports in 2000–2019.

From the beginning of the XXI century until 2019, Chinese enterprises became global leaders regarding the quality and quantity of the offered photovoltaic-based goods. As shown in Figure 2, the value of total global exports and imports of photovoltaic-based components snowballed from 2006, which was strictly related to mentioned governmental incentives. Furthermore, between 2007 and 2016, solar cells, solar power stations, and solar lighting equipment were the main exported categories in China among commodities related to renewable energy sources (Cao et al., 2018). Looking at Figure 6.2, it is vital to acknowledge that the decline between 2011 and 2013 was mainly caused by the anti-dumping and anti-subsidy policy adopted by the United States and European Union (towards Chinese photovoltaic panels and similar commodities, among others). The comparable decrease in PV cells export between 2017–2018 resulted from the USA and China's destructive trade war. The trade war and its exemplification of a significant increase in the American and EU tariffs imposed on PV cells pose a real threat to this sector's development.

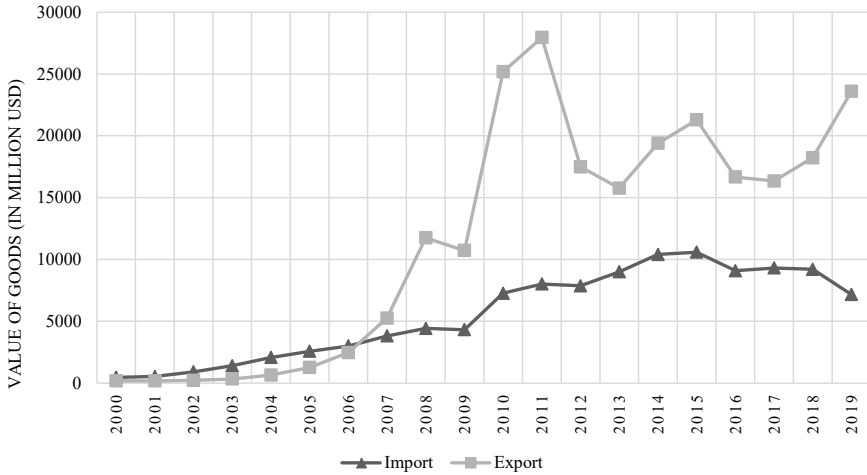


Figure 6.2. Development of Chinese aggregated exports and imports of solar (PV) energy technology-based components 2000–2019 (in million USD)

Source: own elaboration based on United Nations COMTRADE database.

However, a recent study shows that the domestic market exploration and cooperation alongside the BRI countries may vitally contribute to future development despite the Sino-American trade conflict (Fang, 2020).

The development of Chinese exports and imports of photovoltaic technology components over the last two decades is not the only example of the rapid growth in this sector within the studied period. The increasing popularity and profitability of solar power usage also impacted employment within the domestic industry. It is visible in the estimated number of direct and indirect jobs related to photovoltaic cells production. In 2018, 2.194 million jobs were offered in China, which accounted for 60.85% of all jobs available at that time in the world (REN21, 2019).

The success of Chinese companies, which produce photovoltaic cells, is considered on a global scale. In 2018, Chinese enterprises dominated these goods' global production for the tenth year in a row. Among the top ten global producers, these seven following Chinese companies excelled in the worldwide competition: Jinko Solar (at the top of the list), followed by JA Solar, Trina Solar, LONGi, Canadian Solar (China/Canada), Risen Energy, GCL-SI and Talesun. It is also worth mentioning that the top ten companies produced 60% of total solar (PV) cells in 2018 (REN21, 2019). The Chinese photovoltaic cells industry is a global leader in sales figures, exports volume and market share, and applied innovations (REN21, 2020). As presented in the

recent studies, frontier technological progress in China has grown linear over the last years. It has been a result of the following factors: fierce competition among the enterprises which stimulates innovative solutions implementation and a cost reduction, PV technology refinement and R&D progress, global flow of knowledge, and, last but not least, state actions aimed to provide complex support of this industry (Zhao & You, 2018).

4.2. Trade patterns in the photovoltaic cells industry between China and the Belt and Road Initiative countries

The presentation of the Chinese photovoltaic cells industrial transformation and the general characterization explicitly shows how advanced, competitive, and innovative this business has become within a decade. The Belt and Road Initiative is the next opportunity for this sector to expand alongside the BRI project countries. The photovoltaic cells net export values between China and the Belt and Road Initiative countries in 2019 are shown in Figure 6.3.

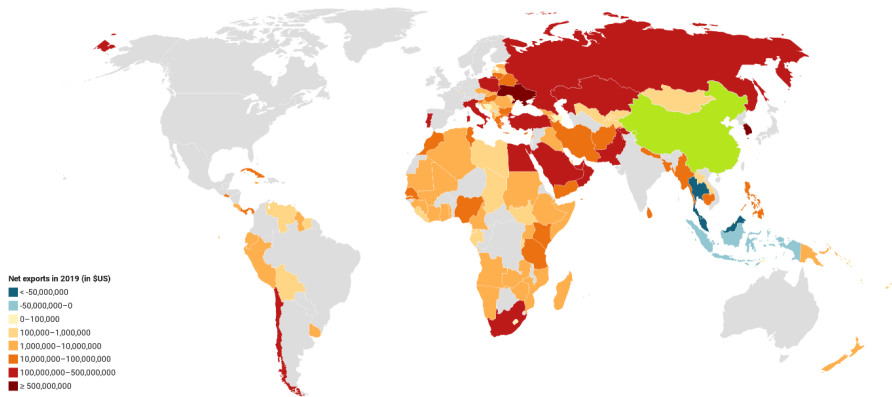


Figure 6.3. Net exports of photovoltaic cells between China and the BRI countries in 2019

Source: own elaboration based on data from United Nations COMTRADE.

In 2019, the share of photovoltaic cells exports value with the BRI countries concerning total exports value accounted for 27.68% and in the context of imports share – 30.02%. Regarding the available data on the photovoltaic cells trade flows in 2019, it is visible that the key BRI partners for China were (starting from the countries that accounted for the highest export value): Republic of Korea, Ukraine, Pakistan, Portugal, Chile, South Africa, United Arab Emirates, Thailand, Italy, Russian Federation, Turkey,

Malaysia, Singapore, Kazakhstan, Egypt, Philippines, Saudi Arabia, Poland, and Oman. The trade with these 19 countries amounted to 84.54% of the BRI countries' total export value in the studied period. However, the import is more concentrated because the value of photovoltaic panels and cells imported only from Malaysia, Thailand, and the Republic of Korea accounted for 92.70% of the total imports value. Undoubtedly, there is a considerable disproportion in exports and imports since China exports significantly more photovoltaic cells than imports within the BRI. The explanation of such asymmetry is related to the previously presented dominant position of Chinese enterprises and the country's industry's potential.

On the other hand, the high exports value in the case of Ukraine is mainly caused by the fact that in recent years this country adopted the highest in the world feed-in-tariffs for power generation from photovoltaic panels: 0.4322 EUR/kWh for rooftop solar power stations with the capacity of more than 100 kW and 0.3476 EUR/kWh for rooftop solar power stations with the capacity of up to 100 kW (PV Europe, 2017). The comparable export value of Chinese photovoltaic cells and panels was with the Arab Republic of Egypt, which has vastly improved and enlarged the capacity of its photovoltaic stations in the last year. The recently accomplished project, 1.8-gigawatt Benban Solar Park, one of the world's largest solar power plants, was fabricated with 7.2 million photovoltaic panels mainly imported from China (Nordrum, 2019).

4.3. The potential of the intra-industry trade between China and the Belt and Road Initiative countries

The Belt and Road Initiative is undoubtedly an excellent opportunity to tighten existing trade bonds with current foreign partners and establish new relations with joining countries. The comparative advantage theory suggests that trade generally ought to occur between two countries differentiated by the production opportunity costs. This cooperation and economic exchange may also be conducted as a two-way trade. Most technically and economically advanced countries like the USA, Canada, or the European Union aim for intra-industry trade relations. Why is IIT so crucial in the context of international trade? The explanation of such cooperation is related to three main advantages.

First of all, IIT allows to split up the value chains – a two cooperating countries gain from a specialization – because, e.g., country A can specialize in the production of essential components so enterprises from country B can import those parts, finalize the production and export back to country A the finished products. Such specialization and a value chain split are possible thanks to advancements in global communication, transportation, and communication (the BRI is possibly one of such incentives).

Secondly, IIT involves economies of scale – e.g., when two countries trade the same or substitutional commodity (like cars) – which equals a decrease of average production costs. However, due to a large number of exchanged goods from both countries, consumers still have a large variety of quality or choices, and the competition between producers is increasing.

The final advantage of intra-industry trade is related to the dynamically changing possessed comparative advantage of the IIT countries. When a two-way trade occurs, companies must adjust to changing market situations and economies of scale to take advantage of product specialization.

The intra-industry trade has its place in the Chinese photovoltaic cells business. Figure 6.4 and Table 1 present the IIT index calculations based on the data from 2019. These indicators allow analyzing the extent of two-way trade between China and 130 countries associated with the Belt and Road Initiative. The concerned commodities (PV cells, photosensitive components, or solar panels) were a subject of intra-industry trade, mainly with the countries in Table 6.1.

Table 6.1. Intra-industry trade index for photovoltaic cells in the context of the trade between the People’s Republic of China and the Belt and Road Initiative countries in 2019

Belt and Road Initiative member countries	Trade Value of Chinese PV cells export (in US\$)	Trade Value of Chinese PV cells import (in US\$)	Net Exports between China and BRI countries (in US\$)	Intra-Industry Trade index (in %)
Indonesia	30 780 613	46 519 421	- 15 738 808	79.6393
Philippines	131 434 543	79 463 085	51 971 458	75.3570
Thailand	241 216 245	426 496 223	- 185 279 978	72.2515
Republic of Korea	1 112 942 370	558 121 147	554 821 223	66.7983
Malaysia	172 569 340	1 007 526 920	- 834 957 580	29.2467
Singapore	167 059 203	17 050 643	150 008 560	18.5223
Czechia	6 750 013	363 731	6 386 282	10.2261

Source: own study based on the data sourced from UN COMTRADE database.

Regarding the IIT index classification, it is visible that the highest two-way trade volume ($IIT_{i,AB} > 0.33$) (Lima & Alvarez, 2008) took place between China and Indonesia, the Philippines, Thailand, and the Republic of Korea. All these countries were either a place of business for the top ten world PV cells producers in 2018 (like Korean Hanwha Q-CELLS) or were supplying PV cells components to the Chinese final solar panels manufacturers (like JA SOLAR, LONGi, and Trina Solar) (Coville, 2019). The map below (figure

4) presents an overview of IIT indicators on a global scale. It concludes that the majority of two-way trade and cooperation occur in the areas of the South China Sea and the Java Sea.

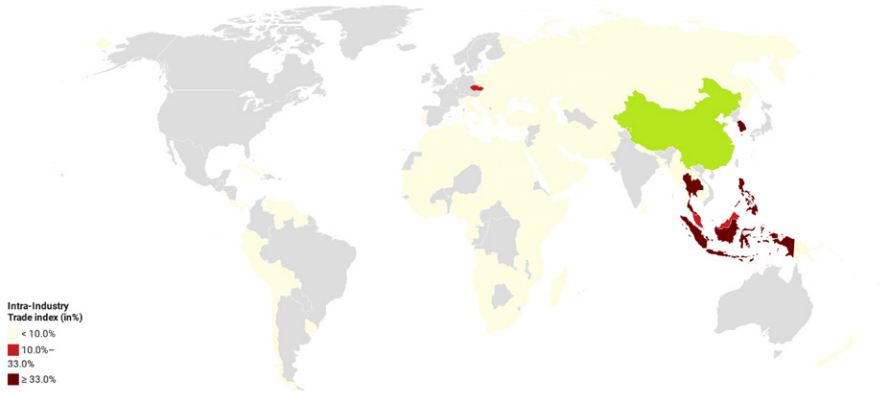


Figure 6.4. The value of intra-industry trade between China and BRI countries in 2019

Source: own elaboration based on data from United Nations COMTRADE.

The second class of the IIT index ($0.10 < IIT_{i, AB} < 0.33$) refers to the economies that can conduct intensive intra-industry trade with China from the Belt and Road Initiative perspective. In 2019, three countries fell into this category – Malaysia, Czechia (Czech Republic), and Singapore. The exception is Malaysia, which had the highest value of net exports with China. Still, the trade between those two countries was not typically two-way (Malaysia was one of the biggest suppliers of PV cell components for Chinese enterprises in this industry among BRI countries).

Like Czechia, the EU member states are also potentially the new intra-industry trade partners for the Chinese economy (from the BRI perspective) because of The European Green Deal adoption in 2019 (European Commission, 2019). This document sets out new priorities and development directions towards more sustainable growth and expresses the need for portfolio diversification, including higher solar power use. The planned clean energy transition will allow the EU economies and China to deepen the two-way trade in photovoltaic cells since they are one of the most energy-effective and eco-friendly energy sources. Undoubtedly, the Belt and Road Initiative will be an effective platform and a framework for such cooperation with its developing infrastructure.

5. Conclusion

This research was focused on the Chinese photovoltaic cells industry to investigate the process of its industrial development, as well as its trade patterns in 2019 and the two-way trade opportunities alongside the Belt and Road Initiative. To conduct this research and present the most relevant information about the studied photovoltaic cells industry, besides textual analysis, the author compared the economic and trade volume indicators, as well as analyzed the Grubel-Lloyd index between China and the individual Belt and Road Initiative countries.

Regarding the first research question, it was crucial to review the most critical changes and policy documents that impacted the development of the studied industry. This industry's dynamic growth, from 1 million MWh in 2000 to 224 million MWh in 2019, presents a challenge to the other countries, especially the USA and the EU Member States, aiming to compete with the Chinese photovoltaic cells industry. As presented before, the growth of this industry was fueled by the high subsidization and state interventionism, which was already criticized by the US and EU administration and led to severe trade policy interventions. Moreover, the studied industry is continuously growing, despite the subsidies and feed-in-tariffs offered by the central authorities have decreased in the last years.

Simultaneously, the Belt and Road Initiative – the network of railways, sea routes, motorways, and the trans-national political cooperation in a global framework – sets the new perspectives for economic expansion for Chinese enterprises and can scale up the value of intra-industry trade within the associated countries. The BRI also has a *green* aspect designed to promote renewable energy sources, including photovoltaic cells. In the context of photovoltaics, China is currently an inimitableness global leader in terms of capacity, production, export, and innovative technology implementation (REN21, 2020), which, together with the BRI potential, may lead to growth acceleration and consolidation of Chinese enterprises global market shares overcoming potential risks coming from the COVID-19 crisis.

Considering the second research question, the analysis of trade volumes revealed the crucial trade partners for the Chinese photovoltaic cells industry: Malaysia, Thailand, and the Republic of Korea, which accounted for 92.70% of the total imports of photovoltaic cells in 2019 among the BRI countries. The highest exports of this category of products were associated mainly with the trade relations with the following BRI countries: Republic of Korea, Ukraine, Pakistan, Portugal, Chile, and South Africa.

It was fascinating to uncover the fact, as the response to the third research question, that the critical partners in intra-industry trade with China are mainly

the economies in the South China Sea, the Yellow Sea and the Java Sea area – Indonesia, the Philippines, Thailand, the Republic of Korea, Malaysia and Singapore. The study also presented the important role of a few EU countries in the intra-industry trade, including Czechia. The potential of the existing trade relations may be developed in the following years together with the increasing role of the Belt and Road Initiative and by higher cooperation between companies from the associated countries. It would allow Chinese companies to gain from even higher specialization caused by splitting up the value chains, economies of scale, product diversification, and increasing value-added final products. The photovoltaic cells buyers from the mentioned countries may also benefit from the growth of this type of international two-way exchange – the more dynamic competition and simultaneous cooperation are between producers, the more differentiated and innovative are final products.

To extend the volume of PV cells exports, Chinese authorities should accelerate transportation and logistics infrastructure reinforcement (mainly maritime routes that go through the South China Sea, Yellow Sea, and the Java Sea) and the inland infrastructure (connecting China and the EU). Secondly, the Chinese authorities should consider rebounding the photovoltaic feed-in-tariffs and other relevant incentives that might positively impact the Chinese photovoltaic cells industry's development within the domestic market in the following years. Finally, as mentioned before, intra-industry trade usually occurs between neighboring countries, so Chinese authorities should consider the acceleration or reinforcement of free-trade zones and trade liberalization with surrounding countries and international parties. Undoubtedly, one of the most significant economic incentives to strengthen the cooperation bonds in this region was the Regional Comprehensive Economic Partnership, signed on 15th November, 2020. This free-trade agreement is an example of one of the most significant economic integration projects potentially contributing to the studied industry's development. On the other hand, the Chinese photovoltaic cells industry is still an example of an industry that has experienced very dynamic growth in recent years due to intensive subsidization, protectionism and industrial policy incentives provided by the central and local authorities. Still, the international trade relations between Chinese enterprises and foreign partners are continuously shaped, and future research in this domain is required.

Regarding the hypothesis mentioned at the beginning of the research article, it is essential to underline that the presented results prove them to a large extent. Indeed, the Chinese trade with photovoltaic cells alongside the Belt and Road Initiative countries was mainly conducted in the Asia-Pacific region in 2019, with the substantial role of the countries in South-East Asia. Moreover, the conducted analysis proved that the Chinese photovoltaic cells industry possesses significant intra-industry trade potential with the

surrounding countries in South-East Asia and the EU. This study, by the Grubel-Lloyd trade index application, contributes to a better understanding of the potential two-way trade between China and the other Belt and Road Initiative countries in the context of the rapidly growing Chinese photovoltaic cells industry. The presented results and the list of potential intra-industry trade partners for the studied industry can guide the regional, national and international policymakers as well as business entities about the trade patterns and opportunities deriving from the international exchange and cooperation in the field of photovoltaics with the People's Republic of China.

This research was limited to the most up-to-date trade data from 2019 (since this type of trade data is available with at least one year delay). However, since the COVID-19 disease pandemic has a substantial impact on the trade relations, global value chains and the global supply chains, future research could also consider the impact evaluation of the COVID-19 disease crisis on the international trade patterns in the context of intra-industry trade of photovoltaic cells or other renewable energy-based goods. Moreover, as it was noted in the article, the Belt and Road Initiative has a *green* impact so that the next studies could analyze the role of the BRI projects on the promotion of renewable energy sources in selected countries, especially in the context of solar and wind power, as they are the most popular non-hydro renewable energy sources.

Acknowledgments

The author emphasizes his gratitude to anonymous reviewers and editors for valuable comments on earlier manuscript versions.

References

- Balassa, B. (1986). The determinants of intra-industry specialization in United States trade. *Oxford Economic Articles*, 38(2), 220–233. <https://doi.org/10.1093/oxfordjournals.oep.a041737>
- Belt and Road Forum for International Cooperation. (2017). Vision and actions on jointly building Belt and Road. Retrieved from <http://2017.beltandroadforum.org/english/n100/2017/0410/c22-45-3.html>
- Bin, L. (2018, August 13). China's solar industry is at a crossroads. *China Dialogue*. Retrieved from <https://www.chinadialogue.net/article/show/single/en/10775-China-s-solar-industry-is-at-a-crossroads>
- Brander, J. A. (1981). Intra-industry trade in identical commodities. *Journal of International Economics*, 11(1), 1–14. [https://doi.org/10.1016/0022-1996\(81\)90041-6](https://doi.org/10.1016/0022-1996(81)90041-6)

- BRIGC. (2019). About the Belt and Road Initiative International Green Development Coalition. Retrieved from <https://green-bri.org/belt-and-road-initiative-green-coalition-brigc/>
- Brusilo, P. (2019). Transition towards energy generation from renewable sources in the People's Republic of China. *Economics of the 21st Century*, 2, 85–97. <https://doi.org/10.15611/e21.2019.2.06>
- Buckley, T., & Nicholas, S. (2017). China's global renewable energy expansion: How the world's second-biggest national economy is positioned to lead the world in clean-power investment. Retrieved from http://ieefa.org/wp-content/uploads/2017/01/Chinas-Global-Renewable-Energy-Expansion_January-2017.pdf
- Cao, X., Rajarshi, A., & Tong, J. (2018). Technology Evolution of China's Export of Renewable Energy Products. *International Journal of Environmental Research and Public Health*, 15(8), no. 1782. doi:10.3390/ijerph15081782
- Ciu, L., & Song, M. (2019). Economic evaluation of the Belt and Road Initiative from an unimpeded trade perspective. *International Journal of Logistics Research and Applications*, 22(1), 25–46. <https://doi.org/10.1080/13675567.2018.1492532>
- Chen, S. C., Hou, J., & Xiao, D. (2018). "One Belt, One Road" initiative to stimulate trade in China: A counter-factual analysis. *Sustainability*, 10(9), 3242. <https://doi.org/doi:10.3390/su10093242>
- China Electricity Council. (2020). 2019年全国电力工业统计快报一览表. List of statistical reports of the national electric power industry in 2019. Retrieved from <http://www.cec.org.cn/>
- Chen, S., Lu, X., Miao, Y., Deng, Y., Nielsen, C. P., Elbot, N., Wang, Y., Logan, K. G., McElroy, M. B., & Hao, J. (2019). The potential of photovoltaics to power the belt and road initiative. *Joule*, 3(8), 1895–1912. <https://doi.org/10.1016/j.joule.2019.06.006>
- Cinar, E. M., Johnson, J., & Geusz, K. (2016). Estimating Chinese trade relationships with the silk road countries. *China & World Economy*, 24(1), 85–103. <https://doi.org/10.1111/ewe.12145>
- Colville, F. (2019, June 9). Top-10 solar cell producers of 2018. *PV TECH*. Retrieved from <https://www.pv-tech.org/editors-blog/top-10-solar-cell-producers-of-2018>
- Drelich-Skulaska, B., & Bobowski, S. (2021). Intra-industry trade and implications of the European Union-Japan Economic Partnership Agreement from the perspective of automotive industry. *Entrepreneurial Business and Economics Review*, 9(2), 183–206. <https://doi.org/10.15678/EBER.2021.090212>
- European Commission. (2019). The European Green Deal. Retrieved from the European Commission website: https://ec.europa.eu/info/sites/info/files/european-green-deal-communication_en.pdf

- Fang, M. M. (2020). A crisis or an opportunity? The trade war between the US and China in the photovoltaic sector. *Journal of World Trade*, 54(1), 103–126. <https://doi.org/10.2139/ssrn.3441479>
- Geng, Q. (2021). The belt and road initiative and its implications for global renewable energy development. *Current Sustainable/Renewable Energy Reports*, 8, 40–49. <https://doi.org/10.1007/s40518-020-00172-2>
- Gu, A., & Zhou, X. (2020). Emission reduction effects of the green energy investment projects of China in Belt and Road Initiative countries. *Ecosystem Health and Sustainability*, 6(1), 1747947. <https://doi.org/10.1080/20964129.2020.1747947>
- Grubel H. G., & Lloyd P. J. (1975). *Intra-Industry Trade: The Theory and Measurement of International Trade in Differentiated Products*. London, United Kingdom: Macmillan Press.
- Grubel, H. G., & Lloyd, P. J. (1971). The empirical measurement of intra-industry trade. *Economic Record*, 47(4), 494–517. <https://doi.org/10.1111/j.1475-4932.1971.tb00772.x>
- Huang, Y. (2016). Understanding China's Belt & Road Initiative: Motivation, framework and assessment. *China Economic Review*, 40, 314–321. <https://doi.org/10.1016/j.chieco.2016.07.007>
- Jackson, M. M., Lewis, I. J., & Zhang, X. (2021). A green expansion: China's role in the global deployment and transfer of solar photovoltaic technology. *Energy for Sustainable Development*, 60, 90–101. <https://doi.org/10.1016/j.esd.2020.12.006>
- Kawecka-Wyrzykowska, E., Ambroziak, Ł., Molendowski, E., & Polan, W. (2017). *Intra-Industry Trade of the New EU Member States Theory and Empirical Evidence*. Warsaw, Poland: Wydawnictwo Naukowe PWN.
- Lancaster, K. (1980). Intra-industry trade under perfect monopolistic competition. *Journal of International Economics*, 10(2), 151–175. [https://doi.org/10.1016/0022-1996\(80\)90052-5](https://doi.org/10.1016/0022-1996(80)90052-5)
- Li, C. Y., Lai, A. C., Wang, Z. A., & Hsu, Y. C. (2019). The preliminary effectiveness of bilateral trade in China's Belt and Road Initiatives: a structural break approach. *Applied Economics*, 51(35), 3890–3905. <https://doi.org/10.1080/00036846.2019.1584387>
- Liu, J. (2019). China's renewable energy law and policy: A critical review. *Renewable and Sustainable Energy Reviews*, 99, 212–219. <https://doi.org/10.1016/j.rser.2018.10.007>
- Lima, J. E. D., & Alvarez, M. (2008). *Indicadores de comercio exterior y política comercial: mediciones de posición y dinamismo comercial*. Santiago de Chile, Chile: Comisión Económica para América Latina y el Caribe (CEPAL), United Nations.
- Liu, Z., Wang, T., Sonn, J. W., & Chen, W. (2018). The structure and evolution of trade relations between countries along the Belt and Road. *Journal*

- of Geographical Sciences*, 28(9), 1233–1248. <https://doi.org/10.1007/s11442-018-1522-9>
- Liu, H., Wang, Y., Jiang, J., & Wu, P. (2020). How green is the “Belt and Road Initiative”? – Evidence from Chinese OFDI in the energy sector. *Energy Policy*, 145, 111709. <https://doi.org/10.1016/j.enpol.2020.111709>
- Ministry of Ecology and Environment of the People’s Republic of China. (2017). Guidance on promoting green belt and road, framework provisions. Retrieved from http://english.mee.gov.cn/Resources/Policies/policies/Frameworkp1/201706/t20170628_416864.shtml
- Nedopil, C. (2020). *Countries of the Belt and Road Initiative*. Retrieved from <https://www.green-bri.org>
- Nordrum, A. (2019, September 17). Egypt’s Massive 1.8-Gigawatt Benban Solar Park Nears Completion – IEEE Spectrum. *IEEE*. Retrieved from <https://spectrum.ieee.org/energywise/energy/renewables/egypts-massive-18gw-benban-solar-park-nears-completion>
- OECD. (2018). China’s Belt and Road Initiative in the global trade, investment and finance landscape. *OECD Business And Finance Outlook 2018*. Retrieved from <https://www.oecd.org/finance/Chinas-Belt-and-Road-Initiative-in-the-global-trade-investment-and-finance-landscape.pdf>
- PV Europe. (2017, March 10). Feed-in tariffs in Ukraine: History, dynamics, and perspectives. *PV Europe – solar technology and applications*. Retrieved from <https://www.pveurope.eu/News/Markets-Money/Feed-in-tariffs-in-Ukraine-history-dynamics-and-perspectives>
- REN21 (2019). *Renewables 2019 – global status report*. UN Environment Programme. Retrieved from the REN21 website: <https://www.ren21.net/>
- REN21 (2020). *Renewables 2020 – global status report*. UN Environment Programme. Retrieved from the REN21 website: <https://www.ren21.net/>
- Shuai, J., Chen, C., Cheng, J., Leng, Z., & Wang, Z. (2018). Are China’s photovoltaic products competitive in the context of the Belt and Road Initiative?. *Energy Policy*, 120, 559–568, <https://doi.org/10.1016/j.enpol.2018.05.042>
- Yu, S., Qian, X., Liu, T. (2019). Belt and Road Initiative and Chinese firms’ outward foreign direct investment. *Emerging Markets Review*, 41, 100629. <https://doi.org/10.1016/j.ememar.2019.100629>
- Song, Z., Che, S., & Yang, Y. (2018). The trade network of the Belt and Road Initiative and its topological relationship to the global trade network. *Journal of Geographical Sciences*, 28(9), 1249–1262. <https://doi.org/10.1007/s11442-018-1523-8>
- The Belt and Road Portal (2020). About the Belt and Road Initiative. Retrieved from <https://eng.yidaiyilu.gov.cn/wap/wap.htm>
- Tian, X., Hu, Y., Yin, H., Geng, Y., & Bleischwitz, R. (2019). Trade impacts of China’s Belt and Road Initiative: From resource and environmental perspectives. *Resources, Conservation and Recycling*, 150, 104430. <https://doi.org/10.1016/j.resconrec.2019.104430>
-

- Urban, F., Wang, Y., & Geall, S. (2018). Prospects, politics, and practices of solar energy innovation in China. *Journal of Environment & Development*, 27(1), 74–98. <https://doi.org/10.1177/1070496517749877>
- US Energy Information Administration. (2019). China – Total Net Annual Electricity Generation. Retrieved from the US Energy Information Administration website <http://www.eia.gov>
- Wang, P., Yuan, L., & Kuah, A. T. H. (2017). Can a fast-expanding market sustain with supply-side government aid? An investigation into the Chinese solar photovoltaics industry. *Thunderbird International Business Review*, 59(1), 103–114. <https://doi.org/10.1002/tic.21771>
- Xu, M., Xie, P., & Xie, B. C. (2020). Study of China’s optimal solar photovoltaic power development path to 2050. *Resources Policy*, 65, 101541. <https://doi.org/10.1016/j.resourpol.2019.101541>
- Zhao, X., & You, Z. (2018). Technological progress and industrial performance: A case study of the solar photovoltaic industry. *Renewable and Sustainable Energy Reviews*, 81, 929–936. <https://doi.org/10.1016/j.rser.2017.08.038>
- Zou, H., Du, H., Ren, J., Sovacool, B. K., Zhang, Y., & Mao, G. (2017). Market dynamics, innovation, and transition in China’s solar photovoltaic (PV) industry: A critical review. *Renewable and Sustainable Energy Reviews*, 69, 197–206. <https://doi.org/10.1016/j.rser.2016.11.053>

Appendix 1. Values of the Chinese PV cells imports and exports and the Grubel-Lloyd index with the BRI countries in 2019.

BRI member countries	Trade Value of Chinese PV cells export (in US\$)	Trade Value of Chinese PV cells import (in US\$)	Net exports between China and BRI countries (in US\$)	Grubel-Lloyd index (in %)
Afghanistan	14 624 762	0	14 624 762	0.00
Albania	2 578 982	0	2 578 982	0.00
Algeria	4 285 843	0	4 285 843	0.00
Angola	2 442 033	0	2 442 033	0.00
Antigua and Barbuda	75 777	0	75 777	0.00
Armenia	3 647 459	34	3 647 425	0.00186429
Azerbaijan	33 079	0	33 079	0.00
Bahrain	2 795 480	0	2 795 480	0.00
Bangladesh	41 608 060	371 301	41 236 759	1.76896928
Barbados	5 280 028	0	5 280 028	0.00
Belarus	36 947 829	351	36 947 478	0.00189996
Bolivia	491 302	0	491 302	0.00
Bosnia Herzegovina	6 154	0	6 154	0.00
Brunei Darussalam	31 088	0	31 088	0.00
Bulgaria	12 706 718	18 167	12 688 551	0.28553500
Burundi	168 122	0	168 122	0.00

BRI member countries	Trade Value of Chinese PV cells export (in US\$)	Trade Value of Chinese PV cells import (in US\$)	Net exports between China and BRI countries (in US\$)	Grubel-Lloyd index (in %)
Cabo Verde	39 673	0	39 673	0.00
Cambodia	44 902 227	5 544	44 896 683	0.02469060
Cameroon	4 658 846	2 065	4 656 781	0.08860929
Chad	527 186	0	527 186	0.00
Chile	302 282 321	60	302 282 261	0.00003970
Cook Island	19 986	0	19 986	0.00
Costa Rica	5 438 251	3 997	5 434 254	0.14688783
Côte d'Ivoire	2 809 892	0	2 809 892	0.00
Croatia	3 582 242	11 437	3 570 805	0.63650649
Cuba	18 442 932	0	18 442 932	0.00
Cyprus	14 257 590	0	14 257 590	0.00
Czechia	6 750 013	363 731	6 386 282	10.22614814
Djibouti	1 938 852	0	1 938 852	0.00
Ecuador	2 476 510	0	2 476 510	0.00
Egypt	146 402 050	0	146 402 050	0.00
El Salvador	68 614 895	6 454	68 608 441	0.01881047
Equatorial Guinea	199 030	0	199 030	0.00
Estonia	3 775 884	12 230	3 763 654	0.64570390
Ethiopia	1 569 627	0	1 569 627	0.00
Fiji	717 440	0	717 440	0.00
Gabon	703 803	0	703 803	0.00
Gambia	1 030 416	0	1 030 416	0.00
Georgia	4 331 430	5644	4 325 786	0.26026764
Ghana	9 204 885	0	9 204 885	0.00
Greece	47 800 953	1 025	47 799 928	0.00428853
Grenada	180 282	0	180 282	0.00
Guinea	3 343 550	0	3 343 550	0.00
Guyana	1 163 854	0	1 163 854	0.00
Hungary	41 913 707	628 030	41 285 677	2.95253577
Indonesia	30 780 613	46 519 421	- 15 738 808	79.63932590
Iran	24 172 075	0	24 172 075	0.00
Iraq	1 510 121	0	1 510 121	0.00
Italy	222 792 975	8 167 282	214 625 693	7.07245663
Jamaica	4 112 336	0	4 112 336	0.00
Kazakhstan	146 566 839	907 758	145 659 081	1.23107032
Kenya	56 413 838	7 309	56 406 529	0.02590873
Kiribati	188 826	0	188 826	0.00
Kuwait	2 272 201	10 708	2 261 493	0.93810134
Kyrgyzstan	279 304	9	279 295	0.00644438
Lao People's Dem. Rep.	110 659	0	110 659	0.00

BRI member countries	Trade Value of Chinese PV cells export (in US\$)	Trade Value of Chinese PV cells import (in US\$)	Net exports between China and BRI countries (in US\$)	Grubel-Lloyd index (in %)
Latvia	218 191	74	218 117	0.06780748
Lebanon	5 483 534	0	5 483 534	0.00
Lesotho	4 827	0	4 827	0.00
Liberia	617 111	0	617 111	0.00
Libya	976 777	0	976 777	0.00
Lithuania	12 659 974	231 538	12 428 436	3.59209998
Luxembourg	7 998 465	0	7 998 465	0.00
Madagascar	7 046 660	0	7 046 660	0.00
Malaysia	172 569 340	1 007 526 920	- 834 957 580	29.24665484
Maldives	1 244 088	511	1 243 577	0.08211480
Mali	2 536 029	13 050	2 522 979	1.02389922
Malta	4 690 275	5 619	4 684 656	0.23931545
Mauritania	1 539 753	0	1 539 753	0.00
Micronesia	13 164	0	13 164	0.00
Mongolia	264 380	0	264 380	0.00
Montenegro	390 158	383	389 775	0.19613818
Morocco	33 063 866	82 192	32 981 674	0.49593831
Mozambique	5 480 902	0	5 480 902	0.00
Myanmar	17 518 128	2 189	17 515 939	0.02498813
Namibia	6 487 271	9 629	6 477 642	0.29641829
Niue	0	0	0	0.00
Nepal	15 132 124	0	15 132 124	0.00
New Zealand	7 569 303	143	7 569 160	0.00377835
Nigeria	42 023 083	0	42 023 083	0.00
North Macedonia	911 308	2 072	909 236	0.45369945
Oman	107 218 724	36	107 218 688	0.00006715
Pakistan	373 336 832	35	373 336 797	0.00001875
Panama	60 042 075	306	60 041 769	0.00101928
Papua New Guinea	1 410 300	0	1 410 300	0.00
Peru	8 924 741	0	8 924 741	0.00
Philippines	131 434 543	79 463 085	51 971 458	75.35702109
Poland	111 513 044	644 326	110 868 718	1.14896774
Portugal	357 684 406	8 291	357 676 115	0.00463582
Qatar	519 047	112	518 935	0.04314670
Republic of Korea	1 112 942 370	558 121 147	554 821 223	66.79831632
Republic of Moldova	141 569	0	141 569	0.00
Romania	2 872 138	79 036	2 793 102	5.35624128
Russian Federation	189 056 023	1 874 048	187 181 975	1.96307265
Rwanda	484 617	0	484 617	0.00
Samoa	467	0	467	0.00
Saudi Arabia	113 961 261	683	113 960 578	0.00119865

BRI member countries	Trade Value of Chinese PV cells export (in US\$)	Trade Value of Chinese PV cells import (in US\$)	Net exports between China and BRI countries (in US\$)	Grubel-Lloyd index (in %)
Senegal	34 388 224	0	34 388 224	0.00
Serbia	883 321	10	883 311	0.00226416
Seychelles	182 387	0	182 387	0.00
Sierra Leone	407 216	0	407 216	0.00
Singapore	167 059 203	17 050 643	150 008 560	18.52225003
Slovakia	1 601 294	3 648	1 597 646	0.45459587
Slovenia	66 636 953	5 687	66 631 266	0.01706715
Solomon Isds	253 615	0	253 615	0.00
Somalia	2 410 626	0	2 410 626	0.00
South Africa	291 452 749	400	291 452 349	0.00027449
South Sudan	628 194	0	628 194	0.00
Sri Lanka	28 651 314	21 425	28 629 889	0.14944509
Sudan	6 261 068	0	6 261 068	0.00
Suriname	317 735	0	317 735	0.00
Tajikistan	110 040	101	109 939	0.18340128
Thailand	241 216 245	426 496 223	- 185 279 978	72.25153238
Timor-Leste	43 696	0	43 696	0.00
Togo	8 260 324	0	8 260 324	0.00
Tonga	1 592	0	1 592	0.00
Trinidad and Tobago	19 086	0	19 086	0.00
Tunisia	22 057 246	79 955	21 977 291	0.72235871
Turkey	174 486 834	241 077	174 245 757	0.27594561
Uganda	8 330 696	0	8 330 696	0.00
Ukraine	918 855 447	1 187	918 854 260	0.00025836
United Arab Emirates	242 471 958	0	242 471 958	0.00
United Rep. of Tanzania	21 183 910	0	21 183 910	0.00
Uruguay	2 109 970	0	2 109 970	0.00
Uzbekistan	882 656	0	882 656	0.00
Vanuatu	242 450	0	242 450	0.00
Venezuela	144 478	0	144 478	0.00
Yemen	10 449 552	26	10 449 526	0.00049763
Zambia	2 539 457	0	2 539 457	0.00
Zimbabwe	5 128 464	0	5 128 464	0.00
TOTAL in 2019	6 533 649 698	2 149 008 364	4 384 641 334	-

Source: own elaboration. List of countries sourced from Nedopil, C. (2020). Countries of the Belt and Road Initiative. Beijing: IIGF Green BRI Center, Retrieved from <https://www.green-bri.org>. Data sourced from the UN COMTRADE database (<https://comtrade.un.org/data/>). Dataset is available at Brusilo, P. (2021). Values of Chinese PV cells imports and exports and the Grubel-Lloyd index with the BRI countries in 2019., Mendeley Data, V1, <https://doi.org/10.17632/d64kvw6cv7.1>.

Biographical note

Paweł Brusilo is a PhD candidate in Economics and Finance in the Department of International Business and a member of the Asia-Pacific Research Centre at the Wrocław University of Economics and Business (Poland). His research interests include evaluating the renewable energy transition and environmental policy in the USA, EU, Japan and China and studying economic and trade relations between the Asia-Pacific countries.

Citation (APA Style)

Brusilo, P. (2021). The Chinese photovoltaic cells industry and the Belt and Road Initiative – the intra-industry perspective. In A. Ujwary-Gil & B. Godlewska-Dzioboń (Eds.), *Challenges in Economic Policy, Business, and Management in the COVID-19 Era* (pp. 139–164). Warsaw: Institute of Economics, Polish Academy of Sciences.

Selected conditions of developing inter-organizational cooperation in innovation processes on the Polish capital market

Joanna Kurowska-Pysz¹

Abstract

The article aims to specify conditions of inter-sectoral cooperation of key actors on the capital market i.e., representatives of science, business, and the legislative and economic environment, supporting innovation processes. The objective of the article was achieved by determining key soft and hard competences of representatives of these sectors to develop inter-organizational cooperation in innovation processes on the capital market, as well as motivators and barriers, and the most effective forms of developing this cooperation allowing key actors to share knowledge and learn together, as well as extend the network relations. The incomplete induction method was used, and the triangulation of research methods was ensured in the conducted quantitative and qualitative research. The research implies that the key role in inter-organizational cooperation is played by soft competences concerning work under time pressure, which representatives of all sectors should possess. Moreover, soft competences which are relevant for representatives of particular sectors and resulting from their role in the innovation process may be indicated. Furthermore, the research indicated that the key hard competences related to the essence of the innovation process do not have a universal character but depend on the scope of provided research and development services. Motivators and barriers of inter-sectoral cooperation are interrelated and diversified in the sectoral system. Moreover, research allowed identifying the most effective forms of inter-organizational cooperation on the capital market, among which the sharing knowledge and experiences are of leading significance.

Keywords: *inter-organizational cooperation, inter-sectoral cooperation, capital market, innovation process, competences, motivators, barriers.*

¹ Joanna Kurowska-Pysz, Ph.D., Associate Professor, The Institute on Territorial and Inter-Organizational Cooperation, WSB University, Ciepłaka St. 1c, 41-300 Dąbrowa Górnicza, Poland, e-mail: jkurowska@wsb.edu.pl (ORCID: 0000-0002-3967-9263).

This is an open access article under the CC BY license (<https://creativecommons.org/licenses/by/4.0/legalcode>).

1. Introduction

Contemporary socio-economic conditions and challenges faced by the Polish capital market require more openness to multi-dimensional innovativeness. The first model of the innovation process, i.e., the model of science-push innovation, was of a supply nature and assumed that innovations originate from scientific research. In another model, i.e., the model of market-pull innovation, the key role was attributed to entrepreneurs seeking innovative solutions on the market; therefore, market needs not-active measures to be undertaken in the R&D sphere and became a drive for creating innovation. In this case, knowledge is significant primarily in the context of developing innovation. In contrast to the supply model, the demand model considers the growing impact of customers' needs on creating innovations (Rothwell, 2002). As of the 70s of the 20th century, the demand-supply model of the innovation process based on the assumption that innovations rarely result only from technological development or satisfying market needs, as they originate from both factors, has been developing. In the 90s of the 20th century, market factors started playing a crucial role in the innovation process. The innovation process model started taking a form of network considering primary and secondary connections among particular elements. Development of models of innovation processes is linked to the occurrence of new forms of cooperation between entities and shapes inter-organizational relations between them. The variability of logics of creating innovations simultaneously determines new solutions in the scope of effective business models based on the cooperation networks and unique relations (Rybicki & Dobrowolska, 2018).

The development of inter-organizational relations on markets is impacted by, among others, integration tendencies resulting from globalization and, on the other hand, the growing competition for resources. In the context of the capital market, it concerns competing for capital, investors, and issuers, who raise funds for investments due to the presence on stock exchanges (Bolesławski & Nowakowski, 2017). Although the attractiveness of the Polish capital market is determined by, among others, the innovativeness of financial products and providing customers with solutions based on innovative technologies, e.g. FinTech, in practice, not many such innovations are created. This innovation process in the conditions of a growing networking nature of the economy requires cooperation of key actors on the capital market, including representatives of business, science and public institutions, and economic environment institutions. However, the establishment or maintenance of cooperation itself is not sufficient to achieve the expected effects of innovation processes. A bigger emphasis on competences allowing active participation in innovation processes is needed, among others, by transferring knowledge

and experiences, and joint learning, as well as ensuring motivators efficiently encouraging representatives of all these environments to network cooperation. Thus, using the synergy generated by inter-organizational cooperation is an opportunity to dynamize the development of the Polish capital market. Therefore, one should strive to reinforce relations thereof with the national innovation system (Zastempowski & Glabiszewski, 2018).

Doubtlessly, the socio-economic policy implemented by the government with the use of institutional, economic, and legal tools significantly influences the innovativeness of the whole economy, including the capital market (Marciniak, 2010).

Innovativeness is understood in work as a certain feature of economic entities implementing innovations. Whereas innovations are the result or process of implementing new or significantly improved solutions on the market. The key innovations include product, marketing, process, organization, and organizational culture innovations (Sopińska & Wachowiak, 2016). The following key categories of innovation are separated (Oslo Manual, OECD, 2005):

- product innovations (introduction of goods or services which are new or significantly improved in the scope of their features or applications);
- process innovations (implementation of a new or significantly improved method of production or supply);
- marketing innovations (implementation of a new marketing method related to significant changes in the project/construction of the product or packaging, distribution, promotion or price strategy);
- organization innovations (consisting in the implementation of a new method of organization in principles of operations adopted by the company, organization of the workplace, or relations with the environment).

In the process of economy modernization, enterprises and financial institutions both stimulate demand and offer a supply of innovative solutions (Jonasz & Koziół, 2007). In the innovative policy, with regard to capital markets, the global approach prevails. It creates development opportunities but also specific threats. The openness of enterprises and financial institutions to various types of innovations, primarily technological, allows achieving competitive advantage and decreasing distance to global leaders. Actors of the Polish capital market participate in capital flows and transactions on the international market, usually as recipients of new technological and product solutions, directly benefiting from the process of internationalization of knowledge resources. Globalization has an impact on eliminating barriers

in the flow of resources and achieving economies of scale for repeatable, standardized processes. However, it also discloses differences in the regulatory and institutional character related to national protectionism. After 30 years of functioning the Polish capital market, the dynamics of its development dropped. Therefore, one may wonder what field for dynamic increases may occur in the future considering the globalization tendencies. The Polish capital market is, in many aspects, too small (among others, in terms of the number of stock exchange transactions, volume of turnovers, or values of public offers) in order to provide conditions for effective implementation of a product or procedural innovations without the use of synergy resulting from inter-organizational, inter-sectoral or international cooperation. Future directions of the development of innovativeness on the Polish capital market are determined by the Capital Market Development Strategy (Official Gazette of the Republic of Poland, 2019).

It indicates the necessity to support enterprises in obtaining funds for the development of the capital market (Kuś, 2020). The Strategy considers equally important actions aimed at the implementation of innovations and funding the fourth industrial revolution through the development of technology supported by legal, tax and education regulations, facilitating the development of the FinTech sector. FinTech comprises companies creating innovative solutions in the scope of finances and banking on the grounds of new technologies and primarily new forms of communication (Harasim & Mitreġa-Niestrój, 2018). The objective of the operation of the FinTech sector is the increase in effectiveness and availability of financial services offered on the market and the development of technologies allowing various types of transactions related to value management. FinTech offers a simple product (e.g., *Ciknciarz.pl*), operates on data in a cloud and data from many sources, ensures quick and easily available solutions (e.g., *Kredytmarket*, 2021), is very flexible and adjusts to changes, as well as ensures customers' convenience, among others, by remote operations. Value of the Polish FinTech market amounts to almost EUR 860 million, which means that Poland is a clear leader of FinTech in the region of Central and Eastern Europe (Deloitte, 2016). One of the barriers in the development of innovativeness of the Polish capital market is the insufficient cooperation between actors, which in compliance with the paradigm of open innovations, should provide relevant conditions for creating innovative products and processes (Sopińska, 2017).

The article's objective was to specify conditions of inter-sectoral cooperation of key actors on the capital market i.e., representatives of science, business, and the legislative and economic environment, supporting innovation processes. The objective of the article was achieved by determining key competences of representatives of the aforementioned sectors to develop

inter-organizational cooperation in innovation processes on the capital market, as well as motivators and barriers, and the most effective forms of developing this cooperation allowing key actors to share knowledge and learn together, along with extending the network relations. The research process is based on the assumptions of the grounded theory. The incomplete induction method was used, and research methods' triangulation was ensured in the research. The theoretical introduction is based on the desk research method. In the further part of the article, results of quantitative research conducted with the survey method and qualitative research, i.e. in-depth individual interviews and focused group interviews, have been presented. The discussion concerning research results has been included in the next subchapter, which orders analyzed contents thematically. The article ends with the subchapter presenting research results. Considering the selection of the research sample, research results can be deemed as highly probable for the capital market.

2. Literature review

In compliance with the functional and procedural approach, creating innovations is a series of events, which can be described as the innovation process. It starts with defining the innovation concept and then covers consecutive phases of research and development works, projecting, implementing, and disseminating innovations (Tidd & Bessant, 2020). In the 21st century, distinguished by increasing globalization, growing hyper-competition, and quickly proceeding technological and ICT revolution, the innovation process may be based on various operation models. They can be inspired by, among others, the paradigm of open innovation (Chesbrough, 2003). It assumes that organizations developing innovations should equally use both internal and external ideas and paths of commercialization, as well as engage in innovation processes of external partners. Such an attitude brings a series of benefits: it allows reducing costs and the risk of innovation activity, better use of technological convergence, and generating economies of scale (Sopińska, 2018). In compliance with this model, one should systematically and simultaneously search for, study, and use various sources of opportunities to create innovations. These sources can be, among others, suppliers, and competitors (often available through trade organizations), customers, universities (Buganza & Verganti, 2009), as well as other stakeholders (e.g., non-governmental organizations or public institutions). As a result, identifying useful sources for opportunities to create innovations, they are intentionally integrated with the potential resources of the organization. Simultaneously, various channels are used in order to develop, and use identified opportunities to create innovations (Inauen

& Schenker-Wicki, 2011). The paradigm of open innovations is based on the natural tendency of contemporary organizations as an open system to interact with the environment (Koźmiński & Piotrowski, 2004), i.e., to the development of relations with other organizations: unilateral or based on mutuality (Koźmiński & Piotrowski, 2009; Freeman, 2010). If the established relation generates expected benefits to the parties, in the long-term, it leads to reinforcing mutual trust and attachment and thus develop inter-organizational relations (Szczeпаńska-Woszczyna & Kurowska-Pysz, 2016).

Inter-organizational cooperation is a relation of two or more organizations that are being reinforced as a result of an evolution of relations based on mutual, beneficial relations (Winkelen, 2010; Berlin & Carlström, 2011). It is based on specific, less or more formal interdependencies between partners, providing them with specific benefits (e.g., better access to knowledge). It is also the innate value obtaining of which requires the parties to ensure skills, competences, and knowledge necessary to establish specific relations (Sitko-Lutek & Pawłowska, 2008). The key attribute of inter-organizational cooperation is collaboration (Kale, Dyer, & Singh, 2020). It occurs in, among others, the innovation process, where partners strive in the same or varied manner to implement concurrent objectives and aims related to creating innovations.

Inter-organizational cooperation, also in the field of innovation, can be developed in various institutional forms: agreements, consortia, alliances, chains, or clusters (Kurowska-Pysz & Gregor, 2014). It may differ with the scope of parties' activity (from the unidirectional use of knowledge to active co-creation) or a type of transferred knowledge: open or hidden (Olszewski, 2020). The more organizations cooperate, the better effects can be achieved, but, at the same time, the more difficult it is to synchronize actions and objectives (Payan, 2007). Asymmetries may occur between partners, e.g., in terms of structures (Kaiser, 2011; Young & Denize, 2011) or participation in the exchange and rights to achieve results. The inter-organizational cooperation can develop between organizations of concurrent or different features (Lundberg & Andersen, 2012) functioning in the private, public or non-governmental sector (Kożuch & Sienkiewicz-Małyjurek, 2015) or between organizations representing various sectors. Then, the inter-sectoral cooperation, in which partners differ the most, is discussed.

Enterprises undertake collaboration only when they are convinced that, as a result of such collaboration, they will reinforce competitiveness that constitutes the condition of staying on the market (Kożuch, 2011). Non-governmental organizations usually implement social missions targeted at specific groups of stakeholders and treat collaboration as a mechanism facilitating the implementation of these missions. In comparison to the commercial or non-governmental sector, in public organizations (including

public universities), authoritarianism and formalization are much more noticeable, the autonomy of acting and making decisions is limited, whereas the competitive pressure does not practically exist at all (Kearney, Hisrich, & Roche, 2009). It is the most difficult for public organizations to engage in cooperation that inherently requires specific flexibility and adaptability.

In the paradigm of open innovations, inter-organizational cooperation among representatives of all sectors is possible within three basic categories of innovation processes based on one- or multi-directional relations. These are inward processes, outward processes, and mixed processes (Chesbrough & Garman, 2010). The so-called open inward innovativeness consists of using the environment only for paid or free-of-charge acquisition of ideas, solutions, and technologies. Relations with other entities serve only to obtain access to their knowledge resources and increase the effectiveness of their innovative activity. The so-called open outward innovativeness is related to using the environment to commercialize solutions created inside the organization in order to make a profit (e.g., sales of solutions that the organization does not intend to use). It allows the organization to generate benefits from knowledge and ideas that are of low value for themselves or impossible to use. In contrast, the so-called open mixed innovativeness joins inward and outward innovativeness. It consists of creating by a given entity formal and informal networks and undertaking cooperation with external stakeholders at various stages of the innovation process (Baloh, Jha, & Awazu, 2008) and serves joint learning and sharing knowledge benefits from the created innovation. The exchangeable relation means that the organization implementing the innovation process uses knowledge resources of partners, yet, at the same time, shares with them a part of its own knowledge resources to create innovations jointly. Therefore, in such a relation, knowledge becomes a key value in the process of exchange between partners.

The significance of knowledge in the innovation process is even greater since the management of innovations fits the contemporary paradigm of the knowledge-based economy well (Błaszczak et al., 2017). Many contemporary organizations establish competitive advantages due to sharing knowledge (Krupski, 2014), joint use of available external knowledge, and joint learning. Extensive and in-depth use of knowledge is one of the most important premises for developing various forms of inter-organizational cooperation, which should be beneficial for each party (Skrzypek, 2019). An important condition of achieving these benefits is to give a proper direction to joint actions and to ensure proper coordination (Zimmer & Mierzwa, 2018). The integration of external and internal resources of cooperating partners allowing creating innovations is a great challenge for the organization and requires effectiveness in establishing networks of connections that serve: identifying

and acquiring necessary knowledge from the environment, searching for external channels of commercialization of own solutions (if they exceed their business model), as well as initiating knowledge sharing between partners (Sopińska & Mierzejewska, 2017; Kelley, 2011).

Inter-organizational cooperation is defined by three key features (Czakoń, 2018):

- exchange (bidirectional transfer of, e.g., knowledge, also including learning; taking into consideration both the contents of the exchange, e.g., research results, as well as the form of exchange, e.g., selling rights to intellectual property (Baglieri, Baldi, & Tucci, 2018);
- engagement (deepening and extending the relation of exchange in order to give it the character of inter-organizational relations, e.g. increasing the number of joint activities, intensification of the information exchange);
- mutuality (maintaining the synergy of engagement and exchange in the area of joint objectives and requirements, e.g. bidirectional transfer of knowledge, equivalent engagement in the process of joint learning, the complementarity of tasks in the joint project, etc.).

Apart from factors determining the inter-organizational cooperation at the institutional level (cooperating partners), engagement of human resources also has a significant impact on the effectiveness thereof in the innovation process. Key importance in these processes is played by so-called knowledge workers (Davenport & Prusak, 1998), that is, persons employed full-time in an organization implementing the innovation process or persons cooperating with such an organization as representatives of other organizations or individually, as performers of so-called liberal professions related to the intellectual work (e.g., adviser, expert). Białoń (2010) characterizes knowledge workers as persons with competences to use their theoretical and application knowledge in innovation processes, as well as to create and share knowledge. Moreover, they are distinguished with the ability to work in various places, teams and projects, openness to changes, flexibility, willingness to learn and improve, and continuously sharing knowledge.

Therefore, the competences of knowledge workers have a significant impact on the course and result of the innovation process in which they participate in a different manner. Motivators and barriers also influence the effectiveness of inter-organizational cooperation in innovation processes, that is, factors that positively or negatively impact the relations between partners at the interpersonal level (persons directly engaged in the innovation process) and institutional level (cooperating organizations). Factors hindering the

development of inter-organizational cooperation in an innovation process can concern, among others (Klimas, 2015):

- lack of funds to use knowledge;
- resistance to change;
- prevailing introvert, reserved culture with a tendency for self-efficiency;
- a lack of relational competences or excessive engagement in relations resulting in dependency on the partner;
- a lack of experiences in developing inter-organizational relations;
- a low level of ability to absorb knowledge in the learning process;
- discrepancy of strategies, management styles and organizational cultures of partners (especially in the inter-sectoral cooperation);
- a low level of mutual trust;
- incompatibility of resources, heterogeneity or homogeneity thereof limiting the possibility of joint use;
- asymmetry concerning the quality and availability of resources, e.g., knowledge;
- the risk of losing knowledge and competences as a result of sharing them.

The counterbalance for barriers in developing the inter-organizational cooperation is provided by motivators, including (Lis, 2021):

- the possibility of gaining access to unique resources, e.g., knowledge;
- decreasing costs of using resources, e.g., using foreign knowledge resources instead of creating own;
- dividing costs, e.g. by sharing knowledge;
- reinforcing the ability of competing as a result of the economies of scale, e.g. joint use of partners' knowledge in order to create innovation;
- benefiting from the so-called resource leverage resulting from the increase in the knowledge value;
- improving organizational processes, including the organizational process and inter-organizational learning;
- maintaining or improving the competitive position due to the acquisition and use of knowledge;
- an increase in the organization's value;
- sharing the risk related to innovation between cooperating organizations;
- limiting uncertainty in reacting to changes related to the use of knowledge.

Due to the individual perception of innovation processes by representatives of cooperating organizations often originating from different sectors, the aforementioned selection of barriers and motivators can be extended by other elements. Among sector-related barriers, the following can be indicated, e.g. a lack of a system of incentives and bonuses for academics due to their engagement in research and development projects (science), a deficit in the knowledge on innovativeness (business), a lack of the habit of continuous cooperation with academic centres and enterprises in the scope of research and development services (public and non-governmental sector). On the other hand, motivators include, among others: additional remuneration (science), access to expert knowledge (business), the possibility of gaining additional experience (public and non-governmental sector).

3. Methodological approach and research procedure

The research problem of the article concerns the insufficient inter-sectoral cooperation on the Polish capital market, including a lack of effective forms of exchanging knowledge and joint learning, which affects innovativeness thereof. Available in the literature, theoretical depictions of the learning process and inter-sectoral cooperation only partially consider application requirements related to innovation processes. Therefore, it is necessary to analyze them in-depth and specify conditions of their use on the capital market. In the article, the research assumption was taken that the effective acceleration of the inter-sectoral cooperation supporting innovativeness of the Polish capital market requires:

- the use of the so-called model of open innovations, i.e., cooperation of representatives of science and business sectors, legislative, and economic environment;
- engagement of specialists who know the capital market and have the competences necessary to participate in innovation processes, as well as understanding the relation between exchanging knowledge and joint learning, and the development of innovativeness;
- appointment of a leader, i.e. an entity directly interested in the implementation of innovation, who has an organizational potential and competences to manage the implementation of research and development services, as well as results thereof;
- providing all organizations and persons participating in the innovation process with benefits expected by them.

In order to solve the research problem, the following research questions (RQ) were asked:

RQ1) What competences of capital market participants support the process of knowledge sharing and joint learning in innovation processes?

RQ2) What factors constitute motivators and barriers in developing inter-organizational cooperation in innovation processes on the capital market?

RQ3) How to effectively develop inter-organizational cooperation allowing knowledge sharing and joint learning, as well as development of network relations in innovation processes on the capital market?

The article aims to specify conditions of inter-sectoral cooperation supporting innovation processes on the Polish capital market, ensuring the possibility of knowledge sharing, joint learning and development of network relations between representatives of science and business sectors, and legislative and economic environment. Three specific objectives have been specified in the article, i.e.:

- 1) Identification of key soft and hard competences of participants in innovation processes on the capital market ensuring possibilities of knowledge sharing, joint learning and reinforcing inter-sectoral cooperation by developing network relations.
- 2) Indication of main motivators and barriers influencing this cooperation.
- 3) Specification of effective forms of inter-organizational cooperation in innovation processes on the capital market, ensuring knowledge sharing, joint learning, and development of network relations.

The research process has been based on the assumptions of the grounded theory. The incomplete induction method has been used (Lisiński, 2016). However, it consists of inductive reasoning on the grounds of observation of only some processes, facilities, and phenomena. In empirical sciences, this method serves to make generalizations on the grounds of experiments and facts. The certainty of inductive reasoning occurs when it is possible to study all elements; however, in the case of the research problem defined above, it was not possible. Thus, the induction by incomplete enumeration method was used in the article, in which a general rule is deduced from the limited number of details. Considering the selection of the research sample, results from the research conducted with this method have been deemed as highly probable for the capital market.

Target groups of the research were representatives of sectors considered to be key actors in the inter-organizational cooperation within innovation processes on the Polish capital market. The academic environment in the research was represented by academics with at least a Ph.D. degree, doctoral students, and students. The business sphere was represented by current and

potential investors, issuers and representatives of brokerage offices, and investment funds. While, the legislative and economic environment was represented in the research by representatives of public institutions and commercial chambers, associations and foundations, whose activity is related to the capital market.

The triangulation of research methods was ensured in the article. Quantitative research was conducted with the use of a survey method and qualitative research was based on the desk research method, individual in-depth interviews (IDI), and focused group interviews (FGI). Desk research results are based on the analysis of national and foreign literature of the subject, as well as strategic documents and results of previous research. On the grounds of the desk research, scenarios of individual in-depth interviews (IDI) were written and conducted on a sample of 8 representatives of science, 9 representatives of business and 4 representatives of the legislative and economic environment. These interviews allowed specifying the issues that were included in the CATI (computer-assisted telephone interviewing) and CAWI (computer-assisted web interview) conducted on a sample of 35 representatives of science, 50 representatives of business, and 15 representatives of the legislative and economic environment.

Conclusions from the survey were subjected to the discussion within three focused group interviews (FGI) with respondents representing all the studied sectors. With regard to all research methods, a non-random sample selection was used, i.e. persons representing particular sectors, who have at least once been engaged in innovation processes on the capital market, that is, participated in the project, the element of which was the performance of the research and development service and the result of which was the implementation of the product or procedural innovation on the capital market, were invited to the research. The self-assessment of soft and hard competences by representatives of target groups resulting from the used research procedure was objectivised in a manner that the competences of each target group were assessed within focused group interviews by representatives of all target groups, considering the experience related to the participation in the performance of research and development services.

4. Results

Given that the innovation process is based on human capital, the research covered soft competences of participants in innovation processes on the capital market (Table 7.1). These competences were assessed in the aspect of their significance for the innovation process (competences indicated by at least 33% of respondents were considered key). Furthermore, it was also studied

which competences are currently held by representatives of target groups. Soft competences included psychophysical features and social and interpersonal skills related to human personality and character of performed activities. As a rule, these features and skills remained without any relations to the industry in which the activities are conducted.

Table 7.1. Held and key soft competences - science

Type of competences	The number of respondents who have these competences (N=35)	The number of respondents who consider these competences key (N=35)
Communicativeness	30	26
Timeliness and punctuality	29	22
Creativity	14	14
Resistance to stress	25	15
Innovativeness	5	15
Impeccable manners	13	8
Willingness to learn and improve	28	7
Logical thinking	10	6
Ability to simultaneously work in various teams and environments	1	6
Positive approach to people	22	6
Ability to work in a group	24	5
Ability to work under pressure of time	8	4
Peacefulness	1	4
Good work organization	13	41
Excellent time management	1	2
Ability to work according to strict guidelines	4	2
Ease in performing tasks	2	1
Ability to focus on the objective	3	1
Ease in establishing relations	0	1
Self-motivation	4	1
Persuasion skills	2	0
Ability to telework	0	0
Adaptability	1	0
Other	0	0

Source: research results within the Project.

The respondents declared that scientists have the majority of key soft competences (communicativeness, timeliness and punctuality, creativity, and resistance to stress), but low innovativeness. Within the IDIs and FGIs, the necessity of improving competences for simultaneous work in different teams and environments was additionally indicated. Whereas, this competence was relatively rarely indicated in the quantitative research as key or held.

Table 7.2. Held and key soft competences - business

Type of competences	The number of respondents who have these competences (N=50)	The number of respondents who consider these competences key (N=50)
Timeliness and punctuality	35	29
Ability to work under pressure of time	35	27
Resistance to stress	36	19
Creativity	34	19
Communicativeness	32	15
Innovativeness	22	13
Good work organization	25	11
Ability to simultaneously work in various teams and environments	15	11
Logical thinking	34	10
Ease in performing tasks	34	9
Excellent time management	24	9
Ability to focus on the objective	19	8
Persuasion skills	7	7
Peacefulness	23	7
Ability to work in a group	16	7
Impeccable manners	20	7
Ability to work according to strict guidelines	19	7
Willingness to learn and improve	22	5
Ability to telework	18	5
Ease in establishing relations	14	5
Self-motivation	7	2
Positive approach to people	25	2
Adaptability	8	0
Other	0	0

Source: research results within the Project.

According to respondents, it is also worth taking care of the development of logical thinking skills, good work organization, including remote, adaptability, and the ability to establish relations (Table 7.2).

Respondents considered as key for the business sphere the following soft competences: timeliness and punctuality, resistance to stress, ability to work under pressure of time, and creativity. At the same time, they stated that business representatives have all of these features. According to the participants in IDIs and FGIs from the business sphere, the most important soft competences include innovativeness, ability to work in a group, ability to work in different teams and environments simultaneously, and willingness to learn and improve. According to the respondents, these competences should be reinforced, although, in the quantitative research a large group of respondents stated that business representatives have these competences (Table 7.3).

Table 7.3. Held and key soft competences – the legislative and economic environment

Type of competences	The number of respondents who have these competences (N=15)	The number of respondents who consider these competences key (N=15)
Ability to simultaneously work in various teams and environments	7	6
Ease in performing tasks	4	6
Excellent time management	8	6
Good work organization	8	6
Ability to focus on the objective	8	5
Timeliness and punctuality	6	5
Ability to work under pressure of time	5	4
Communicativeness	6	4
Ability to work in a group	9	4
Resistance to stress	13	3
Peacefulness	7	3
Ability to telework	8	3
Logical thinking	4	2
Creativity	5	2
Persuasion skills	1	2
Impeccable manners	5	2
Innovativeness	4	1
Ease in establishing relations	6	1

Type of competences	The number of respondents who have these competences (N=15)	The number of respondents who consider these competences key (N=15)
Self-motivation	1	1
Positive approach to people	5	0
Willingness to learn and improve	3	0
Ability to work according to strict guidelines	3	0
Adaptability	0	0
Other	0	0

Source: research results within the Project.

Respondents indicated many more key soft competences for the legislative and economic environment than for other sectors. The assessment was also more even (the ability to simultaneously work in various teams and environments, ease in performance of tasks, excellent time management, good work organization, the ability to focus on the objective, as well as timeliness and punctuality). From among the indicated competences, currently, the ability to perform tasks is missing. The IDIs and FGIs imply that a positive approach to people and willingness to learn and improve are the most important in this sector. Having these competences allows shaping other soft skills. It is worth underlining that these competences were not considered key in the quantitative research.

Furthermore, the research covered with analysis hard competences included measurable skills that should be held by specialists in the scope of the capital market, engaging in innovation processes irrespective of conducting activity in science or business sectors, or the legislative and economic environment. Due to the thematic variety of research and development services provided on the capital market, difficulty was encountered in reliable identification of model hard competences through surveys. Thus, this subject matter was subjected to assessment of representatives of all sectors within IDIs, and then FGIs, which allowed making this assessment consistent. The results have been presented in Table 7.4. At the same time, assessment, whether particular respondents have key hard competences, has been waived. Also, it has been decided that in each innovation process, hard competences are strictly related to the scope of research and development work, and evaluation in this issue cannot be generalised.

Table 7.4. Key hard competences – science, business, and the legislative and economic environment

Type of competences	Competence key for the science sector	Competence key for the business sector	Competence key for the legislative and economic environment
Knowledge of the financial market	YES	YES	YES
Knowledge of the capital market law	YES	NO	YES
Ability to assess the investment risk	YES	YES	NO
Knowledge of the stock exchange products market	YES	NO	YES
Knowledge of financial instruments	YES	YES	YES
Knowledge of FinTech technologies	NO	NO	YES
Knowledge of foreign languages	NO	NO	YES
Knowledge of the principles of stock exchange investment	NO	YES	NO
Knowledge of the principles of obtaining capital from the stock exchange	NO	NO	YES
Ability to execute capital transactions with financial instruments	NO	YES	YES
Ability to create funds and other investment products	NO	NO	YES

Source: research results within the Project.

The approach to key hard competences is very different. Compliance with the assessment was obtained only in the case of competence concerning the knowledge of the financial market and financial instruments. The biggest number of key hard competences, similarly to key soft competences, was indicated by representatives of the legislative and economic environment (9). The highest consistency in the assessment of these competences occurs among representatives of the legislative and economic environment and representatives of science (4). The second area of research comprised factors with a positive or negative impact on the engagement of representatives of science and business sectors, the legislative and economic environment in the inter-sectoral cooperation in innovation processes on the capital market. Respondents were asked to indicate factors encouraging cooperation (motivators) and factors hindering cooperation (barriers). Factors that were indicated in the survey by at least 33% of respondents were considered crucial (Table 7.5).

Table 7.5. Motivators of inter-sectoral cooperation – science, business, and the legislative and economic environment

Motivators – the science sector		Motivators – the business sector		Motivators – the legislative and economic environment	
The name of the motivator	The number of respondents indicating this motivator (N=35)	The name of the motivator	The number of respondents indicating this motivator (N=50)	The name of the motivator	The number of respondents indicating this motivator (N=15)
Additional remuneration	33	Company development	40	Additional experiences resulting from established cooperation	11
Rewarding cooperation with companies with a bonus in the university Assessment system	30	Increasing the company's profit by revenues from the inter-sectoral cooperation	23	The possibility of exchanging thoughts and experiences, transfer of knowledge	8
		Implementation of innovations in the company	18	The possibility of reinforcing competences due to the cooperation with scientists and practitioners	8
				Access to innovation	5
				Prestige resulting from the inter-sectoral cooperation	5

Source: research results within the Project.

Various factors drive the development of inter-sectoral cooperation in the capital market. In the case of science and business sectors, motivators directly or indirectly related to the profitability of innovation processes were considered crucial, whereas more varied motivators were indicated in the case of the legislative and economic environment.

In FGIs, representatives of the scientific environment were less focused on financial issues. They stated that for ambitious scientists, it is also important to have the opportunity to establish contact with companies and reinforce hard competences, as well as the possibility of using results of the application, works in scientific publications, to which, however, many companies, which plan to keep the research results in secret, do not want to agree. From a scientist's perspective, the possibility to publish is the most important, and cooperation with the business environment gives scientists access to fundamental empirical data. Motivators indicated by respondents also allow updating scientists' knowledge on the legislative and economic environment, which is crucial in the context of their economic development, as well as gaining practical experience. Representatives of the scientific environment underlined that all parties in the inter-sectoral cooperation should motivate each other. But from the scientists' point of view, the university authorities should provide them with possibilities and shape the appreciation for the value of this cooperation both, in the financial and non-financial scope. However, it is not always the priority for universities. According to business representatives, the development of inter-sectoral cooperation influences better perception of an enterprise on the market and, above all, allows the use of experience and knowledge of others. Businesses should be motivated to cooperate primarily by the market (i.e., competition, customers, and expectations). Important motivators for representatives of the legislative and economic environment include the possibility of establishing all types of relations that give a chance to acquire expert knowledge, which in turn, allows implementation of missions of such organizations.

Many more barriers in inter-sectoral cooperation than motivators were identified in the research. Additionally, their scope was extended on the grounds of conclusions from FGIs. Key barriers in inter-sectoral cooperation have been presented in Table 7.6.

Respondents in FGIs underlined that each sector should individually diagnose its barriers and undertake measures to limit them. It will allow all parties to achieve expected benefits from participation in innovation processes. Statements were also made, that due to the provisions concerning the activity of public universities (e.g., conditions of providing research and development services), a business should show more openness and invite scientists to cooperate. However, the business itself indicated the most barriers in inter-sectoral cooperation. Some respondents underlined that government and key institutions of the capital market should have their share in minimizing barriers in inter-sectoral cooperation.

Table 7.6. Barriers in the inter-sectoral cooperation – science, business, and the legislative and economic environment

Barriers – the science sector		Barriers – the business sector		Barriers – the legislative and economic environment	
The name of the barrier	The number of respondents indicating this barrier (N=35)	The name of the barrier	The number of respondents indicating this barrier (N=50)	The name of the barrier	The number of respondents indicating this barrier (N=15)
The lack of a system of incentives and bonuses for the academics due to the participation in research and development projects	18	Low effectiveness of participation in conferences, training, seminars and other forms of cooperation with universities, where theoretical and not practical discussions prevail	23	Legal loopholes concerning commercialisation of knowledge in scientific paths, management of intellectual property and protection thereof	7
Developed bureaucracy extending the formalisation of procedures of cooperation with enterprises	15	Time divergence in cooperation (companies are interested in quick cooperation results and universities work in an academic year cycle)	21	Developed bureaucracy extending the formalisation of procedures of inter-sectoral cooperation	5
A significant divergence between implemented directions of research and the possibility of using them in practice	12	A lack of professional mechanisms and competences to absorb knowledge acquired due to the cooperation with the academic environment and use thereof to reinforce the innovative potential of the company	18	A lack of marketing approach to knowledge as a market product	5
		A deficit of knowledge on the actual role of innovativeness in the process of developing the company's competitiveness	18	A lack of legal regulations as the element encouraging to establish cooperation	5

Barriers – the science sector		Barriers – the business sector		Barriers – the legislative and economic environment	
The name of the barrier	The number of respondents indicating this barrier (N=35)	The name of the barrier	The number of respondents indicating this barrier (N=50)	The name of the barrier	The number of respondents indicating this barrier (N=15)
		A lack of resources to develop inside the company a sphere of research and development, as well as to outsource such services for universities	18		

Source: research results within the Project.

The scope of research also covered forms of inter-organizational cooperation in innovation processes on the capital market ensuring effective knowledge sharing, joint learning, and development of network relations. Respondents of CATIs and CAWIs were asked to assess proposed forms of cooperation which were defined on the grounds of IDIs with representatives of target groups. These forms of cooperation that were indicated in the survey by at least half of respondents from each sector have been considered crucial. Assessment of particular forms of inter-organizational cooperation has been presented in Table 7.7.

Table 7.7. Assessment of the effectiveness of particular forms of inter-organizational cooperation - science

Assessment of the form of inter-organizational cooperation	The number of respondents considering the given form of cooperation effective (N=35)
Joint research projects	34
Sharing of experiences and knowledge	32
Joint organization of conferences, seminars, and training	32
Establishing strategies of cooperation	29
Cooperation on the grounds of the Inter-sectoral Cooperation Guide (a set of rules)	28
Using the base of good practices in inter-sectoral cooperation in relations	22
Flow of personnel between sectors	19

Assessment of the form of inter-organizational cooperation	The number of respondents considering the given form of cooperation effective (N=35)
Joint infrastructural investments	17
Spin-off companies (established in order to commercialize and transfer knowledge)	17
Sharing current information via an online tool to inter-sectoral communication	15
Mutual provision of advisory services	3
Informal business relations	3
Other	0

Source: research results within the Project.

Representatives of science, business, the legislative, and the economic environment indicated seven effective forms of inter-sectoral cooperation equally, but they correspond only partially (Table 7.8 and Table 7.9).

Table 7.8. Assessment of the effectiveness of particular forms of inter-organizational cooperation - business

Assessment of the form of inter-organizational cooperation	The number of respondents considering the given form of cooperation effective (N=50)
Sharing experiences and knowledge	40
Establishing strategies of cooperation	33
Mutual provision of advisory services	31
Flow of personnel between sectors	30
Joint research projects	30
Joint infrastructural investments	28
Joint organization of conferences, seminars, and training	27
Sharing of current information via an online tool to inter-sectoral communication	24
Using the base of good practices in inter-sectoral cooperation in relations	24
Spin-off companies (established in order to commercialize and transfer knowledge)	24
Cooperation on the grounds of the Inter-sectoral Cooperation Guide (a set of rules)	20

Assessment of the form of inter-organizational cooperation	The number of respondents considering the given form of cooperation effective (N=50)
Informal business relations	16
Other	1
Other	0

Source: research results within the Project.

Table 7.9. Assessment of the effectiveness of particular forms of inter-organizational cooperation – legislative and economic environment

Assessment of the form of inter-organizational cooperation	The number of respondents considering the given form of cooperation effective (N=15)
Sharing experiences and knowledge	14
Joint organization of conferences, seminars, and training	13
Mutual provision of advisory services	11
Flow of personnel between sectors	11
Joint research projects	11
Joint infrastructural investments	10
Sharing of current information via an online tool to inter-sectoral communication	8
Establishing strategies of cooperation	7
Spin-off companies (established in order to commercialize and transfer knowledge)	7
Using the base of good practices in inter-sectoral cooperation in relations	5
Cooperation on the grounds of the Inter-sectoral Cooperation Guide (a set of rules)	4
Informal business relations	4
Other	1

Source: research results within the Project.

After analyzing the forms of inter-organizational cooperation presented above in a sectoral depiction, a common set of forms considered the most effective for all three sectors, has been formulated. As such, the forms indicated by at least half of the respondents have been considered (Table 7.10).

Table 7.10. The most effective forms of inter-organizational cooperation

The name of the form of inter-organizational cooperation	The number of assessments of a given inter-organizational cooperation in particular sectors		
	science (N=35)	business (N=50)	legislative and economic environment (N=15)
Joint research projects	34	30	11
Sharing experiences and knowledge	32	40	14
Joint organization of conferences, seminars, and training	32	27	13
Flow of personnel between sectors	19	30	11

Source: research results within the Project.

Based on the identified set of the most effective forms of inter-organizational cooperation on the capital market, FGIs' participants were asked to specify crucial conditions of use thereof in innovation processes. It was decided that in order to ensure proper conditions of cooperation, it is necessary to prepare a platform for online communication that may be especially useful both in the conditions of the COVID-19 pandemic and with regard to the dynamic development of ICTs. Such an online tool should serve the development of network cooperation between entities and persons representing the following spheres: science – business – economic environment on the capital market. In the respondents' assessment, in case of the hitherto conditions of cooperation (before the COVID-19 pandemic), there were not many possibilities of developing these processes, and it is necessary to propose something new and different. According to respondents for business and science sectors, such forms of cooperation as conferences, symposia, discussion panels, meetings, tripartite seminars are a good forum for accelerating network cooperation. However, they should be extended with a new element ensuring maintenance of inter-sectoral cooperation in a way that also supports the implementation of other forms of cooperation i.e.:

- searching for partners to joint implementation of research projects;
- creating mechanisms allowing sharing of experiences and knowledge;
- virtual forms of joint learning, i.e., organization of conferences, seminars, and training;
- creating conditions to intensify the flow of personnel between sectors, i.e., primarily engagement of scientists and representatives of the legislative and economic environment in innovation processes on the capital market.

5. Discussion

Due to the size and non-random selection of the research sample, it was not possible in the article to use advanced analytical methods; however, due to the characteristics of the capital market that focuses predominantly on the Warsaw Stock Exchange (*Giełda Papierów Wartościowych SA*), the used research procedure may be considered proper from the point of view of research objectives. The objective was, in fact, to determine types of competences that are key in innovation processes and inter-sectoral cooperation, explain and allow understanding motivations and barriers related to such cooperation, as well as conditions that influence the way of developing this cooperation. Such a depiction of the research problem does not require accurate measurement of the scale of the phenomenon. Respondents from all studied sectors indicated soft competences that they had considered crucial with regard to the participation of representatives of each sector in the innovation process. Such an approach results from the assumption that persons with similar competences will cooperate more harmoniously and effectively than persons with different competences. Nevertheless, this assumption can be challenged by arguing that:

- members of teams providing research and development services originate from various sectors, not providing them with the conditions to acquire all competences;
- innovation processes are implemented in inter-sectoral cooperation, among others, in order to share resources.

Considering both approaches, soft competences indicated both in CATIs and CAWIs, as well as FGIs, were analyzed. It has been noticed that competences related to the performance of tasks under high pressure of time were emphasized in all three studied sectors. It especially regards timeliness and punctuality: however, other, related competences were also indicated:

- resistance to stress (key for representatives of science and business);
- improvement of competences to simultaneously work in various teams and environments (key for representatives of science and the legislative and economic environment);
- an ability to work under pressure of time (key for business);
- time management, good organization of work (key for the legislative and economic environment).

As seen above, the possibility to participate in innovation processes implemented in inter-sectoral cooperation depends on having competences to skillfully balance professional duties related to employment in each sector,

with an additional burden resulting from inter-sectoral cooperation. Therefore, readiness to effectively engage in the innovation process in the required timeframe is strictly related to the aforementioned key competences of representatives of all three sectors. Engagement in inter-sectoral cooperation, joint learning, and development of network relations is attractive, especially for those who notice the significance of complementarity of knowledge, resources, and potentials of partners. In fact, due to collaboration with representatives of other sectors they gain access to values which relations between them have been built on, significant also from the point of view of other undertaken activities. Therefore, it cannot be stated that persons participating in the innovation process should have the same competences since their roles in these activities vary. Representatives of the academic environment are expected to provide scientific input, access to basic research results that are useful in providing research and development services, as well as ensure methodological correctness of the research process. Respondents from the science sector declared having most key soft competences; however, they are not very innovative and lack communicativeness, adaptability, and ability to establish relations. Thus, it may be stated that scientists are usually focused on their environment, and only a part of science representatives engage in innovation processes.

Respondents from the business sector underlined the key significance of creativity and innovativeness, but the latter has a much smaller significance than for scientists. It is confirmed by the existence of a conventional division of responsibilities and tasks in innovation processes. Hereafter, the mutual creation of an idea for a research and development project, the responsibility for ensuring its proper level of innovativeness usually lies on scientists. Business representatives consider more important the competences, which allow them to perform planned activities on time and provide them with proper organizational conditions. It is probably related to the motivator to innovative actions that are crucial for them, that is, development of a company and an increase in profit.

Representatives of the legislative and economic environment, which is made of many entities with various tasks and missions, may play many roles in innovation processes, depending on the scope of research and development services where they participate. This should probably be linked to their slightly different expectations concerning participation in innovation processes and a wide scope of key soft competences they attribute to these responsibilities. Apart from the aforementioned competences jointly indicated by representatives of all sectors, respondents from the legislative and economic environment underline the significance of other competences, such as ease in performance of tasks and the ability to focus on the objective. It can be assumed

that indication of these soft competences is related to the implementation of often quite broadly outlined missions of their organizations or institutions, often even quite remote from the sphere of innovativeness, which does not facilitate their engagement in research and development services, and requires greater effort from them.

The research did not allow to resolve unequivocally how hard competences should be shaped. Most probably, the consensus of all groups of respondents concerning stating as such only the following: knowledge of the financial market and financial instruments is accidental and related to the non-random selection of respondents. It is also confirmed by the fact that the competence commonly considered as key concerning the assessment of the investment risk is key only for representatives of the science and business sectors. This competence is of significant importance in undertaking risky, innovative projects not only on the capital market. At the same time, representatives of business and the legislative and economic environment considered crucial the competence related to the execution of capital transactions with financial instruments, which was not crucial for academic sector representatives. Similarly, as in the case of soft competences, the highest number of key hard competences was indicated by representatives of the legislative and economic environment, whose scope of operation is decidedly the broadest among all studied sectors.

As far as motivators and barriers influencing the engagement of representatives of all sectors in research and development services, network cooperation or joint learning are concerned, also, in this case, it is clearly visible that indicated factors are related to their roles in innovation processes, but also limitations imposed by these roles. Representatives of the academic sector considered their benefits as crucial motivators: direct financial (remuneration) or indirect financial (additional points to employee assessment at the university) benefits. Other motivators, e.g., access to innovations implemented by companies or the possibility to establish a contact for the university, were positively assessed by a significantly smaller group of respondents. It proves that representatives of the academic environment wish to engage in innovation processes on the capital market without their home university. It does not change the fact that they want to use this engagement with regard to the requirement to document their activity to the benefit of the university's environment, which currently is the element of academic centres' evaluation. While business representatives indicate the development of the company and increasing company profits that place first among motivators, science representatives perceive engagement in inter-sectoral cooperation more individually and do not associate it with their activity within the academic activity. A similar approach is presented by representatives of the legislative and business environment, who place gaining additional experiences resulting

from the established cooperation, the opportunity to exchange thoughts and experiences, transfer of knowledge, as well as the possibility to reinforce competences as a result of cooperation with scientists and practitioners, on the first place among motivators. This group of respondents treats prestige for the organization resulting from inter-sectoral cooperation as much more important than gaining new experiences; therefore, it seems that in this case, engagement in the innovation process is aimed at reinforcing the professional position (similarly as in the case of scientists), and only on the second place – the position of the represented organization.

The analysis of barriers in inter-sectoral cooperation on the capital market confirms conclusions from the assessment of motivators. Scientists indicated as key barriers the elements related to the insufficient organizational preparation of the university to provide services to the innovation processes. It confirms the fact that universities are perceived as entities providing proper coordination of research and development services (a lack of motivation system for the academic staff with regard to the participation in research and development projects; bureaucracy extending formalization of cooperation with enterprises; directions of research not useful for economic practice). This assessment, to a large extent, explains the reasons why the academic staff wants to engage in inter-organizational cooperation individually and not through the agency of a university. The largest number of barriers in cooperation (5) was identified by respondents from the business environment and they exclusively concerning cooperation with the academic environment (among others: low effectiveness of participation in conferences and other forms of cooperation with universities mainly in the theoretical scope, time discrepancy in cooperation with universities, a lack of mechanisms and competences to absorb knowledge acquired due to the cooperation with the academic environment and use thereof to reinforce the innovative potential of a company). Only some of the barriers can be indirectly referred to the cooperation with the legislative and economic environment (a deficit of knowledge on the actual role of innovativeness in the process of establishing company's competitiveness, a lack of funds to develop inside the company a sphere of research and development, as well as to outsource such services). It confirms the fact that the burden of inter-sectoral cooperation is primarily based on the relationship between business and science. The legislative and economic environment indicated two barriers that hinder inter-sectoral cooperation in the sphere of innovativeness, predominantly in legal terms. These are legal loopholes concerning the commercialisation of knowledge in scientific paths, management of intellectual property and protection thereof (among others, property of the intellectual solution developed in cooperation of several entities, e.g. within a project co-financed by the EU), as well

as a lack of legal regulations as an element of encouragement to establish cooperation (e.g., a threat of covering with public aid a non-governmental organization engaged in the research and development project). These barriers are essentially independent of cooperation partners, whereas two consecutive ones fully depend on the engaged parties. It concerns extending procedures of establishing inter-sectoral cooperation (among others, a lack of established templates of cooperation agreements between partners of different formal and legal status). The second barrier, a lack of a marketing approach to knowledge as a market product, deteriorates the perception of knowledge as a key force of the innovation process, which should be shared and multiplied and may become a basis for the development of network cooperation.

Effectiveness assessment of particular forms of inter-organizational cooperation in innovation processes on the capital market explicitly confirms that each studied sector has its preferences. It results from specific conditions of their activity and the possibility to use many various forms of inter-organizational cooperation. We managed to identify only four forms of inter-organizational cooperation, which gained acceptance of all studied sectors. Each of them has the potential to be used in inter-organizational cooperation:

- joint research projects become natural platforms for sharing knowledge, group learning and thus provide research results necessary to develop innovation processes;
- sharing of experiences may be identified directly with sharing knowledge and, so this is an area of inter-organizational cooperation, which can be broadly used in joint learning (e.g., in the innovation process), as well as in financial education, crowdsourcing, or ICT solutions aimed at the acceleration of inter-sectoral cooperation on the capital market (it is an especially important element of hybrid communication, which is very dynamically developing during the COVID-19 pandemic, but also opens the era of development of innovative communication techniques, which are already implemented in many organizations due to the crawling pandemic);
- joint organization of conferences, seminars, and training, can be considered an effective form of inter-sectoral cooperation if it focuses on a specific subject matter that is interesting for representatives of all sectors and takes into account interactive forms of sharing knowledge or joint learning, e.g., discussion groups, asking questions, debates, and discussion panels playing a role of a platform for the development of network cooperation;
- a flow of personnel between sectors is an optimal solution in the scope of inter-sectoral cooperation, ensuring full use of various competences of representatives of particular sectors in the innovation process

(among other research projects), which creates conditions for sharing knowledge, group learning, and development of network relations.

6. Conclusions

Soft and hard competences key in inter-sectoral cooperation vary and can be grouped in three levels of significance (Figure 7.1).

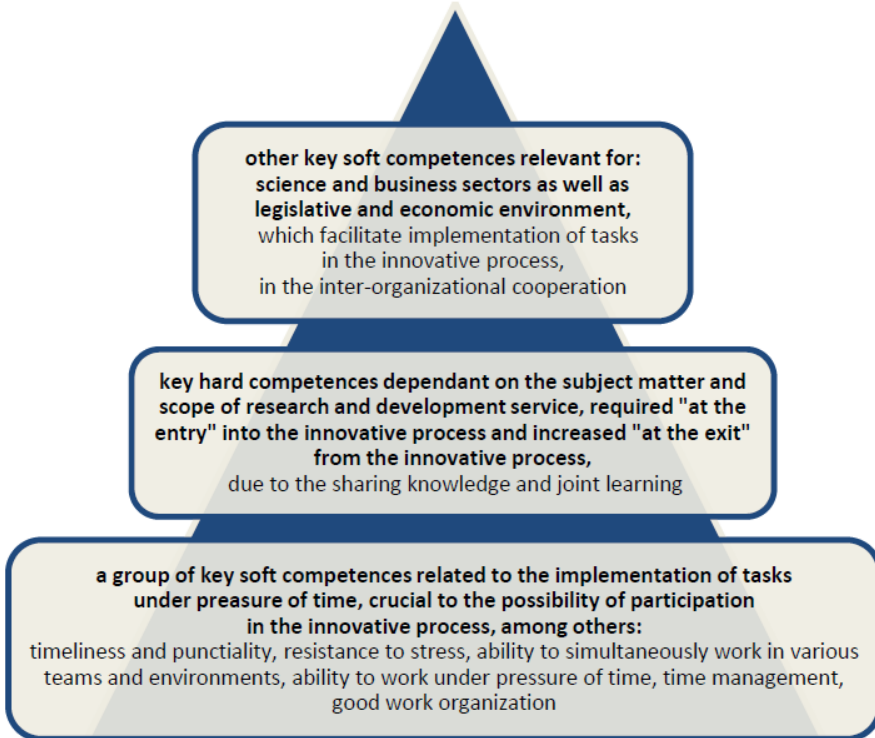


Figure 7.1. Key soft and hard competences in innovation processes on the capital market

The basis is made of a group of related soft competences, identical for all sectors. It should be directly linked to having sufficient time resources, and readiness to undertake such activities by all parties engaged in the inter-sectoral cooperation despite the simultaneous performance of other professional roles. They are related to the performance of tasks under high pressure of time. Other key soft competences differ in particular sectors, which results from their characteristics and approach to innovativeness and inter-sectoral cooperation.

These competences are related to roles and tasks performed by representatives of particular sectors in the innovation process. Between two groups of soft competences in Figure 7.1 there are key hard competences. Although they are indispensable to ensure the expected quality of research and development services, in practice, it is a quite diverse group of competences related to the scope of these services. Having such competences is a condition necessary to participate in the provision of the research and development service. Due to the sharing of knowledge and joint learning, an increase in hard competences of persons providing research and development services occurs in the innovation process, and it is faster than the increase in soft competences, the development of which requires much more time.

Motivators and barriers in the development of inter-organizational cooperation in innovation processes on the capital market are much more diverse than the aforementioned competences. There are relations between motivators and barriers which can be connected with roles of particular sectors in innovation processes, but also limitations imposed by these roles. It can be stated that in the case of the science sector and the legislative and economic environment, benefits of an individual are put first, followed by benefits of the organization and sector represented by such an individual, and in the case of business – this relation is the opposite. Furthermore, it is visible that the burden of the inter-sectoral cooperation in innovation processes is based primarily on the relation between business and science, whereas the legislative and business environment, due to the characteristics thereof, plays a slightly smaller role therein. The four most effective forms of inter-sectoral cooperation in innovation processes accepted by all environments have been presented in the system of correlations in Figure 7.2.

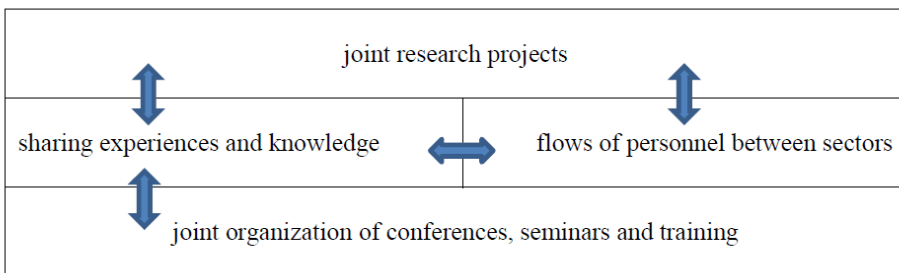


Figure 7.2. Effective forms of inter-sectoral cooperation in innovation processes on the capital market and correlations between them

Sharing experiences and knowledge as the most effective form of inter-sectoral cooperation in innovation processes on the capital market is

connected to other forms of cooperation. We deal with sharing experiences and knowledge both in research projects and during conferences or training, as well as in the case of exchanging staff between sectors. This form of cooperation can be broadly used in various activities related to innovation processes in the capital market.

The second most effective form of inter-sectoral cooperation comprises research projects constituting the basis of innovation processes. They can be related to both sharing experiences and knowledge and the exchange of staff between sectors. These activities are in a way connected since in many projects, it is simply necessary to indicate the formal cooperation of science and business. The flow of personnel between sectors is also related to the possibility of joint learning, development of new hard and soft competences, and improvement of competences already held by representatives of particular sectors, which is naturally done in the conditions of network cooperation.

The most effective forms of inter-sectoral cooperation also include joint organization of conferences, seminars, and training, which may be linked only to the sharing experiences and knowledge; however, it has a significantly higher than other forms potential to develop network cooperation. It should be treated as a supplementary form, which can play a special role at the stage of establishing inter-sectoral cooperation, or presenting good practices aimed at promoting inter-sectoral cooperation.

The identified key soft and hard competences, as well as motivators and barriers in inter-sectoral cooperation in innovation processes on the capital market and the most effective forms of this cooperation, are crucial factors determining relations between representatives of the science and business sectors and the legislative and business environment engaged in the provision of research and development services. Knowledge thereof can significantly improve the effectiveness of the inter-sectoral cooperation on the capital market, which, however, requires certain putting in order and giving a specific direction. The author used the aforementioned research results and conclusions drawn on the grounds thereof to develop a model of acceleration of the inter-sectoral cooperation within innovation processes on the Polish capital market. This model will be presented in other publications devoted to this subject matter.

Acknowledgment

Research results presented herein were obtained within the project: "Knowledge – skills - competences. The innovative model of acceleration of the inter-sectoral cooperation for development of the Polish capital market" (*"Wiedza – umiejętności – kompetencje. Innowacyjny model akceleracji*

współpracy międzysektorowej dla rozwoju polskiego rynku kapitałowego”). The project was implemented by Fundacja GPW, in Warsaw, in the years 2019-2021, with co-financing of the Ministry of Education and Science, within the programme “Dialogue.”

References

- Baglieri, D., Baldi, F., & Tucci, C.L. (2008). University technology transfer office business models: One size does not fit all. *Technovation*, 76–77, 51–63.
- Baloh, P., Jha, S., & Awazu, Y. (2008). Building strategic partnerships for managing innovation outsourcing. *Strategic Outsourcing: An International Journal*, 1(2), 100-121.
- Berlin, J. M., & Carlström, E.D. (2011). Why is collaboration minimised at the accident scene? A critical study of a hidden phenomenon. *Disaster Prevention and Management*, 20(2), 159–171.
- Białoń, L. (2010). Zarządzanie działalnością innowacyjną. Zarys problematyki. *Zarządzanie. Teoria i Praktyka*, 1(1), 23-33.
- Bolesławski, M., & Nowakowski, E.W. (2017). Struktura finansowania i koszt kapitału a innowacyjność przedsiębiorstw. *Journal of Modern Science*, 3(34), 155-179.
- Buganza, T., & Verganti, R. (2009). Open innovation process to inbound knowledge. Collaboration with universities in four leading firms. *European Journal of Innovation Management*, 12(3), 306-325.
- Capital Market Development Strategy. (2019). Resolution No. 114 of the Council Of Ministers of 1 October 2019 on adoption of the Capital Market Development Strategy, Warszawa: *Monitor Polski*, 1027.
- Chesbrough, H. (2003). *Open Innovation*. Boston: Harvard Business Review Press.
- Chesbrough, H., & Garman, A. R. (2010). Otwarta innowacyjność: Recepta na trudne czasy. *Harvard Business Review Polska*, 11, 1-16.
- Czakon, W. (2017). Cechy strategii relacyjnych – wyniki badań eksperckich. *Prace Naukowe Uniwersytetu Ekonomicznego we Wrocławiu. Zarządzanie Strategiczne w Teorii i Praktyce*, 538, 74–83.
- Davenport, T., & Prusak, L. (1998). *Working Knowledge*. Boston: Harvard Business School Press.
- Deloitte Report. (2016). *CEE fintech Report*. Retrieved November, 1, 2021, from <https://www2.deloitte.com/content/dam/Deloitte/global/Documents/About-Deloitte/central-europe/cc-fintech-in-cee-region-2016.pdf>
- Freeman, R.E. (2010). *Strategic Management. A Stakeholder Approach*. Cambridge: Cambridge University Press.
- Harasim, J., & Mitręga-Niestrój, K., (2018). Fintech–dylematy definicyjne i determinant rozwoju. *Prace Naukowe Uniwersytetu Ekonomicznego we Wrocławiu*, 531, 169-179.

- Inauen, M., & Schenker-Wicki, A. (2011). The impact of outside-in open innovation on innovation performance. *European Journal of Innovation Management*, 14(4), 496-520.
- Janasz, W., & Koziół, K., (2007). *Determinanty Działalności Innowacyjnej Przedsiębiorstw*. Warszawa: Wydawnictwo Naukowe PWE.
- Kaiser, F.M., (2011). Interagency collaborative arrangements and activities – types, rationales, considerations. *Congressional Research Service* 7-5700, R41803, 1-37.
- Kale, P., Dyer, J.H., & Singh, H. (2002). Alliance capability, stock market response and long-term alliance success. The role of the alliance function. *Strategic Management Journal*, 23, 747-767.
- Kearney, C., Hisrich, R.D., & Roche, F. (2009). Public and private sector entrepreneurship: Similarities, differences or a combination? *Journal of Small Business and Enterprise Development*, 16(1), 26–46.
- Klimas, P. (2015). Przecłanki i bariery zawiązywania więzi międzyorganizacyjnych. *Problemy Zarządzania*, 1(50), 29-46.
- Kożuch, B. (2011). *Skuteczne Współdziałanie Organizacji Publicznych i Pozarządowych*. Kraków: Instytut Spraw Publicznych Uniwersytet Jagielloński.
- Kożuch, B., & Sienkiewicz-Małyjurek, K. (2015). Mapowanie procesów współpracy międzyorganizacyjnej na przykładzie działań realizowanych w bezpieczeństwie publicznym. *Zarządzanie Publiczne*, 3(31), 237–253.
- Koźmiński, A. K., & Piotrowski, W. (2004). *Zarządzanie. Teoria i praktyka*, 5th edition, amended, Warszawa: Wydawnictwo Naukowe PWN.
- Kredytmarket (2021). Retrieved from <https://kredytmarket.com/blog/fintech/>
- Krupski, R. (2014). Zasoby niematerialne jako główny składnik strategii przedsiębiorstwa działającego w turbulentnym, nieprzewidywalnym otoczeniu. *Organizacja i Kierowanie*, (159), 87–98.
- Kurowska-Pysz, J., & Gregor, M. (2014). The transfer of knowledge in technological cross-border industry cluster – case study. *Management Systems in Production Engineering*, 2(14), 63-67.
- Kuś, A. (2020). *Finansowanie Działalności Innowacyjnej Małych Przedsiębiorstw w Polsce*. Toruń: Wydawnictwo Naukowe Uniwersytetu Mikołaja Kopernika.
- Lis, M. (2021). *Kształtowanie Relacji Uczelni z Przedsiębiorstwami w Warunkach Transformacji Cyfrowej*. Warszawa: Wydawnictwo PWN.
- Lisiński, M. (2016). Procedury naukowe indukcji zupełnej i niezupełnej w metodologii nauk o zarządzaniu. *Zeszyty Naukowe Uniwersytetu Ekonomicznego*, 954(06), 23-46.
- Lundberg, H., & Andresen E. (2012). Cooperation among companies, universities and local government in a Swedish context. *Industrial Marketing Management*, 41(3), 429–437.
- Marciniak, S., (2010). *Innowacyjność i Konkurencyjność Gospodarki*. Warszawa: Wydawnictwo C.H. Beck.

- Oslo Manual, OECD. (2005). Retrieved from <https://ec.europa.eu/eurostat/documents/3859598/5889925/OSLO-EN.PDF>
- Payan, J.M., (2007). A review and delimitation of cooperation and coordination in marketing channels. *European Business Review*, 19(3), 216–233.
- Rothwell, R. (2002). Towards the fifth – generation innovation process. In J. Henry & D. Mayle (Eds.), *Managing Innovation and Change* (pp. 115–135). London: Sage Publication Ltd.
- Rybicki, J., & Dobrowolska, E. (2018). Model współpracy polskich politechnik z przedsiębiorstwami – identyfikacja i kierunki rozwoju. *Organizacja i Kierowanie*, 2(181), 159–174.
- Sitko-Lutek, A., & Pawłowska, E. (2008). Kapitał społeczny a doskonalenie kompetencji menedżerów. *Organizacja i Zarządzanie*, 3, 17–28.
- Skrzypek, A. (2019). Otwarte innowacje jako narzędzie efektywnego zarządzania wiedzą w organizacji. *Problemy Jakości*, 51(1), 8-14.
- Sopińska, A., & Wachowiak, P. (2016). Innowacyjność przedsiębiorstw działających w Polsce. *Przegląd Organizacji*, 5, 17-22.
- Sopińska, A., & Mierzejewska, W. (2017). Wybór partnerów do tworzenia innowacji w modelu otwartym. *Studia Oeconomica Posnaniensia*, 5(9), 123-141.
- Sopińska, A. (2018). Kreatywność a innowacyjność organizacji. Otwarte innowacje jako przejaw współkreatywności. *Studia i Prace Kolegium Zarządzania i Finansów*, 161, 11-27.
- Szczyptańska-Woszczyzna, K., & Kurowska-Pysz, J. (2016) Sustainable business development through leadership in SMEs. *Ekonomia i Zarządzanie*, 8(3), 57-69.
- Tidd, J., & Bessant J. (2020). *Managing Innovation: Integrating Technological, Market and Organizational Change*. Wiley: Hoboken, New Jersey.
- Van Winkelen, Ch. (2010). Deriving value from inter-organizational learning collaborations. *The Learning Organization*, 17(1), 8–23.
- Young, L., & Denize, S. (2008). Competing interests. The challenge to collaboration in the public sector. *International Journal of Sociology and Social Policy*, 28(1–2), 46–58.
- Zastempowski, M., Glabiszewski, W., & Liczmańska-Kopcewicz, K. (2018). Makroocenienie polskich MŚP w kontekście ich innowacyjności. *Organizacja i Kierowanie*, 2(181), 119-134.
- Zimmer, J., & Mierzwa, D., (2017). Orientacja na innowacje otwarte przedsiębiorstw funkcjonujących na polskim rynku. *Przegląd Organizacji*, 1, 4-9.

Biographical note

Joanna Kurowska-Pysz, doctor with habilitation, associate professor at the WSB University in Dabrowa Gornicza, Poland, also works on the Director of Technology Transfer Centre position. She has also been employed on the Warsaw Stock Exchange as the supervisor of R&D projects. She is graduated from the University of Economics in Katowice (economics), Institute of Management and Organization in Warsaw (management), Aalborg University (problem based learning), and Harvard Business School (sustainable business strategies). Her research topics are: inter-organizational cooperation, public governance, innovation & entrepreneurship (more than 120 publications). She is a member of the international organizations: ERSA and TEIN as well as the research groups: VALORIZA (Portugal), ARAM (Spain) and LABOTER (Brazil). She also participated in two Cost Actions (ENTAN, DecoIDEV). She combines academic activities with practice in consulting services in terms of project management.

Citation (APA Style)

Kurowska-Pysz, J. (2021). Selected conditions of developing inter-organizational cooperation in innovation processes on the Polish capital market. In A. Ujwary-Gil & B. Godlewska-Dzioboń (Eds.), *Challenges in Economic Policy, Business, and Management in the COVID-19 era* (pp. 165–200). Warsaw: Institute of Economics, Polish Academy of Sciences.

Part 3

PRO-ENVIRONMENTAL, RESILIENT AND INNOVATIVE ORGANIZATIONS

Symptoms of pro-environmental culture in companies located in Poland

Katarzyna Piwowar-Sulej¹

Abstract

This article presents both theoretically and empirically the concept of pro-environmental culture. In particular, it discusses the essence of this phenomenon as well as research the results related to the symptoms of this culture. Both literature studies and empirical research were used for this study. Empirical research was based on an online survey method. The data was collected in 2020 in the lockdown period caused by the COVID-19 pandemic and came from 199 companies located in Poland. Both descriptive statistics and Pearson's correlation coefficient was used in this study. There are many significant relationships between individual cultural symptoms. The surveyed organizations are generally interested in the development of pro-ecological behaviors and are aware of their impact on the natural environment. However, the organizational culture of the analyzed organizations lacks symptoms that indicate motivating employees towards pro-environmental activities. The organizations are unlikely to reward people showing "green behavior." The employee appraisal system in most companies is not directly related to rewarding for environmental behaviors. The personal employee development goals regarding pro-environmental behaviors are not clear and regularly verified. According to the conducted research, the companies under study show similar cultural symptoms to the enterprises in the UK observed 18 years ago. This study emphasizes the role of organizational culture in achieving company environmental performance and indicates which cultural symptoms need further improvement in order to build pro-environmental organizational culture. It also formulates hypothetical justification for the research results, which may be further explored in future research. This article presents the results of extensive literature studies based on 195 articles indexed in Scopus. It compares the research results with the research conducted in the UK. It provides directions for further research.

¹ Katarzyna Piwowar-Sulej, PhD DSc, Associate Professor, Department of Labor, Capital and Innovation, Wrocław University of Economics and Business, Komandorska 118/120, 53-345 Wrocław, Poland, e-mail: katarzyna.piwowar-sulej@ue.wroc.pl (ORCID: 0000-0002-4627-4344).

This is an open access article under the CC BY license (<https://creativecommons.org/licenses/by/4.0/legalcode>).

Keywords: *green culture, green organizational culture, environmental culture, environmental organizational culture, sustainable development, environmental sustainability.*

1. Introduction

The first publications addressing the idea of corporate culture, including its quality factors, go back to the 90s of the 20th century (Miller, 2012). This concept covers intricate and multiple issues, thus being difficult to define, as confirmed by the renowned researcher Hofstede, who described it as follows: ‘the collective programming of the mind that distinguishes the members of one group or category of people from another’ (Hofstede et al., 2010, p. 93). The assumptions of corporate culture have been steadily developing over time. Initially, i.e., in the 60s of the last century, it was approached with hesitation as a means for a competitive edge and organizational advancement. However, 20 years later, it gained popularity and was perceived as strategic guidance in management and a clear strength in competition, thus acting as an incentive for developing organizational theory models. In 1981, Pfeffer (1981) presented the significance of the symbolic aspects related to leadership, which, through symbols and rituals, were supposed to ensure acceptance among subordinates of the decisions made and the division of powers in an organization, without the need for direct use of the formal authority inherent in the hierarchy. Handy (1983) classified organizational culture specifying its four categories, which influenced organizational objectives and ideas. It was followed by companies including them in their strategies in the 90s of the 20th century (Silva & Gomes, 2015). Despite the evolution in approaching organizational culture, the entire concept remains ambiguous and conditioned by functioning on the border of many scientific disciplines.

Organizational culture is considered the success factor for organizational performance (Lucas, 2006). Also, the researchers who focus on sustainable development have noticed the importance of culture in shaping pro-environmental behaviors. In 2002 Banerjee et al. (2002) stated that corporate culture is a factor that may drive companies to be more environmentally sustainable/responsible/friendly/focused/oriented. At the same time, Harris and Crane (2002) highlighted that the transition towards environmental sustainability requires changes in corporate culture. Similar postulates were also formulated by Norton et al. (2014, 2015). Magsi et al. (2018) proved that organizational culture has a significant impact on environmental performance. Linnenluecke and Griffiths (2010) built a theoretical concept of this culture

based on the Competing Values Framework by Cameron and Quinn (2011). There are ecological values in the heart of such culture (Tepe Küçükoğlu & Pınar, 2015). The organizational culture which positively stimulates environmental sustainability is called pro-environmental or green.

The literature in the field of environmental sustainability had already been developed in several research topics. However, the pro-environmental corporate culture proved to remain less explored. The analyzed culture is often treated as one of many factors contributing to environmental sustainability (Magsi et al., 2018). Empirical studies devoted strictly to this culture are scarce. As Newton and Harte (1997) noticed, a strongly evangelical language of green literature is not enough for the effective implementation of pro-environmental strategies. Empirical research is needed, and on its basis, companies should undertake appropriate actions. This article fills the above-presented gap through a theoretical and empirical presentation of pro-environmental organizational culture. The research question (RQ) is:

***RQ)** How are the symptoms of pro-environmental culture shaped in the companies operating in Poland?*

The next parts of this article are organized as follows. The second section presents the literature background. It discusses the essence of green organizational culture and shows how this phenomenon has been explored in previous studies. The characteristics of the research method used for the purpose of this article are included in the third section. The fourth part of this study shows the research results, which are followed by a discussion. The article ends with conclusions which also include limitations and directions for further research.

2. Literature background

2.1. Pro-environmental culture and its impact on organizational environmental performance

Green organizational culture can be regarded as an element of organizational culture that reflects how important environmental problems are to the organization. It is “a symbolic context about environmental management and protection within which interpretations guide behaviors and processes of members’ sense-making and set of values and norms describing how the company perceives the environmental variable” (Tepe Küçükoğlu & Pınar, 2015, p. 80).

The analyzed culture can be described through its layers, distinguished by Schein (1990). The first layer consists of artifacts (e.g., green building, recycling bins, the use of specific language related to environmental issues, and visible pro-environmental human resource management practices and employees' behaviors). Cultural values (e.g., natural environment) and norms (how to act in an environmentally friendly way) are the second cultural layer. The most hidden layer is made up of basic assumptions, which mean what people feel in relation to the natural environment. Deeper cultural layers can be inferred from the analysis of cultural symptoms identified with artifacts and especially with company practices (Marcinkowski & Sobczak, 2000). The word "symptom" originates from medical science and is understood as a manifestation of disease (Estacio et al., 2017). In this case, cultural symptoms are treated as manifestations of the deeper cultural layers.

The creation of an advanced green organizational culture is an advantage for companies that would like to make a change and reform in the context of green ideas (Sołoducho-Pelc & Sulich, 2020). The importance of this culture in organization management results from its functions performed in the organization's social subsystem. These functions can be identified based on the metaphors used to define the culture. Thus, organizational culture is referred to as an "exchange regulator" and perceived as a control mechanism that keeps all exchange relationships on track. It allows making the right decision, i.e., the best one for the group. It is a factor that replaces monitoring and direct control. It reduces transaction costs (Alvesson, 2002).

Taking another perspective, organizational culture is compared to a compass. In this way, its power of defining the right course of action is highlighted. This course includes, e.g., developing team relationships. Thus, culture is called "social glue." Owing to the right culture, such states as consensus and harmony are not only possible but even natural. Achieving these states is carried out under intragroup control (Alvesson, 2002).

Organizational culture is also approached as a situational factor in motivating employees based on the following algorithm (Dwivedi, 1995):

- knowledge x skills = opportunities;
- attitude x situation = motivation;
- opportunities x motivation = employee's performance;
- employee's performance x resources = organizational performance.

It is, therefore, a fundamental factor in fulfilling the enterprise mission and its strategy implementation to improve organizational effectiveness, and manage changes. Taking the above into account, one can state that a pro-environmental culture is needed to socialize employees according to the

company's environmental strategy (Fernández et al., 2003). Ramus (2001) listed green culture among the factors which influence the pro-environmental behavior of employees, and such behaviors, in turn, have a positive impact on organizational environmental performance. Moreover, as Yunguo (2009) states, such a culture can help establish a great image of an organization, resulting in excellent competitive abilities.

Beyond the strategy, such factors as organizational structure, the external environment (including national culture), and relationships between different elements of an organization can influence green organizational culture (Dauber et al., 2012; O'Reilly & Chatman, 1996). Harris and Crane (Harris & Crane, 2002) distinguished three primary factors of greening organizational culture. The first is the managerial perception of the organization's environmental cultural change. Then, there is the extent to which managers consider the organizational eco-values. The last is a macro-culture and the ways of measuring a company's performance. The concept emphasizes the role of managers in shaping the corporate culture.

2.2. Previous research on the topic

The authors analyzed the articles indexed in the Scopus database to determine the specificity of studies devoted to the analyzed problem. The query used for the selection of articles was: TITLE-ABS-KEY ("green corporate culture" OR "pro-environmental corporate culture" OR "green organizational culture" OR "pro-environmental organizational culture" OR "greening corporate culture") OR TITLE-ABS-KEY ("greening organizational culture" OR "greening of organizational culture" OR "greening of corporate culture" OR "green culture") OR TITLE-ABS-KEY ("environmental organizational culture" OR "environmental corporate culture" OR "pro-ecological organizational culture" OR "pro-ecological corporate culture"). The initial sample consisted of 139 documents. Then, the authors limited the base to the articles published by the end of 2020 (not being in press) and written in English. The authors also excluded the irrelevant articles (examining, e.g., cell culture) by narrowing the research areas to Business and Management, Social Sciences, and Psychology. The final sample size was only 28 articles. While studying the 28 articles, the authors focused on the following issues:

- 1) Are individual empirical articles strictly devoted to the problem of corporate pro-environmental culture?
- 2) What method of diagnosing this culture was applied in previous studies?

All articles in the sample were empirical. However, the conducted analyses revealed that the majority of articles focused on identifying the linkage between pro-environmental organizational culture and company competitive advantage, organizational citizenship behavior, and green innovation (Nhat Tan Pham et al., 2018; Chang, 2015; Gürlek & Tuna, 2018; Roespinoedji et al., 2019). Organizational culture was often placed between different factors impacting employees' pro-environmental behaviors (Chen, 2011; Hoffman & Henn, 2008; Lasrado & Zakaria, 2020; Setthasakko, 2009). Previous diagnoses have been directed towards the identification of either green behaviors (Asmui et al., 2015), or practices, which influence the culture (Roscoe et al., 2019; da Silveira Marques Pereira et al., 2013). For example, Roscoe et al. (2019) examined how green HRM influences the – so-called – enablers of green organizational culture, which are: leadership emphasis, peer involvement, message credibility, and employee empowerment.

As far as the second question is concerned, one can state that organizational culture may be diagnosed using different methods and data sources. The study of organizational culture based on secondary sources consists in analyzing the company's documents. The information for diagnosing the pro-environmental culture can come from measurements of environmental performance, reports, available instructions, or procedures. Both company's environmental outcomes and cultural symptoms (organizational practices towards environmental issues) may be the subject of analysis. Secondary sources should be supplemented with primary sources. In addition, the research on organizational culture can be conducted with the use of quantitative (survey) or qualitative (in-depth interviews) methods (Hopkins, 2006).

For the above-mentioned purposes, a survey method has been used (in 24 articles). The articles list the symptoms of pro-environmental organizational culture (Chamorro & Bañegil, 2006; García-Granero et al., 2020; Roscoe et al., 2019). However, only one complex research instrument for diagnosing organizational pro-environmental culture was presented in the sample (Piwowar-Sulej, 2020). Unfortunately, it was tested in only one company.

The above indicates the need to conduct further research on the issue of pro-environmental organizational culture.

3. Research methods

This research was performed using an online survey and a snowball sampling between March and May 2020, i.e., just at the beginning of the lockdown period caused by the COVID-19 pandemic. The aim of this research was to answer the research question presented in the Introduction. The survey instrument (a questionnaire) was constructed based on the questions addressed

to the respondents in the UK by Zibarras et al. (2012) and used scales as in the research of Zibarras et al. (2012). The respondents were presented with statements about the organizational culture listed in Table 8.1.

Table 8.1. Statements (items) related to cultural symptoms

No.	Statement
1	In general, the organization is interested in developing pro-ecological behaviors.
2	My organization is taking all possible measures to protect the environment.
3	My organization clearly understands its environmental impact.
4	The organization strives to have the image of an eco-friendly company.
5	Actual efforts are taken up to make this company more environmentally friendly.
6	Overall, people working in this organization are motivated to behave ecologically.
7	The organization is proud of its environmental activities.
8	All employees are actively encouraged to act pro-ecologically.
9	Management practices actively reinforce and encourage pro-environmental behaviors.
10	Management understands that part of their job is to act in an environmentally friendly manner.
11	At work, environmental goals are replaced by other priorities.
12	The way in which this organization operates internally is in line with its external “green” brand.
13	Managers provide practical support for environmental behaviors/practices.
14	Organizational goals are directly aligned with environmental issues/problems.
15	The main environmental problem of the organization is to avoid breaking the law.
16	The “green program” is less important, e.g., due to financial problems.
17	The organization manifests rewarding people who show “green” behavior.
18	The employee appraisal system is directly related to rewarding for environmental behaviors.
19	Employee personal development goals regarding pro-ecological behavior are clear and regularly reviewed.
20	Sanctions are imposed if someone does not show pro-ecological behaviors.

Source: own study based on Zibarras et al. (2012).

At this point, it is worth mentioning that many items used in this study were similar to those used by Roscoe et al. (2019) and García-Granero et al. (2020). For example, the item in the form of “When evaluating employees, managers emphasize the importance of green” used by Roscoe et al. (2019) corresponds with item no. 9. In turn, the item “Leaders can help me when facing green problems” is in line with statement no. 13. In turn, García-Granero et al. (2020) used, e.g., the item “Degree of importance of the company’ environmental impact,” which corresponds with item no. 3, and the

item “Degree of importance of achieving environmental objectives,” which is in contradiction to statement 11.

The respondents marked if the given cultural symptoms were visible in their companies choosing between “I strongly disagree/I disagree,” “I have a neutral opinion about it,” and “I agree/I strongly agree.” A total of 199 valid questionnaires from the respondents working in different companies were collected. Table 8.2. presents the characteristics of the research sample group.

Table 8.2. Characteristics of the research sample

Criterion	Item	Number of representatives in the research sample (N=199)	% of the research sample
Company size	Small (up to 50 employees)	42	21
	Medium-sized (51–249 employees)	34	17
	Large (251–5,000 employees)	82	41
	Very large (more than 5,000 employees)	41	21
Respondents’ position	Managerial	79	40
	Line employee position	120	60
Industry	Arts, entertainment, and publishing	1	1
	Agriculture	2	1
	Hotel and food service	2	1
	Construction	3	2
	Government and public administration	4	2
	Education	7	4
	Finance and insurance	8	4
	Business services (technical or legal)	11	6
	ICT	16	8
	Retail and wholesale sales	18	9
	Other services	25	13
	Manufacturing	102	51

As shown in Table 8.2, most of the companies represent either large or very large organizations. Moreover, the manufacturing industry enterprises prevailed in the study. In the analyses, both descriptive statistics and Pearson’s correlation coefficient was used. To measure the correlation, numbers from 1 to 3 were assigned to the answers (1 – “I strongly disagree/I disagree,” 2 – “I have a neutral opinion about it” and 3 – “I agree/I strongly agree”).

4. Results and discussion

Figure 8. 1 shows the percentage of respondents' answers to the statements presented in the methodological section of this study. The author also calculated Pearson's correlation coefficient to identify relationships between individual items used in this study. The results are presented in Table 8.3. Since the only studies using the same items and scale as in the presented article are the ones carried out by Zibarras et al., it is worth comparing the findings of both research projects. Zibarras et al. conducted their research in the UK over 18 years ago. At this point, it is worth emphasizing that The Department for Environment, Food and Rural Affairs in the UK noticed a positive change in environmental behavior at both individual and organizational levels in the period between 2004 and 2009 (Darnton et al., 2011).

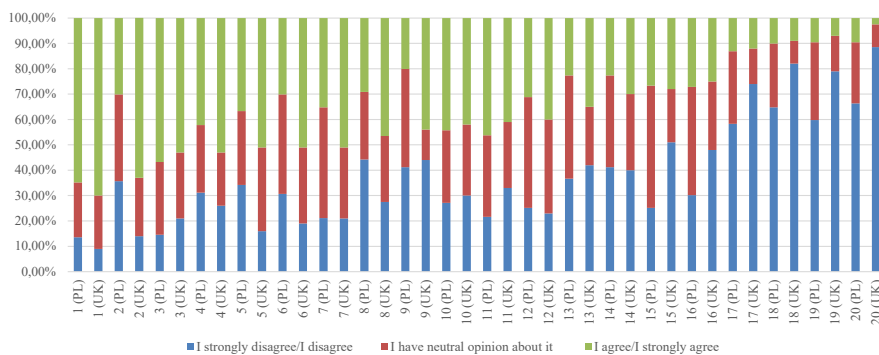


Figure 8.1. The results obtained for 20 cultural symptoms in Poland (PL) and in the UK

There is a lack of further studies which examine the changes in green behaviors among British. On the one hand, there is an overall growth of environmental awareness (Earth Surface, 2021), which should correspond with the cultural changes. This means that, hypothetically, today, the results obtained in such a study in the UK should be even better than 18 years ago. On the other hand, one of the factors negatively influencing the presented research results may be the COVID-19 pandemic, which has an impact on the natural environment. The lockdowns and obligations to use personal protection equipment have resulted in the increased use of single-use plastic products (European Topic Centre Waste and Materials in a Green Economy, 2021).

Table 8.3. The values of Pearson correlation coefficient calculated for the items used in this study (results with $p < 0.05$)

1	1.00	0.48	0.59	0.55	0.56	0.45	0.55	0.45	0.43	0.35	0.51	0.50	0.50	0.50	0.35	0.33	0.33	0.33	0.19
2	0.48	1.00	0.46	0.53	0.59	0.46	0.59	0.47	0.49	0.45	-0.20	0.58	0.49	0.54	-0.16	-0.20	0.39	0.44	0.29
3	0.59	0.46	1.00	0.46	0.43	0.40	0.52	0.48	0.51	0.50	-0.17	0.43	0.51	0.46	0.39	0.35	0.37	0.24	0.24
4	0.55	0.53	0.46	1.00	0.43	0.38	0.56	0.35	0.38	0.26	0.43	0.31	0.49	0.29	0.29	0.35	0.27	0.22	0.22
5	0.56	0.59	0.43	0.43	1.00	0.49	0.59	0.49	0.52	0.46	-0.18	0.54	0.54	0.50	0.35	0.34	0.46	0.20	0.20
6	0.45	0.46	0.40	0.38	0.49	1.00	0.46	0.61	0.44	0.37	0.49	0.51	0.37	0.37	0.37	0.44	0.46	0.18	0.18
7	0.55	0.59	0.52	0.56	0.59	0.46	1.00	0.54	0.47	0.41	-0.18	0.59	0.49	0.63	0.39	0.42	0.40	0.26	0.26
8	0.45	0.47	0.48	0.35	0.49	0.61	0.54	1.00	0.63	0.45	-0.17	0.41	0.60	0.41	-0.19	0.35	0.45	0.42	0.21
9	0.43	0.49	0.51	0.38	0.52	0.44	0.47	0.63	1.00	0.47	0.46	0.60	0.49	0.49	-0.27	0.33	0.40	0.41	0.18
10	0.35	0.45	0.50	0.26	0.46	0.37	0.41	0.45	0.47	1.00	0.45	0.50	0.40	0.40	0.31	0.24	0.28	0.21	0.21
11	-0.20	-0.17	-0.17	-0.18	-0.18	-0.18	-0.18	-0.17	1.00	1.00	-0.26	-0.20	0.22	0.32	-0.28	-0.23	-0.23	-0.23	-0.23
12	0.51	0.58	0.43	0.43	0.54	0.49	0.59	0.41	0.46	0.45	1.00	0.45	0.56	0.45	0.45	0.45	0.33	0.20	0.20
13	0.50	0.49	0.51	0.31	0.54	0.51	0.49	0.60	0.60	0.50	-0.26	0.45	1.00	0.49	-0.19	0.28	0.38	0.32	0.20
14	0.50	0.54	0.46	0.49	0.50	0.37	0.63	0.41	0.49	0.40	-0.20	0.56	0.49	1.00	-0.20	0.29	0.45	0.37	0.37
15	-0.16	-0.16	-0.16	-0.16	-0.16	-0.16	-0.16	-0.16	-0.16	0.22	0.22	0.22	0.22	1.00	0.37	0.15	0.15	0.15	0.19
16	-0.20	-0.20	-0.20	-0.20	-0.20	-0.20	-0.20	-0.20	-0.20	0.32	0.32	-0.19	-0.19	-0.20	0.37	1.00	-0.20	-0.20	-0.20
17	0.35	0.39	0.39	0.29	0.35	0.37	0.39	0.35	0.33	0.31	0.45	0.28	0.29	0.15	1.00	0.59	0.31	0.29	0.29
18	0.33	0.44	0.35	0.35	0.34	0.44	0.42	0.45	0.40	0.24	-0.28	0.45	0.38	0.45	-0.20	0.59	1.00	0.51	0.22
19	0.33	0.44	0.37	0.27	0.46	0.46	0.40	0.42	0.41	0.28	-0.23	0.33	0.32	0.37	0.31	0.51	1.00	0.28	0.28
20	0.19	0.29	0.24	0.22	0.20	0.18	0.26	0.21	0.18	0.21	0.20	0.20	0.20	0.19	0.29	0.22	0.28	1.00	1.00

The presented data show that the surveyed organizations are generally interested in developing pro-ecological behaviors (statement 1), and they are aware of their impact on the natural environment (statement 3). The organizational culture of the surveyed organizations lacks symptoms indicating that their employees are being motivated towards pro-environmental activities. The organizations are unlikely to reward people who show “green behavior” (statement 17). The employee appraisal system in most companies is not directly related to rewarding for environmental behavior (statement 18). Employee personal development goals regarding pro-ecological behavior are clear and regularly verified (statement 19). In addition, no sanctions are imposed if someone does not show pro-ecological behaviors (statement 20).

In both studies (Polish and British), the least frequently applied practices were the above-listed ones (statements from 17 to 20). In the UK, 88% of companies did not impose sanctions for behaviors violating environmental protection, whereas in Poland – 66%. It is also the least often used practice in both cases. The above may prove that enterprises promote pro-environmental behaviors based on positive motivation (rewards, not penalties, are the priority). Positive emotions enhance intrinsic motivation (Lřvoll et al., 2017), which is crucial for shaping employees’ behaviors. However, this is contradicted by the answer to the question of whether the employee appraisal system is directly related to rewarding for environmental behaviors. In the case of 10% Polish companies, it is not, and it was not in 9% of companies in the UK. As for other similarities in the results of both analyzed projects, the “average” awareness of enterprises regarding their impact on the natural environment, deserves attention. In the UK and Poland, only approx. 60% of companies were recognized as an understanding of their impact on this environment.

Considering the significant differences between the analyzed research projects, it should be stated that in Poland, only 29% of the surveyed companies actively encourage all employees to act pro-ecologically. In the UK, the respective result was approx. 50%. In Poland, 35% of the organizations are proud of their environmental activities, while in the UK – 51%. Finally, in Poland, managers provide practical support for pro-environmental behavior/practices in the case of only 23% of companies, while in the UK – 35%.

The research conducted in Poland showed that between 22% and 38% of the respondents admitted they had no opinion on the problem addressed in the survey. In the UK, between 9% and 37% respectively expressed their neutral attitude towards the individual cultural statements. The above may indicate the respondents’ lack of interest in environmental issues or the absence of proper communication on the part of the employer. This communication is a factor influencing the involvement of all company stakeholders, not just employees (Rolland & O’Keefe Bazzoni, 2009). Organizational goals directly

adjusted to environmental issues/problems, which were confirmed by only 23% of the respondents in Poland, and 30% of the respondents in the UK are considered one of the major symptoms related to pro-environmental organizational culture (Chamorro & Bañegil, 2006).

As far as the relationships between items are concerned, one can state that the research revealed strong (between 0.5 and 0.7) correlations between many items. This may be evidence that the main construct (organizational culture) is internally consistent. The problem is that such items, e.g., no. 15 (The main environmental problem of the organization is to avoid breaking the law), and no. 16 (The “green program” is less important, e.g., due to financial problems) should be negatively correlated with many other items than presented in Table 8.3. This issue is worth deeper empirical exploration. The highest value of Pearson’s indicator was obtained for the relationship between the item no. 4 (The organization strives to have the image of an eco-friendly company), and the item no. 7 (The organization is proud of its environmental activities). Both these items are related to the issue of a company image.

The findings on the symptoms of pro-environmental culture presented in this article show that in many places, the companies located in Poland are at the stage which the UK companies reached 18 years ago. There may be many reasons for this situation. As indicated in the theoretical part of the article, the activities inside the organization may be determined by the national culture of the employees’ country of origin. According to Eurostat data (2020), Poland is ranked below the average for all the EU countries concerning various environmental indicators. Moreover, the research highlights that only 1/3 of Poles undertake activities to protect their health relating to air quality in their place of residence. When buying beverages in glass packages, 7 out of 10 people do not pay attention to whether the bottle is a returnable one. These are just some of the research findings addressing Polish residents’ environmental awareness and behavior conducted in 2019 for the Ministry of Climate (Polish Ministry of Climate, 2019).

5. Conclusion

As Ajmal et al. (2018) stated, “one of the most important challenges faced by business managers today is the integration of sustainability into their core functions. The contemporary enterprise is forced to leap forward from the mere adoption of green practices toward rethinking, redesigning, and redeveloping business practices in a more sustainable way.” It should be remembered that the implementation of due procedures will not work if the organizational culture does not change. According to the conducted research,

the companies under study show similar cultural symptoms to the enterprises in the UK observed 18 years ago.

This study provides implications for business practice. It highlights which cultural symptoms need further improvement in order to build pro-environmental organizational culture. Caring for the natural environment and taking actions to develop the pro-environmental organizational culture is important not only from an ethical and compliance perspective but also from the image-oriented one. Pro-environmental activities are a response to the expectations of the contemporary labor market participants. As early as 2000, Albinger and Freeman (2000) found that sustainability-driven organizations are preferred by job applicants over other organizations. Representatives of the young generation perceive that if an organization desires to invest in and care for the natural environment (which is not even directly related to the organization's activities), it is much more likely to respect and treat its employees well (Chaudhary, 2018).

Although this study is practically-oriented and provides analyses from literature studies, it has some limitations. First, the presented research and comparisons between countries were based on a non-representative sample. Second, this study is mainly descriptive and country-oriented. Third, the adopted questionnaire included only 20 statements. Fourth, some relationships identified between the items remain unclarified. Additional research may overcome these limitations through using a representative sample, developing new research instruments, providing comparisons between companies of different sizes, from different industries, and – finally – from different countries. Moreover, in this study, some hypothetical justifications were formulated based on the research findings. It would be worth determining the factors which influenced the presented results, including the role of the COVID-19 pandemic. To recognize the mechanism of shaping green organizational culture, a mix-method approach is needed based on both quantitative and qualitative research methods.

References

- Ajmal, M. M., Khan, M., Hussain, M., & Helo, P. (2018). Conceptualizing and incorporating social sustainability in the business world. *International Journal of Sustainable Development & World Ecology*, 25(4), 327–339. <https://doi.org/10.1080/13504509.2017.1408714>
- Albinger, H. S., & Freeman, S. J. (2000). Corporate social performance and attractiveness as an employer to different job seeking populations. *Journal of Business Ethics*, 28(3), 243–253.

- Alvesson, M. (2002). *Understanding Organizational Culture*. London: SAGE Publications. <https://doi.org/10.4135/9781446280072>
- Asmui, M., Mokhtar, N. M., Musa, N. D., & Hussin, A. (2015). Green culture and its attachment to organizational commitment among public university' staff. *Advanced Science Letters*, 21(6), 1902–1905. <https://doi.org/10.1166/asl.2015.6156>
- Bakhsh Magsi, H., Ong, T., Ho, J., & Sheikh Hassan, A. (2018). Organizational culture and environmental performance. *Sustainability*, 10(8), 2690. <https://doi.org/10.3390/su10082690>
- Banerjee, S. B. (2002). Corporate environmentalism: The construct and its measurement. *Journal of Business Research*, 55(3), 177–191. [https://doi.org/10.1016/S0148-2963\(00\)00135-1](https://doi.org/10.1016/S0148-2963(00)00135-1)
- Cameron, K. S., & Quinn, R. E. (2011). *Diagnosing and Changing Organizational Culture, Third Edition: Based on the Competing Values Framework*. Hoboken: Jossey-Bass.
- Chamorro, A., & Bañegil, T. M. (2006). Green marketing philosophy: A study of Spanish firms with ecolabels. *Corporate Social Responsibility and Environmental Management*, 13(1), 11–24. <https://doi.org/10.1002/csr.83>
- Chang, C.-H. (2015). Proactive and reactive corporate social responsibility: Antecedent and consequence. *Management Decision*, 53(2), 451–468. <https://doi.org/10.1108/MD-02-2014-0060>
- Chaudhary, R. (2018). Can green human resource management attract young talent? An empirical analysis. *Evidence-Based HRM: A Global Forum for Empirical Scholarship*, 6(3), 305–319. <https://doi.org/10.1108/EBHRM-11-2017-0058>
- Chen, Y. (2011). Green organizational identity: Sources and consequence. *Management Decision*, 49(3), 384–404. <https://doi.org/10.1108/00251741111120761>
- da Silveira Marques Pereira, G., Jabbour, C., V.W. Borges de Oliveira, S., & Alves Teixeira, A. (2013). Greening the campus of a Brazilian university: Cultural challenges. *International Journal of Sustainability in Higher Education*, 15(1), 34–47. <https://doi.org/10.1108/IJSHE-10-2011-0067>
- Darnton, A., Elster-Jones, J., Lucas, K., & Brooks, M. (2011). *Promoting Pro-Environmental Behaviour: Existing Evidence to Inform Better Policy Making. Summary Report. A Study for The Department for Environment, Food and Rural Affairs*. Oxford: University of Oxford).
- Dauber, D., Fink, G., & Yolles, M. (2012). A configuration model of organizational culture. *SAGE Open*, 2(1), 215824401244148. <https://doi.org/10.1177/2158244012441482>
- Dwivedi, R. K. (1995). *Organizational Culture and Performance*. Delhi: MD Publications PVT Ltd.
- Earth Surface. (2021). *The Growth Of Environmental Awareness*. Retrieved from <https://www.climate-policy-watcher.org/earth-surface-2/the-growth-of-environmental-awareness.html>

- Estacio, C. F., Butow, P. N., Lovell, M. R., Dong, S. T., & Clayton, J. M. (2017). What is symptom meaning? A framework analysis of communication in palliative care consultations. *Patient Education and Counseling*, 100(11), 2088–2094. <https://doi.org/10.1016/j.pcc.2017.05.006>
- European Topic Centre Waste and Materials in a Green Economy. (2021). *Impact of COVID-19 on single-use plastics and the environment in Europe. EIONET REPORT - ETC/WMGE 2021/4*. Retrieved from <https://www.eionet.europa.eu/etcs/etc-wmge/products/impact-of-covid-19-on-single-use-plastics-and-the-environment-in-europe>
- Fernández, E., Junquera, B., & Ordiz, M. (2003). Organizational culture and human resources in the environmental issue: A review of the literature. *The International Journal of Human Resource Management*, 14(4), 634–656. <https://doi.org/10.1080/0958519032000057628>
- García-Granero, E. M., Piedra-Muñoz, L., & Galdeano-Gómez, E. (2020). Measuring eco-innovation dimensions: The role of environmental corporate culture and commercial orientation. *Research Policy*, 49(8), 104028. <https://doi.org/10.1016/j.respol.2020.104028>
- Gürlek, M., & Tuna, M. (2018). Reinforcing competitive advantage through green organizational culture and green innovation. *The Service Industries Journal*, 38(7–8), 467–491. <https://doi.org/10.1080/02642069.2017.1402889>
- Handy, C. (1983). *Understanding Organizations*. Oxford: Oxford University Press.
- Harris, L. C., & Crane, A. (2002). The greening of organizational culture. *Journal of Organizational Change Management*, 15(3), 214–234. <https://doi.org/10.1108/09534810210429273>
- Hoffman, A. J., & Henn, R. (2008). Overcoming the social and psychological barriers to green building. *Organization & Environment*, 21(4), 390–419. <https://doi.org/10.1177/1086026608326129>
- Hofstede, G., Hofstede, G. J., & Minkov, M. (2010). *Cultures and Organizations: Software of the Mind: Intercultural Operation and its Importance for Survival*. New York: MCGraw-Hill.
- Hopkins, A. (2006). Studying organisational cultures and their effects on safety. *Safety Science*, 44(10), 875–889. <https://doi.org/10.1016/j.ssci.2006.05.005>
- Lasrado, F., & Zakaria, N. (2020). Go green! Exploring the organizational factors that influence self-initiated green behavior in the United Arab Emirates. *Asia Pacific Journal of Management*, 37(3), 823–850. <https://doi.org/10.1007/s10490-019-09665-1>
- Linnenluecke, M. K., & Griffiths, A. (2010). Corporate sustainability and organizational culture. *Journal of World Business*, 45(4), 357–366. <https://doi.org/10.1016/j.jwb.2009.08.006>
- Lřvoll, H. S., Rřysamb, E., & Vittersř, J. (2017). Experiences matter: Positive emotions facilitate intrinsic motivation. *Cogent Psychology*, 4(1), 1340083. <https://doi.org/10.1080/23311908.2017.1340083>

- Lucas, L. M. (2006). The role of culture on knowledge transfer: The case of the multinational corporation. *The Learning Organization*, 13(3), 257–275. <https://doi.org/10.1108/09696470610661117>
- Marcinkowski, A., & Sobczak, J. (2000). Kultura poszukiwana. *Personel*, 16, 1–16.
- Miller, K. (2012). *Organizational Communication: Approaches and Processes 6th Edition*. Belmont: Wadsworth.
- Newton, T., & Harte, G. (1997). Green business: Technicist kitsch? *Journal of Management Studies*, 34(1), 75–98. <https://doi.org/10.1111/1467-6486.00043>
- Norton, T. A., Zacher, H., & Ashkanasy, N. M. (2014). Organisational sustainability policies and employee green behaviour: The mediating role of work climate perceptions. *Journal of Environmental Psychology*, 38, 49–54. <https://doi.org/10.1016/j.jenvp.2013.12.008>
- Norton, T. A., Zacher, H., & Ashkanasy, N. M. (2015). Pro-environmental organizational culture and climate. In *The Psychology of Green Organizations* (pp. 322–348). Oxford: OxfordUniversity Press. <https://doi.org/10.1093/acprof:oso/9780199997480.003.0014>
- O'Reilly, C., & Chatman, J. A. (1996). Culture and social control: Corporations, cult and commitment. *Research in Organizational Behavior*, 18, 157–200.
- Pham, N. T., Phan, Q. P. T., Tučková, Z., Vo, N., & Nguyen, L. H. L. (2018). Enhancing the organizational citizenship behavior for the environment: The roles of green training and organizational culture. *Management & Marketing*, 13(4), 1174–1189. <https://doi.org/10.2478/mmcks-2018-0030>
- Piwowar-Sulej, K. (2020). Pro-environmental organizational culture: Its essence and a concept for its operationalization. *Sustainability*, 12(10), 4197. <https://doi.org/10.3390/su12104197>
- Ramus, C. A. (2001). Organizational support for employees: Encouraging creative ideas for environmental sustainability. *California Management Review*, 43(3), 85–105. <https://doi.org/10.2307/41166090>
- Roespinoedji, R., Saudi, M. H. M., Hardika, A. L., & Rashid, A. Z. A. (2019). The effect of green organizational culture and green innovation in influencing competitive advantage and environmental performance. *International Journal of Supply Chain Management*, 8(1), 278–286.
- Rolland, D., & O'Keefe Bazzoni, J. (2009). Greening corporate identity: CSR online corporate identity reporting. *Corporate Communications: An International Journal*, 14(3), 249–263. <https://doi.org/10.1108/13563280910980041>
- Roscoe, S., Subramanian, N., Jabbour, C. J. C., & Chong, T. (2019). Green human resource management and the enablers of green organisational culture: Enhancing a firm's environmental performance for sustainable development. *Business Strategy and the Environment*, 28(5), 737–749. <https://doi.org/10.1002/bse.2277>

- Schein, E. H. (1990). Organizational culture. *American Psychologist*, 45(2), 109–119. <https://doi.org/10.1037/0003-066X.45.2.109>
- Setthasakko, W. (2009). Barriers to implementing corporate environmental responsibility in Thailand. *International Journal of Organizational Analysis*, 17(3), 169–183. <https://doi.org/10.1108/19348830910974905>
- Silva, M. do C., & Gomes, C. F. S. (2015). Practices in project management according to Charles Handy's organizational culture typologies. *Procedia Computer Science*, 55, 678–687. <https://doi.org/10.1016/j.procs.2015.07.074>
- Sołoducho-Pelc, L., & Sulich, A. (2020). Between sustainable and temporary competitive advantages in the unstable business environment. *Sustainability*, 12(21). <https://doi.org/10.3390/su12218832>
- Tepe Küçükoğlu, M., & Pınar, R. İ. (2015). Go green at work: Environmental organizational culture. *Modern Environmental Science and Engineering*, 1(2), 79–88. [https://doi.org/10.15341/mese\(2333-2581\)/02.01.2015/004](https://doi.org/10.15341/mese(2333-2581)/02.01.2015/004)
- Yunguo, W. (2009). Research on the green culture of Chinese enterprise. *Chinese Journal of Population Resources and Environment*, 7(1), 94–96. <https://doi.org/10.1080/10042857.2009.10684916>
- Zibarras, L., Judson, H., & Barnes, C. (2012). *Promoting environmental behaviour in the workplace: A survey of UK organisations*. Retrieved from <https://greenedge.co.za/files/Downloads-Pro-environmental-behaviour-in-the-workplace-UK-survey-2012.pdf>

Biographical note

Katarzyna Piwowar-Sulej, *doctor habilitatus* of management sciences, Associate Professor at Wrocław University of Economics and Business, head of postgraduate studies for business trainers and postgraduate studies “Management 3.0.” Her current research interests focus on sustainable human resource management. She has proven experience in managing HR departments and leading HR projects in business. The winner of two scholarship competitions organized by PAIP (financed by the European Social Fund). Project manager of a research project financed by The National Science Centre, Poland. Author of more than 120 publications (including articles in high-ranked Journals) and participant of more than 50 conferences (both academic and business ones) as a lecturer or expert. Active reviewer (cooperation, i.e., with JEMI, Current Psychology). Member of the Scientific Society of Organization and Management. Her individual academic achievements have been honored ten times with the Award of the Rector of Wrocław University of Economics and Business.

Citation (APA Style)

Piwowar-Sulej, K. (2021). Symptoms of pro-environmental culture in companies located in Poland. In A. Ujwary-Gil & B. Godlewska-Dzioboń (Eds.), *Challenges in Economic Policy, Business, and Management in the COVID-19 Era* (pp. 203–220). Warsaw: Institute of Economics, Polish Academy of Sciences.

The concept of organizational resilience model and adequate measurement mechanism

Bartosz Grucza¹, Piotr Tomszys²

Abstract

The aim of the article is to define the concept of the dynamic organizational resilience model of enterprises and to propose an adequate measurement mechanism. The dynamic element of the model is based on the measurement of resilience in the time dimension - before, during, and after the disturbance. Based on the literature review, the concepts, definitions, and classifications related to the idea of resilience have been arranged. Also, the adopted definition of organizational resilience of the enterprise has been presented. The model was operationalized by adopting directly observable indicators as a parameter to evaluate the resilience thus defined. The proposed model may be an effective tool for conducting comparative empirical studies of the organizational resilience of various enterprises. One can empirically verify the correctness of the developed model by comparing found results with the results of other models of measuring resilience or by referring directly to the measures of business achievements of the analyzed organization (e.g., financial results, market share). The proposed model is in line with the trend of increasing interest in enterprise resilience analyses and complements the scientific discussion of the problems of conceptualization and measurement of resilience. One should empirically verify the model in the occurrence's context of a specific disruption of the organization's operations. The current state of the COVID-19 pandemic, as an example of a disruption adversely affecting enterprises and entire industries, may provide a unique opportunity to verify the developed model. Although the number of empirical studies on the organizational resilience of enterprises increases significantly, it still seems unsatisfactory, especially in the Polish market. There are only limited tools for qualitative or quantitative measurement and for assessing the organizational

1 Bartosz Grucza, Ph. D., Hab. Associate Professor, Department of Infrastructure and Mobility Studies, SGH Warsaw School of Economics, Al. Niepodległości 162, 02-554 Warsaw, Poland, e-mail: bgrucz@sgh.waw.pl (ORCID: 0000-0002-4355-1705).

2 Piotr Tomszys, Asseco Poland S.A., ul. Branickiego 13, 02-972 Warsaw, Poland, Warsaw, Poland, e-mail: piotr.tomszys@asseco.pl (ORCID: 0000-0003-4368-8645).

This is an open access article under the CC BY license (<https://creativecommons.org/licenses/by/4.0/legalcode>).

resilience of enterprises. Methods of measuring the organizational resilience of business entities remain still a significant research gap. The proposed concept of the resilience model and the aspects of assessing resilience level are important because of the theoretical and practical implications.

Keywords: *resilience, volatility, uncertainty, complexity, ambiguity, VUCA, brittleness, anxiety, non-linearity, incomprehensibility, BANI, resilience life cycle, antifragile.*

1. Introduction

Organizational resilience of enterprises, in the most general sense, concerns the managing of enterprises in an unpredictable business environment. Today, every enterprise is exposed to the unfavorable influence of various factors, both external and internal. The current business environment is highly volatile and unpredictable. The main features of such an environment are volatility, uncertainty, complexity, and ambiguity, which is described by the acronym VUCA (Nurbantoro, 2021), and brittleness, anxiety, non-linearity, and incomprehensibility, which translates into the BANI model (Santorski & Oksanowicz, 2020; Cascio, 2020). In addition, enterprises are exposed to destructive events with severe impact on their functioning of the so-called Black Swans (Taleb, 2014), and Gray Rhinos (Wucker, 2016). Therefore, to develop such a dynamic business environment, enterprises must be resilient. The concept of resilience is used today on many levels and in various contexts – both for ecosystems, infrastructure and individuals, and for economic systems and communities (Ayyub, 2014).

The analysis of the literature shows that attempts to conceptualize the organizational resilience of enterprises and its measurement have a significant impact on the development of research and readiness of organizations to cope with today's turbulent conditions. While the number of empirical studies on the organizational resilience of enterprises is increasing significantly, it still seems to be unsatisfactory, especially in the Polish market. There are only limited tools for qualitative or quantitative measurement and for assessing the organizational resilience of enterprises. Methods of measuring the organizational resilience of business entities are still a significant research gap.

The article aims to propose the concept of the organizational resilience of an enterprise - in business and management - and to propose an adequate measurement model. A working hypothesis assumes that the organizational resilience of enterprises is a function of certain factors (states, features, attitudes, actions, and behaviors) that shape the organization. On this basis,

a definition of dynamic organizational resilience of enterprises was proposed. To operationalize the model, an attempt was made to quantify the resilience using directly observable factors, and an adequate measurement model was built. The proposed model should then be empirically verified for its validity, reliability, and applicability. After positive verification, as part of further research, it is possible to outline a model development plan towards creating an effective tool for empirical research and comparative analysis of business resilience of various entities. The proposed concept of the resilience model and the aspects of measuring the level of resilience are important because of the theoretical and practical implications.

2. Literature background

As already mentioned, many sources, depending on a specific perspective, present different, sometimes inconsistent, definitions of resilience. The concept of resilience has been criticized for being vague and lacking a clear definition, thus reducing the importance of its idea for practice and science. The English term “resilience” comes from the Latin word *resilio* (*resilire*), which means “to bounce back.” PWN Dictionary of the Polish Language defines “resilience” as insensitivity (the inverse of susceptibility) to physical or moral influences. Physical influences relate to the so-called “hard” systems, such as infrastructure and fixed assets. Instead, moral influences relate to “soft” systems such as individuals and communities. On this basis, by analogy, one can propose the division into the so-called “hard” and “soft” resilience (Table 9.1). Hard resilience applies to fixed assets, such as materials, machinery, institutional tools, and infrastructure. Hard resilience refers to the structural, technical characteristics, as well as capabilities, abilities, and functions. Soft resilience refers to the aspect related to the individual, family, community, and society. Soft resilience focuses on people and their needs, behaviors, relationships, and endeavors.

Table 9.1. Hard and soft resilience

Hard resilience	Soft resilience
assets, facilities, machines, tools, infrastructure, technology	people, individuals, teams, society

In technical objects - materials, machinery, and equipment - resilience is defined by their functions of strength, reliability, susceptibility to disturbance, and ease of maintenance (Sarwar et al., 2018). The US National Institute of Standards and Technology defines resilience simply in its guide to creating resilience for buildings and infrastructure systems in two dimensions: loss

of system functionality because of disruption and time to recover from a disruptive event. It visualizes graphically this approach as a “bathtub curve.” This concept will be used in this article and discussed later (NIST, 2016). In 2013, Presidential Policy Directive PPD-21, the term “resilience” means the ability to prepare for and adapt to changing conditions and withstand and recover rapidly from disruptions. Resilience includes the ability to withstand and recover from deliberate attacks, accidents, or naturally occurring threats or incidents (PPD-21, 2013).

More broadly, in a national context, the US Department of Homeland Security (DHS) adopts the following official definition: resilience is the ability of systems, infrastructure, government, business, and citizens to resist, absorb the impact and recover or adapt to an adverse event that may cause damage, destruction, or loss of national importance (DHS, 2017). Several types of research on resilience deal with the occurrence and effects of natural disasters. The United Nations Office for Disaster Risk Reduction UNDRR, in its Disaster Resilience Strategy, characterized resilience - in this case, cities - by “the ability of a system, community or society exposed to hazards to resist, absorb, accommodate, adapt to, transform and recover from the effects of a hazard in a timely and efficient manner” (UNDRR, 2017)

In relation to humans, as defined by the American Psychological Association (APA), resilience is adapting easily to various threats and adversities or significant sources of stress, such as trauma, tragedy, family, or workplace problems, serious health problems, or financial stressors (APA, 2021). Focusing on society, a representative set of definitions of resilience in a social context is presented in the document “Community Resilience as a Metaphor, Theory, Capability, and Disaster Preparedness Strategy” (Norris et al., 2008). In systems science, a succinct definition of a resilient system is the ability of the system to deal with a destructive event and avoid a failure and recover from a perturbation. A resilient engineering system should therefore operate with a reduced probability of failure, reduced potential consequences after failure, and reduced recovery time (Bruneau & Reinhorn, 2006). Based on enterprises, its business resilience, in supply chain resilience, speaks of being prepared to face unexpected events, respond to disruptions, and regain business viability by maintaining the continuity of the company’s relationships, structure, and functions (Ali et al., 2020).

In generalizing the above definitions, resilience is the readiness of a specific entity to the occurrence of a disturbance, unforeseeable or unplanned events with an adverse impact. The ability, which is a characteristic, process, behavior, strategy, approach, or a combination thereof, can withstand or absorb the impact of a threat through resilience or adaptation. Maintaining its characteristic features, functions, and capabilities at the moment of disturbance

occurrence will return to the equilibrium state after the disturbance is over. In particular, this means that a specific entity in the face of - unfavorable internal and external changes, considering the possibility of mild partial degradation, keeps its structure, critical systems and key functions and quickly recovers after a disruption.

3. Methodological approach: Conceptual framework for the resilience model

By transferring and simplifying the previously presented definition of resilience to the enterprise level, in the business and management context, organizational resilience means the ability of an economic entity to deal with serious disruptions to the business, considering the time dimension in relation to the time of occurrence of the disruption, i.e., before, during and after a disturbance occurs. The time dimension introduces a dynamic element to the model (Figure 9.1). With this approach, managing the organizational resilience of the enterprise is a process that begins with the active prevention phase (before disruption A), the absorption and adaptation phase (during the A-B-C disruption), and the reactive phase (after the C-D disruption). Preventive resilience is the forerunner of absorptive and adaptive abilities, while absorptive and adaptive abilities have implications for a company’s reactive abilities (Supardi & Hadi 2020). These elements form the “resilience life-cycle” or the “disruption life-cycle,” i.e., bathtub curve.

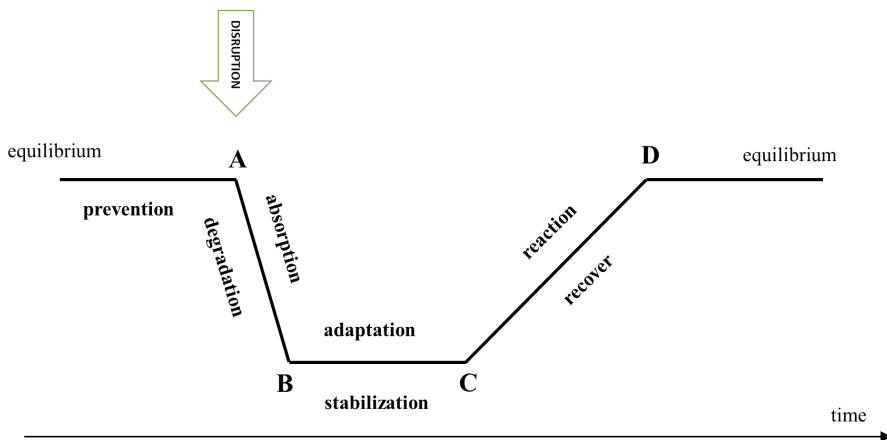


Figure 9.1. Disruption life cycle on bathtub curve model

Source: author’s work based on Taleb-Berrouane & Khan (2018).

The bathtub curve visualizes three resilience categories:

- **preventive resilience (before A)** - the company’s ability to prevent disruptions and be ready for their occurrence;
- **absorption resilience (A-B)** - the company’s ability to absorb disturbances, considering possible degradation of functions and survival at a reduced level;
- **adaptive resilience (B-C)** - the company’s ability to adapt to changes;
- **reactive resilience (C-D)** - reconstruction capacity - the company’s ability to return to effective functioning after a disruption, at a stable level, preferably not lower than before its occurrence.

It aims each of the categories at different goals and activities. Targets are sequenced - prevent and protect - from disruption; adjust, react, respond – in duration, and recover and rebuild - after the disruption is over. At each of the above stages, unique features of the enterprise’s resilience are required, which at the same time may make up its dimensions - prediction and pre-prevention, absorption, resilience and adaptation during disruption, and recovery after it, respectively. This sequence translates into specific actions (Figure 9.2).

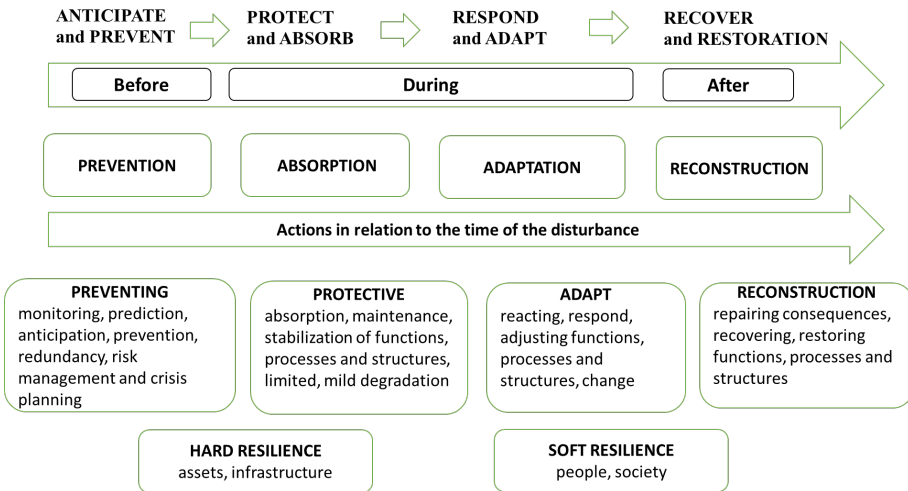


Figure 9.2. Phases and resilience categories

Source: author’s work based on Kahan et al. (2009).

Monitoring the environment, anticipating and preventing the occurrence of disruption, building redundancy, redundant resources and supply chains, risk management, dynamic strategies are examples of activities at the preventive stage. Building strength creates stability and solidity of structures, processes

for absorption and stabilization, ensures agility and flexibility of structures and processes, transparency, fast communication and distributed decision-making processes at the adaptation stage. Finally, mitigating the effects, recreating functions, structures processes through corrective actions that take the system out of a temporary, stabilized stage, to a fully operational state as good as it was before the disturbance or another stable level in the response stage.

Throughout the resilience cycle, the key factors are the harmonization of goals and the comprehensiveness of the scope for all three phases and categories of resilience, respectively:

- prediction, avoidance, or readiness for disruptions at the preventive stage;
- absorption, maintenance, and adaptation of the adaptation stage;
- mitigating the consequences and recovering during the reconstruction phase.

Resilience manifests itself through specific states, functions, features, attitudes, behaviors, and actions presented by employees. These translate into the way the organization deals with disruptions throughout the disruption life cycle (Table 9.2).

Table 9.2. Objectives and activities for different categories of resilience

	Preventive resilience	Absorption resilience	Adaptive resilience	Reactive resilience
major goals	anticipation, prediction, prevent, protect, mitigation, readiness	protect, resilience, endurance, sustaining,	adaptation, flexibility, agility, reaction, response	restoration, recovery, reconstruction, (recover)
sample activities	monitoring of the environment, multi-scenario strategies, risk management and crisis plans, building redundancy of resources	building strength, stability and solidity of structures and processes	ensuring agility and flexibility of structures and processes, fast communication and distributed decision-making processes	repairing the effects, finding extra activities and markets

According to the conceptualization and operationalization presented above, the organizational resilience of the enterprise and its categories (preventive, absorptive, adaptive, and reactive) have been described as latent and higher-order constructs. Perhaps this is an obvious conclusion because all these constructs are immaterial - directly unobservable (latent variables). These constructs also have a multidimensional structure and a complex and ambiguous nature. The organizational resilience of the enterprise is therefore understood as a deeply embedded, inherent, individual feature of the

enterprise. It also results from many related attributes and dimensions, which can never be fully described and can only be assessed with a wide margin of accuracy. These constructs can only be measured through the observation of other measurable and/or observable indicators. The model adopted the concept of quantifying resilience by using directly observable factors. This model is synonymous with the assumption that the latent phenomenon under study - resilience - and its categories - preventive, absorbent, adaptive, and reactive resilience - are derived from the occurrence of certain observable phenomena.

Determinants are formative indicators or cause indicators (Edwards & Bagozzi, 2000). This study means that changes in indicators determine changes in the hidden variable. These symptoms may have a specific relationship with the hidden variable. It means that some symptoms correlate positively - determining high resilience, strengthen resilience - positive correlation, the so-called “Activators,” while others correlate negatively - determining low resilience - negative correlation, the so-called “Deactivators.” Examples of activators and deactivators of organizational resilience of enterprises for individual resilience categories were collected and presented as a Resilience Model Map in Table 9.3. The model map is the basis for building an adequate tool for measuring and assessing the organizational resilience of enterprises.

Table 9.3. Map of the resilience model

Weakening indicators / deactivators		Supporting indicators / activators		
Hard resilience	Soft resilience	Hard resilience	Soft resilience	
PREVENTION	<ul style="list-style-type: none"> • traditional planning based on historical ex-post data 	<ul style="list-style-type: none"> • overly optimistic attitude and planning errors (optimize bias and planning fallacy), unrealistic and unattainable expectations in the planning phase, „turkey” effect 	<ul style="list-style-type: none"> • dynamic multi-scenario and „walking” strategies 	<ul style="list-style-type: none"> • monitoring and anticipation of changes in the external environment, because of estimation of costs, inputs, and time
	<ul style="list-style-type: none"> • short-term profit orientation 	<ul style="list-style-type: none"> • maximizing every element of value - productivity, money, work 	<ul style="list-style-type: none"> • redefinition of the organization’s mission (dilemma: responsibility versus profitability) 	<ul style="list-style-type: none"> • use and improvement of forecasting algorithms and techniques
	<ul style="list-style-type: none"> • resistance to change (resistance) 	<ul style="list-style-type: none"> • fear of the consequences of changes (good or bad) and acceptance of something new (with unknown consequences) 	<ul style="list-style-type: none"> • active change management processes 	<ul style="list-style-type: none"> • „Vigilance” too early warning signals about problems and launching corrective actions if necessary, emergency plans
	<ul style="list-style-type: none"> • traditional risk management 	<ul style="list-style-type: none"> • risk aversion and reluctance to withdraw from ineffective projects, the sunk cost effect 	<ul style="list-style-type: none"> • dynamic risk management, scenarios, and emergency plans, „premortem” assessments 	<ul style="list-style-type: none"> • failure management instead of minimizing risk, smart defeats - learning from mistakes - making mistakes as-least-costly way as possible

Weakening indicators / deactivators		Supporting indicators / activators		
Hard resilience	Soft resilience	Hard resilience	Soft resilience	
PREVENTION	<ul style="list-style-type: none"> • long delays between cause and apparent effect (hysteresis) or too little knowledge 	<ul style="list-style-type: none"> • focus on short-term activities, the so-called „Fire fighting” 	<ul style="list-style-type: none"> • prioritizing projects and programs 	<ul style="list-style-type: none"> • Deferring key decisions until the information is got on an if-then decision tree
	<ul style="list-style-type: none"> • lack of adequate inventories and reserves reluctance or inability - to leave excess (redundancy) or slack 	<ul style="list-style-type: none"> • lack of clear, consistent and visible and active organizational support 	<ul style="list-style-type: none"> • resource gap analysis 	<ul style="list-style-type: none"> • slack and redundancy, redundancy of resources and supply chains
	<ul style="list-style-type: none"> • „Information overload,” „butterfly effect” 	<ul style="list-style-type: none"> • no analysis and no response to minor signals of problems 	<ul style="list-style-type: none"> • shared responsibility, commitment, identification with the organization 	<ul style="list-style-type: none"> • job security, work-life-balance (Mental Health and well-being)
	<ul style="list-style-type: none"> • The four main areas for tackling complexity: scope, communication, stakeholders, and risk 	<ul style="list-style-type: none"> • The current events and decisions made seem often illogical, pointless, or simply absurd 	<ul style="list-style-type: none"> • servant leadership 	<ul style="list-style-type: none"> • facilitation, support, leadership
	<ul style="list-style-type: none"> • rigid, vertical, hierarchical, and oversized structure 	<ul style="list-style-type: none"> • bureaucracy, hierarchy, over-control, autocratic management (command-and-control) 	<ul style="list-style-type: none"> • flat, design, federated, cooperative, or network structure 	<ul style="list-style-type: none"> • multidisciplinary, multitasking
	<ul style="list-style-type: none"> • centralized and hierarchical decision making 	<ul style="list-style-type: none"> • authoritarianism, territorialism, micro-management, careerists, „fighting for positions” 	<ul style="list-style-type: none"> • decentralized team decision making 	<ul style="list-style-type: none"> • democracy and teamwork, empowerment
ABSORPTION	<ul style="list-style-type: none"> • over-control, pressure, mobbing, pressurized environment, enforcement of results 	<ul style="list-style-type: none"> • insecurity and anxiety, helplessness, passivity, and lack of commitment 	<ul style="list-style-type: none"> • trust, motivation and empowerment, teamwork 	<ul style="list-style-type: none"> • integration, cooperation, creative conflict resolution
	<ul style="list-style-type: none"> • enterprise size - inertia, absorption, strength, solidity 			
	<ul style="list-style-type: none"> • rules, procedures, instructions, cascade, sequence, a large number of steps 	<ul style="list-style-type: none"> • tribal mindset, the rivalry between group members, mental liveness „us versus them” 	<ul style="list-style-type: none"> • common goals, values, and patterns of behavior 	<ul style="list-style-type: none"> • compliance, sustainability
	<ul style="list-style-type: none"> • obsolete technologies (legacy system) and organizational systems, technological debt 	<ul style="list-style-type: none"> • lack of stakeholder commitment 	<ul style="list-style-type: none"> • redundancy, „backlash,” resource and supply chain redundancy, integrated supply chains 	<ul style="list-style-type: none"> • rationalization, effective decision making, postponing key decisions until the information is received

Weakening indicators / deactivators		Supporting indicators / activators		
Hard resilience	Soft resilience	Hard resilience	Soft resilience	
ADAPTATION	<ul style="list-style-type: none"> • silos and territorialism, internal rivalry and competition, conflicts 	<ul style="list-style-type: none"> • mobbing, manipulation, looking for blame 	<ul style="list-style-type: none"> • flexibility, scalability of resources, scalability „pay for what you use” (pay-as-you-go) 	
	<ul style="list-style-type: none"> • rules, procedures, instructions, cascade, sequence, a large number of steps 		<ul style="list-style-type: none"> • learning organization 	<ul style="list-style-type: none"> • experimenting, continuous learning and skills improvement, knowledge sharing
	<ul style="list-style-type: none"> • culture of „fear”, looking for the guilty (stick / carrot) 	<ul style="list-style-type: none"> • apathy, caution, risk aversion 	<ul style="list-style-type: none"> • open systems, automation, „Lean”, 	<ul style="list-style-type: none"> • coordination, predispositions, motivations, interpersonal relations
	<ul style="list-style-type: none"> • obsolete technologies (legacy), closed systems (on-site, on-premise), heterogeneous (heterogeneous) 	<ul style="list-style-type: none"> • conservatism, reluctance to change 	<ul style="list-style-type: none"> • modern, open systems (cloud), automation, homogenous (homogeneous) 	<ul style="list-style-type: none"> • flexibility, adaptation to changes, combination potential
	<ul style="list-style-type: none"> • closed platforms and systems, single critical points of failure, dependence on vendor lock suppliers 		<ul style="list-style-type: none"> • corporate social responsibility, taking care of the environment (circular economy) 	<ul style="list-style-type: none"> • holistic long-term planning
RECONSTRUCTION		<ul style="list-style-type: none"> • group thinking is a phenomenon in which the group’s striving for conformism and harmony takes precedence over rational decision making 	<ul style="list-style-type: none"> • development of a shared model (management and employees) responsibility for the effective activities of the company (e.g., through the employee share ownership concept) 	<ul style="list-style-type: none"> • cooperation, self-organization
		<ul style="list-style-type: none"> • specialization, skills, qualifications, competences 	<ul style="list-style-type: none"> • technical and business innovations modern technologies and processes 	<ul style="list-style-type: none"> • innovation, creativity, design and integrated (opposing) thinking
	<ul style="list-style-type: none"> • excessive control, pressure, mobbing, pressure environment, enforcement of results 	<ul style="list-style-type: none"> • insecurity and anxiety, helplessness, passivity, and lack of commitment 	<ul style="list-style-type: none"> • sharing economy 	<ul style="list-style-type: none"> • activation, universality, iteration, prioritization, the feedback loop

4. Results

4.1. Description of the resilience model

Today, every enterprise is exposed to unfavorable influences of risk factors - both external and internal, which are the source of disruption. The concepts of VUCA and BANI were adopted as a structured description of these external risk factors. The VUCA model was created in the 1980s in the US Army

to reflect the battlefield conditions. Today, this model is commonly used to describe complex reality. The VUCA model focuses on and emphasizes the difficulties in deciding on the paradigm of frequent shocking and confusing social, political, technological, and cultural changes. In order to cope with functioning in such conditions, enterprises use tools and techniques to predict and adapt to various changes, create and implement dynamic-scenario strategies, as well as to experiment (simulations and models, sensors), and learn by making mistakes. These tools do not answer the question about the future but allow us to expect and prepare for what may happen. Unfortunately, the VUCA model is not sufficient today. Therefore, a new acronym BANI has recently appeared, which means Brittleness, Anxiety, Non-linearity, and Incomprehensibility, respectively (Cascio, 2020). The BANI model is used to describe situations in which conditions are completely chaotic. Sheer volatility or complexity no longer fully describes the situation, in which case, the future becomes completely unpredictable. Fragility is an illusory force. When something is brittle, it is prone to sudden and catastrophic failure. Things that are brittle look strong, sometimes they can even be strong, but only until they reach a breaking point when everything falls apart. Brittle things are not resilient and inelastic. The fragility concept describes a system that is apparently in good condition but is actually on the brink of collapse. Fragility in a company is often the result of reluctance or inability to leave redundancy or reserves in the system and maximize all efforts to “squeeze” every smallest element of value out of the system, e.g., energy, efficiency, money. Brittleness also means the dependence on a single critical point of failure. In today’s interconnected world geopolitically, economically, and technologically, a catastrophic collapse in one country can create a wave effect across the planet, as exemplified by the current COVID-19 pandemic and the disruption of supply chains in the electronics and automotive industries.

In this context, one can assume that all today’s systems - social, economic, or political - are fragile. To prevent brittleness, the abstract concept of “anti-brittleness” is used. It was created and described by Taleb (2012). The main idea of anti-fragility is based on reaping the benefits of change. Anti-fragile organizations are those that are not only immune to disruption but also grow stronger and stronger. Such an organization, by definition, grows thanks to change and becomes stronger by drawing energy from it for development. The second element of the BANI model is fear and anxiety. Today, the sense of fear is intensified through media messages, including information provided on social networks. Media information mainly focuses on presenting the so-called “Bad news” on all kinds of scandals, violence, and similar sensational events that attract the recipients’ attention. In social networks, there is a lot of false information (fake news), deliberately misleading various types of

conspiracy theories, not to mention “hate,” or attempts to manipulate the behavior of recipients (e.g., attempts to influence citizens’ voting decisions). Other areas that significantly contribute to the feeling of fear and anxiety are digital, financial, and job insecurity.

Taken together, all of this leads today to a life of constant restlessness and fear. To reduce uncertainty and concerns, enterprises use activities related to honesty and trust, employee empowerment, good communication, and ensuring security in various aspects - e.g., physical, digital, or employment security. The third element of the model is non-linearity. In a non-linear world, cause and effect are seemingly unrelated or disproportionate. This may result, for example, from a long delay between the cause and the visible effect (hysteresis) or from insufficient knowledge about the state of the phenomenon. In a non-linear world, the effects of actions taken or not taken can cause an imbalance. Small actions or decisions end in huge consequences. This is called the “butterfly effect” - flapping a butterfly’s wings in Brazil causes a hurricane in another part of the world or a slight error in the initial data, which generates serious errors in further calculations. Taleb (2012) calls this non-linearity causal opacity: it is difficult to see the arrow leading from the cause to the effect, so many traditional methods of analysis, as well as logic, no longer apply. Examples of such non-linear events are, for example, climatic disturbances or the spreading process of atmospheric pollution or global warming. The last element of the model signifies incomprehensibility. The current events and decisions made seem illogical, pointless, or simply absurd. There is no point in trying to find the answer. The additional information does not guarantee a better understanding. More data - even big data - can be counterproductive, overwhelming the ability to understand the world and making it difficult to recognize noise from a signal. In this context, incomprehensibility is a state of “information overload.” One way this phenomenon manifests itself is, for example, through systems and processes that appear to be dysfunctional but still running. It can also be the other way around - systems that stop working with no apparent logic or reason. Actions to prevent non-linearity and incomprehensibility in enterprises include, above all, full transparency of activities, open and multi-faceted communication, experimenting, and learning from mistakes.

Other important sources of disturbance are unpredictable events with a drastically negative impact on the reality of the so-called Black Swan. The concept of a “Black Swan” event is based on the thesis of the philosopher of science Karl Popper, which says that if someone has seen only white swans all his life, it does not mean that black swans do not exist. These are events for which no element of the past demonstrates the possibility of its occurrence, and, after its occurrence, everyone looks for a justification for it, so it becomes

explainable and predictable (Taleb, 2014). Examples of such events were, for example, the terrorist attack on the World Trade Center in 2001 and the economic crisis in 2008 after the collapse of the American investment bank Lehman Brothers Holdings Inc. Some also refer to the current COVID-19 pandemic as “Black Swan,” but the author of this term disagrees. A pandemic does not fulfill the premise of an unexpected event that has never occurred in the past. It is known that pandemics of various diseases have occurred many times in the earlier period and that there was concrete evidence for a similar pandemic to occur now or in the future. Here, a better metaphor is the so-called “Gray Rhino.” The rhinoceros is a large and formidable animal that can attack any human being. However, no tourist who goes to Africa on a safari assumes that this is what will happen to him. The term Gray Rhino was introduced into the business language by Michele Wucker in January 2013 at the annual meeting of the World Economic Forum in Davos. The concept was further developed in the book “Gray Rhino: How to Recognize and Treat Obvious Threats We Ignore” (Wucker, 2016). A common feature of events such as the Black Swans and the Gray Rhinos (Table 9.4) is a high, mostly negative, and destructive influence on the surrounding reality. However, unlike the Black Swans, the Gray Rhinos are highly probable events that have occurred in the past but have been neglected in the sense of underestimating the likelihood of their occurrence and therefore not being prepared for their consequences.

Table 9.4. Black Swans and Gray Rhinos

Black Swan	Gray Rhino
Incredible, unique - never happened before	Probable and repeatable - it has happened many times in the past
It has a drastic impact on reality	It has a drastic impact on reality
Only after its occurrence, its premises, symptoms or sources are searched for in order to justify its occurrence.	It is known that it can occur, but the likelihood of it occurring has been ignored or underestimated.

By adopting the above-described VUCA and BANI models and the Black Swan and Gray Rhinoceros events as a structured description of the main sources of disruption, enterprises need to be resilient today to function and survive in such a complex, chaotic, and unpredictable environment.

Resilience varies with the type of business and industry. This is obvious because resilience is inherent in an organization and depends on its resources and potential. According to the Leavitt model (Firley, 2007), enterprises are complex engineering and social systems, i.e., a plane of interpenetration and complementation of two worlds: soft – human, including the social system, with all goals and tasks set and implemented by the organization (strategy),

relations, motivations and behavior patterns of its participants (culture); and hard - engineering, which comprises the organizational structure, including the formal division of power in the organization, tasks, responsibilities and information flow, as well as tools and technologies, i.e., infrastructure, and material and technical equipment. The organizational resilience in a company depends both on assets and infrastructure elements (hard resilience), but above all, on the attitudes, behaviors, and actions taken by people - staff, suppliers, subcontractors, and all stakeholders related to a company (soft resilience). The organizational resilience of an enterprise emerges through the purposeful collaboration of managers and employees across constraints - geographic, functional, business, and decision-making - using the available means and resources to build a resilient enterprise. In this context, the organizational resilience of enterprises manifests itself through specific states, functions and features of the enterprise (strategy, structure, processes, procedures, tools, and technology) and the attitudes, behaviors and actions presented by employees (culture).

All the elements described above have been logically related to each other within the concept of the organizational resilience model of enterprises visualized in Figure 9.3.

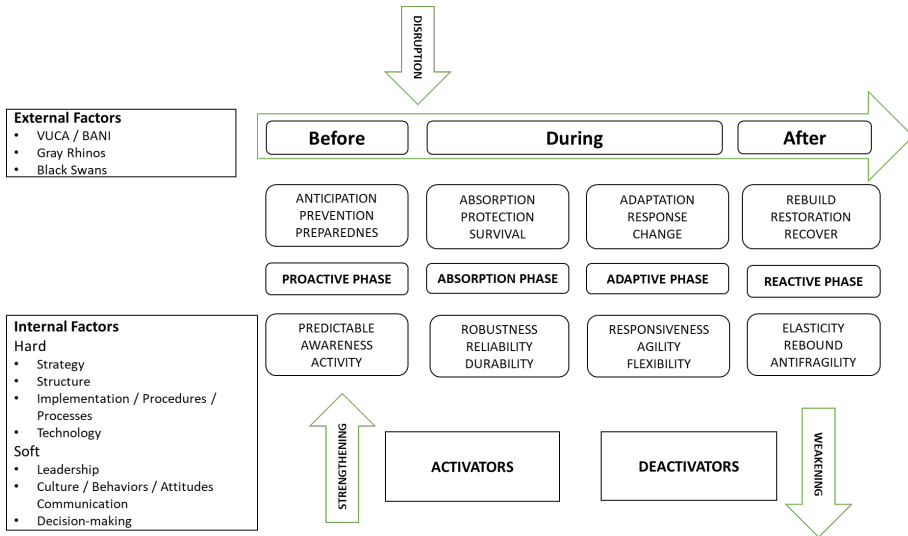


Figure 9.3. The concept of the organizational resilience model of enterprises

Source: author’s work based on Supardi and Hadi (2020).

4.2. Model operationalization – measurement

As already mentioned, organizational resilience was characterized as a second-order latent construct that manifested at the first-order level. Under the approach based on the theoretical concept, to understand the specification of the measurement model of higher-order formative construction, quantification of the organizational resilience of an enterprise can be performed using directly observable variables, which are determinants of its occurrence. The idea of measuring the organizational resilience of enterprises, adopted in this article is based on a set of selected, directly observable indicators, i.e., states, functions, features and attitudes, actions or behaviors presented by employees that determine the level of organizational resilience of the enterprise. The indicators are divided into two categories - strengthening resilience – the positive correlation - determining high resilience, the so-called “Activators” and weakening resilience – the negative correlation – determining low resilience, the so-called “Deactivators.”

The individual steps to measure and calculate the global average resilience index of the enterprise (R - from Resilience) are described below.

Step 1. Select indicators to be assessed

Based on the model diagram in Table 9.3, a list of selected activators and deactivators of organizational resilience of enterprises was prepared, broken down into specific areas of activity given in Table 9.5. In order to estimate the organizational resilience of the enterprise in particular areas, opposing indicators were compared. There is no minimal number of indicators, but to get adequate credibility, it should count at least a dozen parameters and cover as many areas of the company’s activity as possible. The more indicators and areas are considered, the more accurate the result of estimating the resilience of the enterprise should be.

Table 9.5. Organization Resilience Assessment Form

Area	Indicators lowering resilience - deactivators (grades 1-3)	Indicators supporting resilience - activators (grades 4-6)
values	chaotic and inconsistent or complete lack of common norms, patterns of behavior and values	a coherent set of common norms, patterns of behavior and values
attitudes	lack of commitment and identification of employees with the values of the organization	high commitment and full identification of employees with the values of the organization

Area	Indicators lowering resilience - deactivators (grades 1-3)	Indicators supporting resilience - activators (grades 4-6)
cooperation	territorialism and silence, internal rivalry, and conflicts	full cooperation and integration of employees, direct interactions (peer-to-peer) between employees, effective conflict resolution techniques
approach to change	conservatism, passivity, reluctance to change	continuous development, continuous learning and improvement of qualifications, easy adaptation to changes
risk management	risk aversion, risk avoidance	experimenting and learning from mistakes, predictive methods of detecting and estimating risks, prepared and tested crisis management plans (stress tests)
qualifications	job descriptions based on skills and experience, hard competences	job descriptions based on the commitment and character of employees, soft skills
skills	specialization, formalization	multifunctionality and multitasking (generalists), cross-training covering many areas
predisposition	caution, conformism, pessimism	optimism, positive attitude, focus on success, open mind
motivations	low morale, low motivation, lack of trust and job satisfaction, job insecurity (high rates of absenteeism and fluctuation)	trust, high morale and motivation, job satisfaction (pride), job stability (low absenteeism and fluctuation rates)
interpersonal relations	culture of „fear”, searching for the guilty (stick and carrot), manipulation, intimidation, mobbing,	integrating and motivating employees,
balance	disturbed work-life balance, long working hours	taking care of maintaining the right balance between work and private life (work-life balance)
management style	autocratic leader, individualism and career-oriented „command-and-control”	leader as a coach, advisor, „gardener” (servant leadership)
innovation	procedure of tasks and activities, procedures and rules, routine activities	improvisation, spontaneous and creative problem-solving efforts, creative, opposing (integrated) or design thinking
mission	focus on profit, quality, efficiency, or market dominance	ecology, social responsibility, environmental protection
strategy	traditional strategies based on distinction, responsiveness instead of prevention	scenario strategies and simulation models, pre-mortem analysis, anticipation of possible future events and planning appropriate action scenarios

Area	Indicators lowering resilience - deactivators (grades 1-3)	Indicators supporting resilience - activators (grades 4-6)
business model	traditional business model - focus on profit and creating value for shareholders	modern business models, sharing economy, attitude to social values, ethics, responsibility, environmental protection
perspective	short-term perspective - focus on current activities (fire fighting), focus on short-term profit	long-term planning, the ability to generate a stable profit in the long term
target beam	poor goal setting - bureaucratic planning systems, traditional planning based on approximation of historical data	clearly defined goals set under the SMART technique and established principles of operation to achieve them
goal tree	no decomposition of strategic goals into operational goals	correct decomposition of strategic goals into operational goals and specific measures and methods of achieving them
tasks	poor assignment of responsibilities and tasks - mess, chaos, entropy	well-allocated, flexible ranges of duties and tasks, efficiency, order, efficiency
hierarchy	configuration - vertical, hierarchical (many levels), oversized, inconsistent structure	configuration - flat, project structure, federation, network (self-organizing)
organizational chart	fossilized organizational chart (inertia, inaction), excess employment, large monolithic multinational corporation	adjusting the size of the organization to the scale of the business, agile business organization, consolidated key function divisions
scope of activities	excessive procedural and formalization of tasks	Freedom and interchangeability of tasks and activities,
instructions	centralized, arbitrary,	decentralization, delegation of powers,
decision-making	bureaucratic (hierarchical) management chains	distributed decision making, empowerment
information flow	internal communication - communication bottlenecks, lack of communication between employees and management	clear internal communication at all levels of the organization
know-how	low expenditure on research and development, no own patents, and copyrights	high expenditure on research and development, a large number of patents and copyrights
production	standardization, mass production	flexible production lines and methods
data processing	obsolete IT systems (legacy systems), obsolete production lines, technological debt	modern IT systems (Cloud, IoT, AI, Big Data), modern production lines (automation and digitization of manufacturing processes)

Area	Indicators lowering resilience - deactivators (grades 1-3)	Indicators supporting resilience - activators (grades 4-6)
technology	technology treated only as a support for business processes	technology as a driving force of business, integration of technology with business activities (technology driven)
monitoring and control	improper measurement of results. excessive control, micromanagement	effective controlling - practices, tools and communication functions to facilitate monitoring and control

Step 2. Determining the grading scale

The following measurement scale was adopted: values from 1 to 3 – for deactivators and values from 4 to 6 for activators. For each assessed area, decide which indicator is present in the organization (activator/deactivator) and assess its impact on the organization's resilience accordingly. The individual assessments reflect the following situations:

- 1 - powerful influence of deactivator - significantly lowers resilience.
- 2 - standard deactivator influence - lowers resilience.
- 3 - weak influence of the deactivator - slightly lowers resilience.
- 4 - weak influence of the activator - slightly strengthens resilience.
- 5 - standard activator effect - strengthens resilience.
- 6 - powerful influence of the activator - significantly strengthens resilience.

It was assumed that the proposed indicators are so universal and disjointed that they will not be differentiated by weight. Each of the assessed indicators is included in the total assessment with the same weight. Of course, during the research - at the stage of preparing the survey - one can consider the possibility of introducing additional weights for companies from various industries, adequately to the specifics of their activities. For example, for manufacturing companies, more important can be assigned to the area of production and for technology companies to the area of know-how.

Step 3. Calculate the Global Average Resilience Index of the Organization

The value of the enterprise's organizational resilience index R (resilience) is calculated based on the sum of all assessments of determinant indicators in relation to the maximum value of the assessment (for the adopted assessment scale - value 6). The ratings are translated into a percentage:

$$R = \frac{1}{n} \left(\sum_{n=1}^n \frac{(D)}{\text{Max}(D)} \right) * 100\% \quad (1)$$

where:

R (Resilience) – index of organizational resilience of the enterprise,

D (Determinant) – assessment value for the measured indicator (determinant),

Max D – the maximum value of the indicator's rating

n - number of assessed indicators

The obtained result is interpreted under the scheme proposed in Table 9.6.

Table 9.6. Estimated level of organizational resilience

Organization Resilience Index Value R	Interpretation	Recommendation
R < 34%	The organization is not resilient, „fragile” and „unstable,” has a low level of resilience, susceptible to disturbances (negative sensitivity). Chaotic and inconsistent activities in specific areas. High risk of significant problems in the event of exposure to disturbances.	Organizing and standardizing activities in individual areas to strengthen the resilience of the organization.
35% < R < 65%	The organization is „stable,” has a medium level of resilience (neutral sensitivity). Coherent actions in all areas. Medium risk of significant problems arising when exposed to disturbances.	Monitoring and strengthening activities in specific areas in terms of consistency around organization resilience.
R > 66%	Resilient organization „elastic” / „anti-fragile”, highly stable, has a top level of resilience (positive sensitivity). Changes in the environment and unpredictable events strengthen the organization. Resilience in all areas of action. Low risk of significant problems in the event of exposure to disturbances.	Cyclical monitoring of activities in individual areas in order to maintain high consistency around the resilience of the organization.

In the presented model, the value of the average enterprise organizational resilience index ranges from 0 to 100% and reflects the probability of the enterprise's ability to cope with disturbances. The higher this ratio is, the more resilient the enterprise should be to disruptions. This means that there is less risk of significant problems arising when exposed to disturbances. In the long run, this should also translate into greater stability for the company and higher chances of survival and growth. The lower the ratio, the risk of arising significant problems increases, which translates into a decrease in resilience

and, in the long run, may lead to a decrease in the enterprise's stability and increase the risk of not surviving. According to Table 9.6, it was assumed that the level of the resilience index (R) below 34% is the borderline value between the minimum resilience of the organization in the possibility's context of its survival on the market and stable development in the long term. This level is called the "bifurcation point," which means an organization is on the verge of surviving or collapsing. This level shows a significant threat to the further stable functioning of the enterprise.

5. Discussion and conclusion

The proposed model is a conscious simplification. In order to enrich the model, more advanced mathematical tools can be used, e.g., the probability density function. The correctness of the proposed model should be empirically verified first. This can be done by confronting the results obtained according to the proposed model for a company with other models of enterprise resilience assessment (e.g., with the so-called "resilience profile" calculated for key functions in critical systems, based on three parameters - function, delay limit, and limit minimum performance) (Ayyub, 2014) or directly with common measures of a company's business performance (e.g., financial performance, performance and efficiency, image and reputation, market share) in relation to the time of the specific disruption. Conducting research during the COVID-19 pandemic, which is an example of a disruption adversely affecting most enterprises and industries, is a unique opportunity to verify the developed model.

Organizations need to be resilient in the event of adversely affecting the enterprise, such as during the COVID-19 pandemic. The proposed model considers both "hard" areas - enterprises, such as strategy, structure, performance, and the "soft" ones, such as organizational culture, leadership, or innovation. The proposed concept of the resilience model and the aspects of measuring the level of resilience are important because of the theoretical and applied implications. The measurement model bases on estimating (R), considering indicators that determine resilience in the organization. The proposed model can be an effective tool for conducting empirical research on the comparative analysis of the resilience of various enterprises. Healthy, stable organizations should be characterized by a high value of the index, which would show a high level of their resilience, which should translate, in the long term, into an increase in the organization's durability - a positive impact on the organization's life cycle. Conversely, a low level of the organization's resilience index would be a signal of an organization's increasing sensitivity (susceptibility to failure), and thus it would signal a high risk of significant problems in the event of exposure

to disruptions, which in the long term may lead to a shorter life cycle of the organization. A low level of the organization's resilience index would suggest the management take preventive and remedial actions.

With positive verification, validity, reliability and applicability of the model, several directions can be outlined as part of further research. First, consider reducing the number of indicators tested. The model assumes that the individual indicators are disjointed, but in fact, in an enterprise, many areas are emergent and synergistic. It should therefore be expected that some symptoms can be correlated with each other, and it is enough to select only some of them (e.g., the so-called "scree method") to get sufficiently reliable results. It is also worth looking for further approximations of the model, adequate for specific sectors and industries of the economy, first, in terms of selecting indicators for measuring resilience. An interesting direction of exploration also seems to be the measurement of resilience, considering different perspectives of the company's stakeholders. Resilience can be something different for a company operating in isolation, and something different for a business caught up in networks and the expectations of many interest groups. For this purpose, it is possible to use the signaled possibility of introducing additional weights to the evaluation system, depending on the industry or the specificity of the enterprise. It should also be noted that some distortions, for several enterprises, because of the specificity of the sector, may be more or less severe. The same disruptions may pose a threat to some industries while others may create development opportunities, e.g., the COVID-19 pandemic. Also, it has a drastically destructive impact, for example, on the catering, tourism, or air transport industries, and has a positive impact on the new technology enterprises. In future testing and development, it is also worth relating the model to the ongoing digital transformation. Using machine learning algorithms, with the selection of indicators to develop an optimal model of enterprise resilience, seems technologically possible and very attractive today.

Acknowledgments

The article was published thanks to the support of Krzysztof Bartosik Ph.D. - the head of the Executive DBA postgraduate studies at the Institute of Economics of the Polish Academy of Sciences.

References

American Psychological Association. (2021). Building your resilience. Retrieved September 10, 2021, from <https://www.apa.org/topics/resilience>.

- Ayyub, B. (2014). Systems resilience for multihazard environments: definition, metrics, and valuation for decision making. *Risk Analysis*, 34(02), 340–355. <https://doi.org/10.1111/risa.12093>
- Bruneau, M., & Reinhorn, A. (2006). Overview of the resilience concept. *Proceedings of the 8th U.S. National Conference on Earthquake Engineering*. San Francisco, California, USA, Article No. 2040. Retrieved July 26, 2021, from www.researchgate.net
- Carlson, L., Bassett, G., Haffenden, R.A., Buehring, W.A., Collins, M.J., Folga S., ... Whitfield, R.G. (2012). Resilience: Theory and application. *Decision and Information Sciences Division, Argonne National Laboratory*. Report number: ANL/DIS-12-1. Retrieved from <https://doi.org/10.2172/1044521>
- Cascio, J. (2020). Facing the age of chaos. Retrieved January 10, 2021, from <https://medium.com/@cascio/facing-the-age-of-chaos-b00687b1f51d>
- Department of Homeland Security. (2017). *Lexicon Terms and Definitions, 2017 Edition – Revision 2*. Washington, DC, USA. Retrieved from https://www.dhs.gov/sites/default/files/publications/18_0116_MGMT_DHS-Lexicon.pdf
- Edwards, J. R., & Bagozzi, R. P. (2000). On the nature and direction of relationships between constructs and measures. *Psychological Methods*, 5(2), 155–174. <https://doi.org/10.1037/1082-989X.5.2.155>
- Firlej, K. (2007). Models of management systems - Levitt's and Watterman's model in a holistic approach. Cracow: Cracow University of Economics. Retrieved September 10, 2021, from https://www.researchgate.net/publication/280318698_Model_e_systemow_zarzadzania_-_model_Levitt%27a_i_Wattermana_w_ujeci_u_holistycznym
- Ali, I., Nagalingam S., & Gurd, B. (2017). Building resilience in SMEs of perishable product supply chains: Enablers, barriers and risks. *Production Planning & Control*, 28(15) <https://doi.org/10.1080/09537287.2017.1362487>
- Gilbert, S. (2010). *Disaster Resilience: A Guide to the Literature*. National Institute of Standards and Technology Special Publication ((NIST SP), 1117. Retrieved September 30, 2021, from https://tsapps.nist.gov/publication/get_pdf.cfm?pub_id=906887
- Kahan J., Allen A., & George, J. (2009) An operational framework for resilience. *Journal of Homeland Security and Emergency Management*, 6(1), Article 83. <https://doi.org/10.2202/1547-7355.1675>
- National Institute of Standards and Technology. (2016). *Community Resilience Planning Guide for Buildings and Infrastructure Systems*, Volume I, NIST Special Publication 1190. Retrieved September 30, 2021, from <http://dx.doi.org/10.6028/NIST.SP.1190v1>
- Norris, F.H., Stevens, S.P., Pfefferbaum, B., Wyche, K.F., & Pfeeeerbaum, R.L. (2008). Community resilience as a metaphor, theory, set of capacities,

- and strategy for disaster readiness. *American Journal of Community Psychology*, 41, 127–150. <https://doi.org/10.1007/s10464-007-9156-6>
- Nurbantoro, E. (2021). Strategic leadership in the VUCA era: Challenges facing COVID-19. *Academia Letters*, 2570. <https://doi.org/10.20935/AL2570>
- Presidential Policy Directive, PPD-21. (2013). *Critical Infrastructure Security and Resilience*. Washington, DC, USA. Retrieved July 25, 2021, from <https://obamawhitehouse.archives.gov/the-press-office/2013/02/12/presidential-policy-directive-critical-infrastructure-security-and-resil>
- Rose, A. (2004). Defining and measuring economic resilience to earthquakes. National Science Foundation. Earthquake Engineering Research Centers Program. Retrieved August 10, 2021, from http://cbp.lsu.edu/wp-content/uploads/docs/3604_rose.pdf
- Rose, A., & Krausmann, E. (2013). An economic framework for the development of a resilience index for business recovery. *International Journal of Disaster Risk Reduction*, (5), 73–83. <https://doi.org/10.1016/j.ijdr.2013.08.003>
- Santorski, J., & Oksanowicz, P. (2020). „I”/ *Refleksje o Przywództwie Jutra*. Warszawa: Wydawnictwo Agora SA.
- Sarwar, A., Khan, F., Abibola, M., & James, L. (2018). Resilience analysis of a remote offshore oil and gas facility for a potential hydrocarbon release. *Risk Analysis* 38(8), 1601–1617. <https://doi.org/10.1111/risa.12974>
- Supardi, Syamsul Hadi. (2020). New perspective on the resilience of SMEs proactive, adaptive, reactive from business turbulence: A systematic review. *Journal of Xi'an University of Architecture & Technology*, XII(V). <https://doi.org/10.37896/JXAT12.05/1524>
- Taleb, N.N. (2012). *Antykruchosc O Rzeczach Którym Służą Wstrząsy*. Warszawa: Kurhaus Publishing Kurhaus Media.
- Taleb, N. N. (2014). *Czarny Łabędź, O Skutkach Nieprzewidywalnych Zdarzeń*. Warszawa, Polska: Kurhaus Publishing Kurhaus Media.
- Taleb-Berrouane, M., & Khan, F. (2019). Dynamic resilience modelling of process systems. *Chemical Engineering Transactions*, 77. <https://doi.org/10.3303/CET1977053>
- United Nations Office for Disaster Risk Reduction. (2017). *How to make Cities More Resilient, A Handbook for Local Government Leaders*. UNDRR. Retrieved October 23, 2021, from <https://www.preventionweb.net/publication/how-make-cities-more-resilient-handbook-local-government-leaders-0>
- Wucker, M. (2016). *The Gray Rhino: How to Recognize and Act on the Obvious Dangers We Ignore*. New York, USA: St. Martin's Press.

Biographical notes

Bartosz Grucza (Ph.D., Hab.). Head of the Department of Research on Infrastructure and Mobility, College of Management and Finance, Warsaw School of Economics. In 2013–2016 chancellor of the Warsaw School of Economics, in 2006–2008 chancellor of the Medical Academy in Warsaw and the Medical University of Warsaw. A graduate of the Warsaw School of Economics and a long-term employee of the Department of Project Management at the Warsaw School of Economics, co-founder and lecturer of Postgraduate Studies in Project Management. Project manager and consultant in project management, including those financed from EU funds. Manager, who has been implementing projects in private enterprises and public institutions for many years. Co-author of several publications and popular textbooks in project management and management. Propagator of the idea of project management in the academic, business and social environment.

Piotr Tomszys, Experience Project Manager, implementing IT projects for the financial sector for almost 30 years. A graduate of the Warsaw University of Technology (master's studies at the Faculty of Mechanics, Energy, and Aviation) and the University of Lodz (postgraduate studies at the Faculty of Management) and the Institute of Economics, Polish Academy of Sciences (postgraduate Executive DBA studies). Certificate holder: PMP (2004) and Executive MBA The Robert H. Smith School of Business University of Maryland (1998). Research interests focus on: project management, strategic management, and modern software development methods.

Citation (APA Style)

Grucza, B., & Tomszys, P. (2021). The concept of organizational resilience model and adequate measurement mechanism. In A. Ujwary-Gil & B. Godlewska-Dzioboń (Eds.), *Challenges in Economic Policy, Business, and Management in the COVID-19 Era* (pp. 221–244). Warsaw: Institute of Economics, Polish Academy of Sciences.

Measuring innovative management with the Management Innovation Assessment Tool

Magdalena Gorzelany-Dziadkowiec¹

Abstract

The article's objective was to develop a tool (an original questionnaire) for diagnosing and assessing innovative management in organizations and then to verify its usefulness. The first step of the research process was a bibliometric analysis and systemic literature review using the Scopus and Google Scholar databases from January 2020 to March 2021. The query involved the following keywords: innovations in management, management innovations, organizational innovations, non-technological innovations. The analysis identified a knowledge gap, namely the need for a tool for diagnosing and assessing innovative management in organizations. The original, innovative management questionnaire (Management Innovation Assessment Tool, MIAT) was modeled on the organizational culture questionnaire, OCAI. The questionnaire was discussed with management experts and practitioners. It was then applied to diagnose and assess innovative management in a sports club (case study) and random enterprises represented by graduates of the economics and management-related studies who are either employed or running a business. This stage was the test phase for the MIAT. For this reason, the author added questions regarding respondent data, enterprise size, clarity of the questionnaire, ease of use, the usefulness of the questionnaire for assessing innovative management, and whether any improvements were necessary to the questionnaire. The limitations include a small sample and a random selection of enterprises. Therefore, the results do not facilitate general conclusions but provide foundations for future research. Management calls for innovative solutions. The analysis reached the objective, which was to develop and discuss the MIAT questionnaire. Opinions of experts and respondents demonstrated that the tool is clear, easy to use, and no amendments are necessary. The subjects furthermore noted that the MIAT was useful for diagnosing and assessing innovative management. The questionnaire can be

¹ Magdalena Gorzelany-Dziadkowiec, PhD, Position, Cracow University of Economics, Department of Organizations Development, ul. Rakowicka 27, 31-510, Kraków, e-mail: gorzelam@uek.krakow.pl (ORCID: 0000-0001-9062-5984).

This is an open access article under the CC BY license (<https://creativecommons.org/licenses/by/4.0/legalcode>).

used by managers of various levels, entrepreneurs, or social activists. The tool can also be used by teachers and lecturers, training future managers (such as students of management or business administration). It can further be used by business consultants and during business management training courses. The added value of the article is the original questionnaire that can be a cornerstone for future research on relationships between innovative management and organizational culture or operating efficiency. Moreover, future research can attempt to tackle the research question of whether innovative management affects business results and employee motivation.

Keywords: *innovations in management, management innovation, innovative management, assessment tool,*

1. Introduction

The increased pace of technological changes and the latest trends modify the attitude of the business towards innovation. As a result, the role of innovation managers evolved. Innovation attracts the attention of entrepreneurs, the third sector, researchers, and public administration. An analysis of the opportunities for innovations exposed an evolution of the innovation system paradigm. The interest (both theoretical and practical) in technological and marketing, social, organizational, or management innovations grows. Innovations in management stem from organizational innovation that is broadly discussed in the literature. The presented management paradigms illustrated with metaphors help understand the evolution of management. ‘Machine organization,’ ‘organism organization,’ ‘brain organization,’ and today’s ‘innovative organization’ have distinctive characteristics. The demonstration did not judge the paradigms but rather opened a new perspective for looking at organization management. For the purposes of the article, innovative management was assumed to characterize an ‘innovative organization.’

The article aims to develop a tool (an original questionnaire) to diagnose and assess innovative management in organizations and verify its usefulness. The first step of the research process was a bibliometric analysis and systemic literature review using the Scopus and Google Scholar databases from January 2020 to March 2021. The query involved the following keywords: innovations in management, management innovations, organizational innovations, non-technological innovations. The analysis identified a knowledge gap, namely the need to diagnose and assess innovative management in organizations. The original, innovative management questionnaire (Management Innovation Assessment Tool, MIAT) was modeled on the organizational culture

questionnaire, OCAI. The questionnaire was discussed with management experts and practitioners. It was then applied to diagnose and assess innovative management in a sports club (case study) and random enterprises represented by graduates of the economics and management-related studies who are either employed or running a business. This stage was the test phase for the MIAT. For this reason, the author added questions regarding respondent data, enterprise size, clarity of the questionnaire, ease of use, the usefulness of the questionnaire for assessing innovative management, and whether any improvements were necessary to the questionnaire. The limitations include a small sample and a random selection of enterprises. In the future, research can attempt to tackle the research question of whether innovative management affects business results and employee motivation. The manuscript consists of four parts. Firstly, the literature background was carried out. The second part contains the concept of empirical research, and the third part presents the results and discusses it. The article ends with conclusion.

2. Literature background

Organisational innovations are defined as new methods for enterprise organization and operation that refer to the organizational structure (Hage, 1999; Czekaj 2013; Lichtarski 2010; Lam, 2004; Steiber & Sverker, 2015; Razavi & Attarnezhad, 2013; Leovaridis & Popescu, 2015; Bagnoa, Salernob, & Diasa, 2017; Damanpour, 2020). Authors of the Oslo Manual identified three types of organizational innovations: new methods within operating principles (such as delivery management or quality management); new methods for task division and decision-making among employees; and new methods in external relations with other entrepreneurs or public institutions (OECD, 2005; Kamiński, 2018).

The identification of organizational innovation in the literature was the cornerstone for defining innovations in management (management innovations). Hamel and Prahalad (2002; 2006) define management innovation as a departure from traditional management principles, processes, and practices. In other words, management innovation concerns new solutions for processes, principles of operation, methods of operation, and organization management structures that significantly change how goals are achieved within organization (Birkinshaw, Hamel & Mol, 2008). They are new management practices and methods that involve a change in how the organization operates and, consequently, its evolution (Flak, 2012). The introduction of new management practice, process, structure, or technique is always set to improve operating efficiency (Vaccaro et al., 2012; Mothe & Thi, 2010), meaning increased effectiveness and performance of operations.

Management innovations concern management processes in marketing, finance, human resources, and knowledge, affecting the competitive positioning. Flak (2012) proposed an interesting approach to management innovation pointing out functional, subject-matter, and process innovations. Tranfield, Denyer, and Smart (2003), however, relate management innovation to planning, executing, and reporting. Therefore, management innovation is a mechanism for creating, improving, and promoting new ideas. They also fuel the pro-innovative activity that facilitates quick and flexible response to market signals and challenges, leading to strategy implementation (Nonaka & Takeuchi, 2000; Obłój, 2007; Penc, 1999; Pomykalski, 2001; Robbins & De Cenzo 2002; Tiwari, Buse, & Herstatt, 2007).

Kraśnicka, Głód, and Wronka (2014) investigated the inclusive meaning of management innovation. The authors contributed a very insightful review of Polish and international literature with a summary of definitions of management innovation proposed by various authors. They concluded that innovations in management are a new management practice. This conclusion is consistent with the work by Damanpour and Aravind (2011), who described three approaches involving innovations in management (organizational innovations, administrative innovations, and innovations in management) and used the term 'managerial innovation'. From this point of view, management innovation can be perceived as a manifestation of the behavior of top-level managers, their ability to generate, adapt, and implement new solutions for organization management. In 1981, Kimberly differentiated between innovations in management and 'other' innovations, such as technological progress. In her definition of management innovation, Kimberly (1981) pointed out that managers introduce innovations as a program, product, or technique that significantly deviate from the current knowledge and affect the nature, distribution, quality, or quantity of information available for decision-making. She proposed that management innovations are introduced by managers and can change traditional decision-making in firms.

The diversity of concepts of innovations in management (management innovations) presented above, and their definitions facilitated the proposal of an original definition of management innovation. Innovations in management are referred to as the very definition of management, according to Stabryła (2007). This management is an information-decision process aided by planning, organization, motivation, and control functions. In management, innovations concern new mental and cultural trends in planning, organizing, leading (motivating), and controlling combined with new decision-making methods. Innovations in management are called management innovations, as well. On the other hand, innovative management can implement new solutions in management and the degree to which they are implemented. Innovative

management has a characteristic capability or skill of implementing modern solutions in management. An organization exhibits innovative management if management innovations are implemented there.

Hence, innovation in management is an aspect of innovation management. Considering innovation in the field of management, it should be determined whether an enterprise is innovative in management (whether it exhibits innovative management), i.e., whether hitherto unknown planning, organizing, leadership (motivating), and control methods have been discovered. Most entrepreneurs perceive management innovation as a secret process, an irregular, uncertain, and potentially disappointing investment. It is a time for something new, an open approach with inherent risk (Wolpert, 2002) by managers. On the other hand, it is claimed that the current management standards stem differs from the early industrial era of the late nineteenth and early twentieth centuries, which renders them anachronistic and disappointing today (Hamel 2002, 2006). The changing management paradigms, as discussed extensively by Krochmal (2010), Ciesielski (2014), Marczyk (2004), and Kraśnicka (2010), may become the lodestar for changes in management introduced by managers. Metaphors for changing paradigms are used to visualize the evolution of management sciences better. Today, metaphors and analogies are important instruments in management sciences (Niemczyk, 2002). The classic author in this regard is Morgan (2013), whose theory of metaphors indicates that the organization can be a little of everything: culture, organism, or brain. Morgan attempted to describe the organization using various metaphors (machine, organism, brain, cultural system, psychic prison, political system). He indicated that metaphors were different from definitions in that they open new possibilities of perceiving the obvious, fueling discussion, and exchange of thoughts. Ciesielski (2014) pointed out the use of the term 'paradigm' to comprehend management principles. The most common in literature is the metaphor of machine (drawing on the classical approach), followed by an organism and brain. Therefore, they will now be discussed and used to develop an original questionnaire for diagnosing and assessing innovative management.

The first identified type of organization is the machine. This paradigm draws on the classical school. In Antiquity or Middle Ages, the differences among ruling, commanding, or administering were not as pronounced as they are today. One simply built a mill, installed machinery, hired workers, bought materials, and became a factory owner (Gliński, Kuc, & Szczepankowski, 1995; Wiszniewski & Wiszniewski, 2002). Hierarchy did not matter, and most units were artisan workshops. The environment changed with time. Factories were built, and the owner and worker were separated by 'hierarchy,' 'management structure,' and 'line of reporting' (Jay, 1996). Management science grew exceptionally well in the second half of the twentieth century.

It was the time of significant development of concepts, models, methods, techniques, and research on management in various domains of economic life. The four principles of scientific management of F.W. Taylor put into practice in the nineteenth century had a tangible influence on the product organization. By clearly emphasizing that management is common to all types of activity in business, public administration, and even households, the general administrative theory of H. Fayol (Machaczka, 1999) fueled the constant research growth back in the late nineteenth and early twentieth century. One should not leave out the contribution of M. Webber to the theory of organization. Just as the four principles of F.W. Taylor and fourteen universal principles of H. Fayol, his input remains the foundation of modern management concepts. The characteristic features of the organization as a machine are a profound and stable division of work, extremely high level of formality, clear hierarchical roles divided between managerial and executive posts, domination of highly centralized hierarchical structures, mainly vertical and formal information flow, and knowledge and control held centrally at the top level. The management style is dubbed the perfect machine (Marczyk, 2004).

Slightly different approaches to organization and management sciences were proposed by A. Maslow (with his hierarchy of needs), D. McGregor (Theory X and Theory Y), and E. Mayo. They represented the humanist (interpersonal) trend that mental and emotions play a vital role in the operations of any organization. Performance can be improved through 'strict principles' and with a good atmosphere and motivation (Wiszniewski, 2002; Robbins & De Cenzo, 2002). In other words, management here means such actions of the manager that improve the performance and efficiency of work and the organization resembles an organism. The organization is an open system and undergoes or initiates adaptation processes. It adapts to survive and retain its vital functions (Krochmal, 2010). The characteristic features of this type of organization are employee participation in setting common tasks, catering to the needs of its members, an open system, weak hierarchical relations, vertical and horizontal flow of knowledge and information, knowledge and control spread over different management levels, clear decentralization. The organization is treated as an organism that knows, feels, and understands (Machaczka, 1999).

Management requirements grow (Mikuła, 2007; Miś 2009, Tyrańska, 2015) with technological progress and intensification of such factors as competition (Stankiewicz, 2002; Gorzelany-Dziadkowiec, 2014; Godziszewski, 2001; Faulkner & Bowman, 1996), globalization of the economy, complexity and flexibility of structural solutions, computerization of work and communication processes (Bratnicki, Strużyna, & Dyduch, 2001; Gierszewska & Romanowska, 1999; Stabryła, 2011; Krupski, 2003; Lachiewicz, 2014, Oblój., 2007), and advancement in and popularization of

theories of managing knowledge (Mikuła, 2001; Nonaka & Takeuchi, 2000; Ziębicki, 2009; Gorzelany-Dziadkowiec, 2015), intellectual and human capital (Grodziski, 2003; Hoffman, 2003; Poczowski, 2003, 2007), and competencies and talent. The metaphor of the organization as the brain proposed by Morgan (2005) offers the view of the organization as a self-organizing unit that learns and learns how to learn. In such organizations, tasks are spread among specialized units; and yet can operate separately or without any help from auxiliary units. Moreover, members of the organization cooperate and have numerous interrelations. This way, the organization's intelligence is more than just a sum of the intelligence of its participants (Ziembicki, 2009). This proposal is consistent with the paradigms of the learning organization and intelligent organization (Ginter & Kałuza, 2013; Quinn, 1992; Handy, 1998; Dyduch & Bratnicki, 2016; Hejduk, 2016; Wilensky, 1967; March & Olsen 1979; Quinn 1992; Haeckel & Nolan, 1993; Romanowska, 2001; Sieja, 2000).

The last organization management paradigm dominant today is the innovative enterprise (innovative organization) founded on innovative management (Kraśnicka, 2018). This paradigm is related to innovations in management discussed in the literature review. According to the innovative organization paradigm, innovations concern a set of shared beliefs, values, or mental models (particularly of the management) regarding establishing (planning) goals, resources allocation criteria, expectations towards employees, and the relationships with the surroundings and their perception (Obłój, 2003). The innovative organization is the response to the changing environment and management paradigms. From this point of view, the features of an innovative organization (one that introduces management innovations for innovative management) include new planning methods (a departure from devising plans at the very top of the organization), changes in planning: the creation of flexible structures, a departure from power and hierarchy towards authority and decentralization, based on expert knowledge, cooperation, orientation towards people's needs in leadership, talent growth, appreciation of links between traits and educational potential, and nourishment of strengths (Mróz, 2015; Poczowski, 2008; Cannon & McGee, 2015).

The presented management paradigms illustrated with metaphors help understand the evolution of management. 'Machine organization,' 'organism organization,' 'brain organization,' and today's 'innovative organization' have distinctive characteristics. The demonstration did not judge the paradigms but rather opened a new perspective for looking at organization management. For the purposes of the article, innovative management was assumed to characterize an 'innovative organization.'

3. Methodological approach: The concept for the empirical research

In all empirical sciences, management sciences included, the goal of the research is the progress of knowledge or new propositions, theses, axioms, generalizations, or definitions. The general methodology offers some methods that can be considered universal as they are employed in all fields of both deductive and empirical sciences. Analysis and synthesis are such methods (Lisiński, 2016). They are the primary methods for the present research. Moreover, the research method can be defined as a method for research work with specific (research) procedures and research tools. The essence of the research method should strive towards the coordination of the procedure with the research objective (Apanowicz, 2020).

The first step of the research process was a bibliometric analysis and systemic literature review using the Scopus and Google Scholar databases. The articles were filtered according to their research goals. They were then searched with the following keywords: innovations in management, management innovations, organizational innovations, non-technological innovations. The literature analysis was conducted from January 2020 to March 2021. It demonstrated that changing management paradigms allow people in charge of enterprises and employees a unique perspective of the organization.

Furthermore, the analysis identified a knowledge gap, namely the need for a tool for diagnosing and assessing innovative management in organizations, with which one could identify the management paradigm in the organization (for example, 'machine organization' may work well for an organization so that no management changes are needed). The original questionnaire for assessing innovative management (Management Innovation Assessment Tool, MIAT) was developed at this stage. The questionnaire was discussed with management experts and practitioners (teaching and research staff at the Management Institute of the Cracow University of Economics and managers).

The management innovation assessment questionnaire for measuring the level of management innovation was modeled on the OCAI organizational culture assessment questionnaire (Cameron & Quinn, 2003), where the respondent evaluates the current and desired state. The assessment of the current and desired state is significant because it helps identify the respondent's opinion regarding the identified management paradigm in the organization and identify any discrepancies between the current and desired state. If any are found, it is an indication of the necessity of changes in the analyzed domains. The current state assessment in the MIAT was intended to identify innovative management in the organization; if responses suggested an innovative organization (D), it would mean it can introduce management changes. On the other hand, the desired state assessment would help identify

areas in need of changes to help the organization face future challenges and requirements of the violent environment, according to the respondents. The investigation into the current and desired state helps determine whether any changes in the management paradigm are necessary. If the current and desired state overlap, management is correct, and no changes are needed. It may turn out, for example, that the classical paradigm (hierarchy, centralization, goals set at the top tier) gives good results, and members of the organization do not want any changes (the responses indicate organization A, and the current and desired states are identical). The tool is intended for both the management and employees. As mentioned above, the managers are responsible for decisions, and self-assessment is most difficult. Self-evaluation is often biased. For this reason, questionnaires should be addressed to managers and employees when diagnosing and assessing innovative management.

The development of the questionnaire (Table 10.1) was based on the definition of management as an information-decision process determined by management functions: planning, organizing, leadership (motivating), and controlling. The questions in the questionnaire refer to selected metaphors (the most popular ones in the literature): machine – A, organism – B, brain – C, and innovative – D. Each of the five questions has four answers (based on the literature review). Each answer is assigned a score of one hundred, depending on how much it reflects the situation in the organization. In the current state part, the respondent is to assign the most points to the response that most closely reflects the situation in the organization, while in the desired state part, the most points are to be assigned to those characteristics that should be found in the organization. The scores in Table 10.1 were assigned randomly as an example of questionnaire use (how to complete the questionnaire and interpret it). Rows two and three in column three were assigned thirty points, meaning that decisions are taken in 30% by the management and 30% by organization members, whereas the desired state is decisions taken by the management in 10%. Rows three and four, column three and four show the need for increased participation of all organization members in decision making (20 to 30 and 20 to 40).

As the next analytical step, the summary from Table 10.1 can be translated into radar charts to present results in each domain more clearly. Mean results can be calculated by adding all scores of answers A in the ‘current state’ column and dividing it by 5. The same process is repeated for answers B, C, and D and then for the desired state. The means can then be illustrated with a radar chart. The innovative management chart for the data in Table 10.1 is shown in Figure 10.1.

Table 10.1. Innovative management assessment questionnaire with random data

	Current state	Desired state
Decision making		
A Decisions are applied by the top management. The main factor for the decision is targets and results.	30	10
B Decisions are applied on various management levels. Members participate in decision-making. Decisions are oriented towards human needs.	30	20
C Decisions are applied by all members of the organization. Information analysis (knowledge) plays a crucial role in decision-making. Mistakes are analyzed in decision-making.	20	30
D Decisions are made by all members of the organization who exhibit diverse attitudes and creativity. Decision-making methods change depending on environmental changes.	20	40
Total	100	100
Planning		
A Goals are set at the top management level and communicated down the line to be executed.	40	10
B Members participate in goal setting and affect planning – determining the methods for achieving the goals.	40	20
C Goals are set based on knowledge and modification of behavior within the organization. Goal setting is oriented towards intangible assets (intelligence, skills, and abilities of the members).	10	30
D Goals are set for strategic (long-term) horizons based on unique propositions modified depending on the environment.	10	40
Total	100	100
Leadership (motivating)		
A Employees are expected to obediently execute tasks as per procedures. Creative tasks are assigned to managerial positions. People are treated as unqualified, work-shy, and in need of supervision.	40	10
B The dominant orientation is towards each member. Management is oriented towards goals and tasks. People are treated as qualified, hardworking, and not requiring supervision.	20	10
C The management fosters the personal development of each member with continuing education. It inspires action, promotes teamwork, and does not punish for mistakes. People are treated as creative contributors.	20	40
D The management is oriented towards change and appreciates the potential of every employee. Leaders emerge that help to reach goals. Superiors do not use power but employ authority. People are treated as the most valuable asset.	20	40
Total	100	100

	Current state	Desired state
Organizing		
A A clear hierarchical division into managerial and operative positions. Deep and stable division of responsibilities is intended to improve work efficiency. Hierarchical, highly centralized organizational structure.	60	10
B Weak hierarchy, qualification-based division of responsibilities, flat, decentralized organizational structure.	20	10
C The structure emerges from the self-organization of members. Everyone can pursue their tasks independently based on knowledge and experience. Relationships are crucial for the organization.	10	50
D The structure is highly flexible, oriented towards the changing environment. Changes of employees in positions depend on new tasks, licenses, and responsibilities. Responsibilities are divided among organizational units. Units are merged, divided, or created organically.	10	30
Total	100	100
Controlling		
A Control at the top management level. Strict control.	60	10
B Controlling units at various tiers of the organization.	20	10
C Monitoring instead of controlling: observation of activities and ad-hoc corrective interventions, if needed.	10	50
D Changes in controlling methods depend on the organization's needs. Trust, relation-building, and teamwork as the foundation.	10	30
Total	100	100

Source: original work based on the literature review.

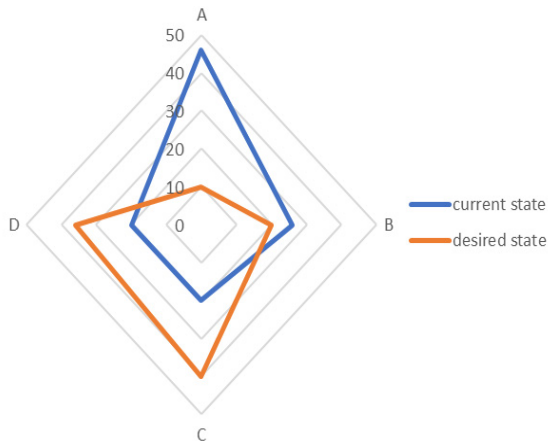


Figure 10.1. Innovative management – graphical representation of the assessment

According to Figure 10.1, the dominant features are represented by answers A ('machine'), and the desired status is the metaphor of brain or innovative management. The conclusion for the example data is that management changes are necessary. Additionally, the example data represent a marginally low level of innovative management (less than 10% of 'innovative organization' characteristics in the current state with 30% in the desired state). If the current and desired state were 20%, the innovative management level would be low. For 30%, it would be sufficient, and for 40–50%, significant. If the responses reached 60%, a significant level of innovative management could be concluded.

4. Results and discussion

In the following stages of the research, the questionnaire was employed to diagnose and assess innovative management in a sports club (case study) and random enterprises represented by graduates of economics and management-related studies who are professionally successful. This stage was the test phase for the MIAT. For this reason, the author added questions regarding respondent data, enterprise size, clarity of the questionnaire, ease of use, the usefulness of the questionnaire for assessing innovative management, and whether any improvements were necessary to the questionnaire.

First, it was evaluated with the Respekt Myślenice Sports Club and then with random enterprises. The sports club was selected because innovative management occurs not only in business but also in the third sector or public administration. Moreover, the author has collaborated with the club for several years, and all its members readily complete questionnaires. Respekt Myślenice is a single-sport association of women's football. It has about 50 active members in three tiers. The survey involved adult players who had the necessary knowledge to complete the questionnaire acquired through workshops with a short lecture on basic management and innovation concepts. As the diagnosis and assessment should include both the employee and managers, the questionnaire was completed by the coaching staff (coach, physiotherapist, captain, sports manager) responsible for decision making and training organization. The statutory objectives of the club include the provision of conditions for the promotion of football, particularly among girls and women, provision of various sports training, organization of matches, camps, competitions, and provision of out-of-school sports activities for children and young people. A total of nineteen responses were collected and visualized in Figure 10.2.

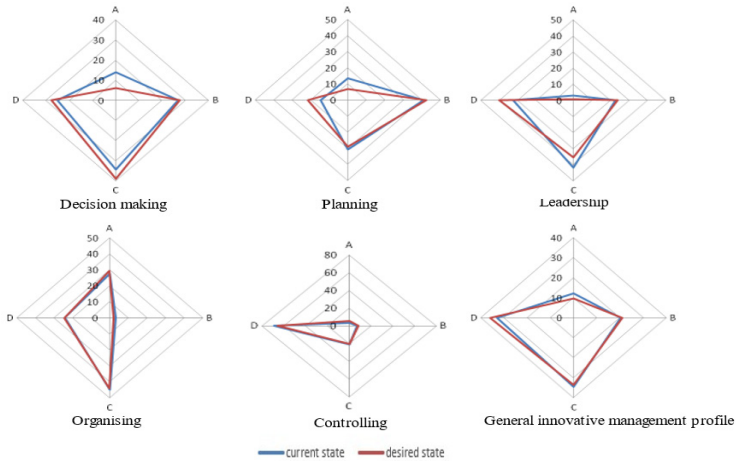


Figure 10.2. Innovative management in Respekt Myślenice – graphical representation of the assessment

Figure 10.2 demonstrated that the members believed the organization exhibited the learning and innovative ‘brain organization’ paradigm the most. It is clear from the answers regarding each domain. The general innovative management profile indicates a limited need for departing from the ‘machine organization’ paradigm towards the innovative organization. Detailed answers show that the need for change can be found in decision-making, planning, and, to a small degree, leadership. These areas exhibit slight differences between the current and desired state. The area of decision-making calls for more collaborative processes. Planning should focus more on strategic than short-term goals. According to the respondents, the sports club is too much oriented towards personal development. The more desirable state would be an orientation towards changes, tapping into the individual potentials of the players, and the coach as a leader. The current state is identical to the desired state regarding organizing and controlling.

The questionnaire was then sent to fifty randomly selected representatives of enterprises, graduates of economics and management who are now employed or run their businesses. They returned twenty completed questionnaires. Thus, the respondent structure is four medium enterprise employees, eight large enterprise employees, four small enterprise employees, three managers in small enterprises, and one manager in a small enterprise. Forty percent of the respondents were from large enterprises, 30% represented medium enterprises, and 30% represented small enterprises. The summary of the results is presented in Figure 10.3.

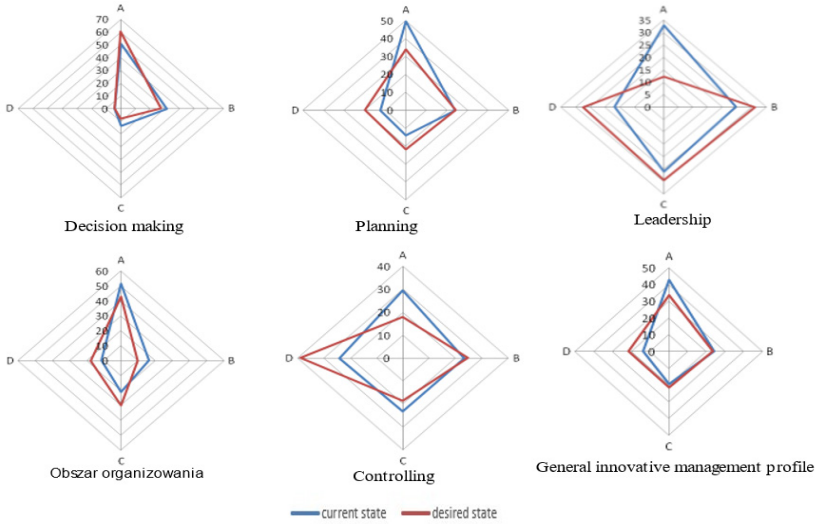


Figure 10.3. Innovative management in the investigated enterprises – graphical representation of the assessment

According to Figure 10.3, the current state was different from the desired state in every respect. The smallest differences were found in decision-making and organizing. Decision-making was oriented towards joint action and distribution of decision-making authority over all management tiers. The desired state was decisions made at the top of the management. It is the only area where the respondents chose the classical paradigm as the desired state. The organizational structure was hierarchical, based on the division of tasks. The expectation was a more flexible structure. The planning and controlling domains exhibited the ‘machine organization’ paradigm, while the desired state was knowledge-based planning, modification of behavior, and orientation towards unique propositions. Controlling should vary depending on the needs of the enterprise. According to the respondents, it should be founded on trust, relationship building, and teamwork. The most significant difference between the current and desired state was in leadership. The respondents believed that leadership should be more oriented towards personal development and inspiration to act. The manager’s orientation towards appreciating the potential of every employee was desirable. The considerations conform to the general profile of innovative management where the innovative organization profile is apparent at the expense of a departure from the classical approach (organization as a machine).

The next stage of the research was the investigation of the relationship between answers, the size of the enterprise, and the position of the respondent. The relationships were analyzed using the Spearman’s rank correlation coefficient. The closer the result was to one, the stronger the correlation between the variables. The correlation coefficient for answers of employees of large and medium enterprises and responses in the questionnaire was 0.5, which indicates a correlation. Therefore, the results for the seven large enterprises and two medium enterprises represented by employees that exhibited correlations are shown in Figure 10.4.

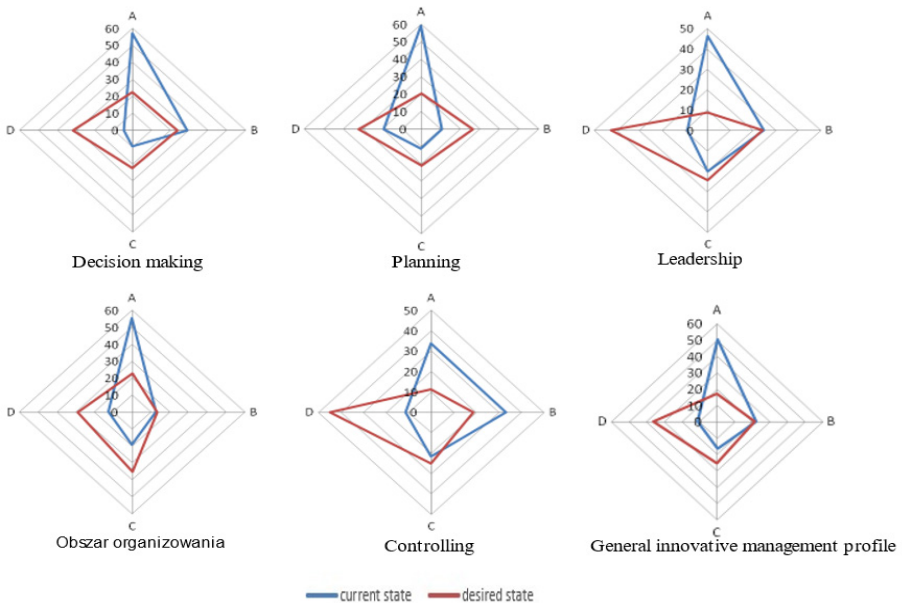


Figure 10.4. Innovative management in medium and large enterprises – graphical representation of the assessment

According to Figure 10.4, the employees assessed the two medium and seven large enterprises as displaying a significant difference between the current and desired state in all areas. It means the need for changes in these enterprises towards innovative management. It is apparent in the general profile where the classical paradigm of the organization as a machine occurs in 60%, while it is desired in 22%. On the other hand, the innovative organization paradigm based on innovative management is evident only in 4%, while it is desirable in 32%.

The MIAT questionnaire (Management Innovation Assessment Tool) was developed to diagnose innovative management. All the subjects (39) considered it a straightforward and easy-to-use tool for assessing innovative management in organizations. Moreover, the respondents believed the questionnaire did not need any amendments and was useful for assessing innovative management in the investigated organizations.

Management calls for new solutions (Kraśnicka, 2018). The innovative management profile in the sports club demonstrated that the current state was not much different from the desired state. The analysis of enterprise representatives' opinions demonstrated that the desired state was different from the current state, particularly in large enterprises. Therefore, these enterprises require more in-depth analyses of the existing management paradigms to design management changes. According to the available opinions, changes should be made regarding setting goals at the top management level and communicating them down the line to be executed. The subjects would see increased employee and functional management participation in goal setting and more strategic goals. Regarding leadership, the opinions demonstrate that managers should focus more on changes, appreciation of each employee's potential, and evolution of their attitudes towards leading. Managers should abandon autocratic methods (employees expected to execute tasks as per procedures obediently).

Regarding controlling, the respondents believed a change in controlling methods was necessary depending on the organizational needs. Management should be based on trust and relationship building rather than strict control. Furthermore, the organizational structure should be more flexible and emerge from the self-organization of its members.

The analysis confirmed the conclusions of Kraśnicka (2018) and Hamel (2006) that management requires new solutions during rapid changes to provide the enterprise with pro-innovative activities that facilitate quick and flexible response to market signals and challenges, leading to strategy implementation (Penc, 1999 and Pocztowski, 2003). The proposed questionnaire may be a valuable tool for diagnosing and assessing innovative management in organizations. The MIAT will help people in charge determine the current and desired management paradigm. However, entrepreneurs' ignorance regarding the usability of the tool can be a serious limitation. Many business people are thriving despite never diagnosing their management paradigm and not knowing their management style. On the other hand, it is yet to be investigated whether lack of innovative management causes crises in organizations.

5. Conclusion

The article has achieved its research objective. The original MIAT questionnaire for diagnosing and assessing innovative management has been discussed. Regarding practical implications, the questionnaire will help entrepreneurs, managers, and leaders of public administration diagnose and assess innovative management in their organizations. Furthermore, the research confirmed the need for new management solutions and a change in the attitude of managers, as discussed extensively by Czakon (2020).

Kraśnicka (2018); made it clear that management changes are necessary regarding planning, organizing, leadership (motivating and leading). This is the purpose of the MIAT. It is intended as a valuable tool for diagnosing and assessing an organization's management paradigm and designing changes that take into consideration new, different perspectives on the obvious (Morgan, 2013). The questionnaire can be used by managers of various levels, entrepreneurs, or social activists. It can also be employed by teachers and lecturers training future managers (such as students of management or business administration during courses of integrated management, management system design, business management, or local government administration). It can further be used by business consultants and during business management training courses.

The added value of the article is the original questionnaire for diagnosing and assessing innovative management in organizations. The results do not support generalized conclusions but give grounds for future research on dependencies between innovative management and organizational culture or operational efficiency. Moreover, future research can attempt to tackle the research question of whether innovative management affects business results and employee motivation. The limitations include a small sample and a random selection of enterprises. Another limitation could be the application of the questionnaire to case studies. The best solution is to analyze the entire organization and involve all its members.

References

- Apanowicz, J. (2002). *Metodologia Ogólna*. Gdynia: Wyższa Szkoła Administracji i Biznesu.
- Bagnoa, R. B., Salernob, M.S., & Diasa, A.V.C. (2017). Innovation as a new organizational function: Evidence and characterization from large industrial companies in Brazil. *Production*, 27, e20162073. <https://doi.org/10.1590/0103-6513.207316>

- Birkinshaw, J., Hamel, G., & Mol, M.J. (2008). Management Innovation. *Academy of Management Review*, 4, 825–845. <http://dx.doi.org/10.5465/AMR.2008.34421969>
- Bratnicki, M., Strużyna, J., & Dyduch, W. (2001). Kapitał intelektualny: Odwieczne problemy a nowe propozycje metodologiczne. In A. Poczowski (Ed.), *Kapitał Intelektualny. Dylematy i Wyzwania*. Nowy Sącz: Wyższa Szkoła Biznesu – National Louis University.
- Cameron, K.S., & Quinn, R.E. (2003). *Kultura Organizacyjna – Diagnoza i Zmiana*. Kraków: Oficyna Ekonomiczna.
- Canen, A.G. (2002). Innovation management education for multicultural organizations: Challenges and a role for logistics. *European Journal of Innovation Management*, 2, 73–83.
- Cannon, J.A., & McGee, R. (2015). *Zarządzanie Talentami i Planowanie i Ścieżek Kariery*. Warszawa: ABC a Wolters Kluwer business.
- Czekaj, J. (2013). *Metody Organizatorskie w Doskonaleniu Systemu Zarządzania*. Warszawa: Wydawnictwo WNT.
- Ciesielski, M. (2014). Paradygmaty w naukach o zarządzaniu. *Przegląd Organizacji*, 1, 3–6.
- Czakon, W. (2021). *Krótkowzroczność Strategiczna Menedżerów*. Kraków: Wydawnictwo Uniwersytetu Jagiellońskiego.
- Damanpour, F. (2020). *Organizational Innovation. Theory, Research, and Direction*. Retrieved from <http://dx.doi.org/10.4337/9781788117449>
- Damanpour, F., & Aravind, D. (2011). Managerial innovation: Conceptions, processes, and antecedents. *Management and Organization Review*, 8(2), 423–454. https://econarticles.repec.org/article/blamgorev/v_3a8_3ay_3a2012_3ai_3a2_3ap_3a423-454.htm
- Dyduch, W., & Bratnicki, M. (2016). Charakterystyki organizacji inteligentnej. *Zeszyty Naukowe SGH w Warszawie, Studia i Prace Kolegium Zarządzania i Finansów*, 149, 10–11.
- Faulkner, D., & Bowman C. (1996). *Strategie Konkurencji*. Warszawa: Gebethner&Ska.
- Flak, O. (2012). Rola wybranych aspektów innowacyjności zarządczej w tworzeniu konkurencyjności przedsiębiorstwa. *Współczesne Zarządzanie*, 4, 46–55.
- Gierszewska, G., & Romanowska, M. (1999). *Analiza Strategiczna przedsiębiorstwa*. Warszawa: Polskie Wydawnictwo Ekonomiczne.
- Ginter, A., & Kałuża, H. (2013). Inteligentna organizacja jako źródło sukcesu organizacji na wybranym przykładzie. *Zeszyty Naukowe Uniwersytetu Przyrodniczo –Humanistycznego w Siedlcach, Seria: Administracja i Zarządzanie*, 97, 114–124.
- Gliński, B., Kuc, B.R., & Szczepankowski, P. (1996). *Zarządzanie Strategiczne*. Warszawa: Key Text.
- Godziszewski, B. (2001). *Zasobowe Uwarunkowania Strategii Przedsiębiorstwa*. Toruń: Uniwersytet Mikołaja Kopernika.

- Gorzelany-Dziadkowiec, M. (2014). *Analiza Konkurencyjności Organizacji*. Kraków: Uniwersytet Ekonomiczny.
- Grodziski, J. (2003). *Rola Kapitału Ludzkiego w Rozwoju Gospodarki Globalnej*. Gdańsk: Uniwersytet Gdański.
- Haeckel, S.H., & Nolan, R.L. (1993). The role of technology in an information age. In P.J. Myer (Ed.), *The Knowledge Economy. The Nature of Information in the Twenty-first Century*. Institute for Information Studies. Harvard: Harvard University Press.
- Hage, J.T. (1999). Organizational innovation and organizational change. *Annual Review of Sociology*, 25, 597–622. <https://doi.org/10.1146/annurev.soc.25.1.597>
- Hamel, G. (2006). Innowacje w sferze zarządzania: Powody, cele i sposoby. *Harvard Business Review – Polska*, 38, 57–68.
- Hamel, G., & Prahalad, C.K. (2002). Thinking differently. *Business Quarterly*, 59(4), 22–35.
- Handy, Ch. (1998). *Wiek Przewyciężonego Rozumu*, Warszawa: Business Press.
- Hejduk, I.K. (2016). Nowe paradygmaty zarządzania – od organizacji inteligentnej do koncepcji sustainable enterprises (przedsiębiorstwa przyszłości). *Zeszyt Naukowy SGH w Warszawie, Studia i Prace Kolegium zarządzania i Finansów*, 149, 26–36.
- Hoffman, E. (2003). *Ocena Psychologiczna Pracowników*. Gdańsk: Gdańskie Wydawnictwo Psychologiczne.
- Kamiński, R. (2018). Istota innowacji - definicje, wyznaczniki i rodzaje. In R. Kamiński (Ed.), *Innowacje Gospodarcze - Wybrane Aspekty Ekonomiczne i Prawne* (pp. 13–25). Poznań: Wydawnictwo Naukowe UAM.
- Kimberly, J.R. (1981). Managerial innovation. In P.C. Nystrom, & W.H. Starbuck (Eds.), *Handbook of Organizational Design* (pp. 84–104). New York: Oxford University Press.
- Kraśnicka, T. (2018). *Innowacje w Zarządzaniu. Nowe Ujęcie*. Warszawa: Wydawnictwo C. H. Beck.
- Kraśnicka, T., Głód, W., & Wronka, M. (2014). Pojęcie, determinanty i znaczenie innowacji zarządczych (management innovation) - Stan badań nad zjawiskiem. *Zeszyty Naukowe. Organizacja i Zarządzanie, Politechnika Śląska*, 73, 333–349.
- Krupski, R. (2003). Zarządzanie strategiczne w nieprzewidywalnym otoczeniu. *Przegląd Organizacji*, 3, 10–13.
- Lachiewicz, S. (2014). Innowacje organizacyjne w małych i średnich przedsiębiorstwach. *Studia Ekonomiczne Uniwersytet Ekonomiczny w Katowicach*, 183, 153–161.
- Lam, A. (2004). Organizational innovation. Brunel Research in Enterprise, Innovation, Sustainability, and Ethics Uxbridge, West London UB8 3PH U.K. Working Article No. 1. https://doi.org/10.1007/978-1-4020-6071-7_5

- Leovaridis, C., & Popescu, G. (2015). Organizational innovation – A means to enhance quality of life for employees in knowledge economy. *Management Dynamics in the Knowledge Economy*, 3(1), 25–43.
- Lichtarski, J.M. (2010). Innowacje w obszarze struktur organizacyjnych przedsiębiorstw i jednostek sektora publicznego. *Prace Naukowe Akademia Ekonomiczna w Katowicach. Tom: Innowacje w Zarządzaniu Przedsiębiorstwem oraz Instytucjami Sektora Publicznego. Teoria i Praktyka*, 373–380.
- Lisiński, M. (2016). Metody naukowe w metodologii nauk o zarządzaniu, *Przegląd Organizacji*, 4, 11–19.
- Machaczka, J. (1999). *Podstawy Zarządzania*. Kraków: Akademia Ekonomiczna.
- March, J.G., & Olsen, J.P. (1979). *Ambiguity and Choice in Organizations*. Bergen, Norway: Universitetsforlaget
- Marczyk, K. (2004). Użytkowa i poetycka funkcja metafory: O metaforze maszyny w analizie organizacji przedsiębiorstw i w poezji. *Annales Universitatis Paedagogicae Cracoviensis. Studia Historicolitteraria*, 4, 241–250.
- Mikuła, B. (2001). *Elementy Nowoczesnego Zarządzania. W Kierunku Organizacji Inteligentnych*. Kraków-Kluczbork: Antykwa.
- Mikuła, B. (2007). Zarządzanie talentami. In B. Mikuła, A. Pietruszka-Ortyl, & A. Potocki (Eds.), *Podstawy Zarządzania Przedsiębiorstwami w Gospodarce Opartej na Wiedzy* (pp. 6–24.). Warszawa: Difin.
- Miś, A. (2009). Zarządzanie talentami w organizacji. *Zeszyty Naukowe Uniwersytetu Ekonomicznego*, 810, 39–54.
- Mothe, C., & Thi, T. U. N. (2010). The link between non-technological innovations and technological innovation. *European Journal of Innovation Management*, 13(3), 313–332.
- Morgan, G. (2013). *Obrazy Organizacji*. Warszawa: Wydawnictwo Naukowe PWN.
- Mróz, J. (2015). Zarządzanie talentami – modele i podejścia badawcze. *Nauki o Zarządzaniu, Management Sciences*, 2, 93–107.
- Nonaka, I., & Takeuchi, H. (2000). *Kreowanie Wiedzy w Organizacji*. Warszawa: Poltext.
- Obłój, K. (2007). *Strategia Organizacji*. Warszawa: Polskie Wydawnictwo Ekonomiczne.
- OECD (2005). *Oslo Manual*. Retrieved from <http://www.oecd.org/science/inn/2367580.pdf>
- Penc, J. (1999). *Strategie Zarządzania*, Warszawa: Placet.
- Pocztowski, A. (2003). *Zarządzanie Zasobami Ludzkimi. Strategie – Procesy – Metody*. Warszawa: Polskie Wydawnictwo Ekonomiczne.
- Pocztowski, a. (2008). *Zarządzanie Talentami w Organizacji*. Warszawa: Wolters Kluwer.

- Pocztwoski, A. (2007). *Zarządzanie Zasobami Ludzkimi*. Warszawa: Polskie Wydawnictwo Ekonomiczne.
- Pomykański, A. (2001). *Zarządzanie Innowacjami*. Warszawa-Łódź: Polskie Wydawnictwo Ekonomiczne.
- Quinn, J.B., (1992), The intelligent enterprise. A new paradigm. *Academy of Management Review*, 4, 48–59.
- Razavi, S.H., & Attarnezhad, O. (2013). Management of organizational innovation. *International Journal of Business and Social Science*, 4(1), 226–232.
- Robbins, S.P., & De Cenzo, D.A. (2002). *Podstawy Zarządzania*. Warszawa: Polskie Wydawnictwo Ekonomiczne.
- Romanowska, M. (2001). Kształtowanie wartości firmy w oparciu o kapitał intelektualny. In R., Borowiecki & M. Romanowska (Eds.), *Systemy Informacji Strategicznej. Wywiad Gospodarczy a Konkurencyjność Przedsiębiorstwa* (pp. 10–30). Warszawa: Difin.
- Sieja, Z. (2000). Przedsiębiorstwo inteligentne. In K. Perechuda (Ed.), *Zarządzanie Przedsiębiorstwem Przyszłości. Koncepcje, Modele, Metody* (pp. 36–47). Warszawa: Placet.
- Stabryła, A. (2007). *Zarządzanie Strategiczne w Teorii i Praktyce Firmy*. Warszawa: Polskie Wydawnictwo Naukowe.
- Stabryła, A. (2011). Koncepcja wieloaspektowej analizy systemów zarządzania przedsiębiorstwem. *Zeszyty Naukowe Uniwersytetu Ekonomicznego w Krakowie*, 871, 5–23.
- Steiber, A., & Sverker, A. (2015). Organizational innovation: a comprehensive model for catalyzing organizational development and change in a rapidly changing World. *Steiber and Alänge Triple Helix*, 2(1), 1–25. <https://doi.org/10.1186/s40604-015-0021-6>
- Storey, Ch., & Kahn, K.B. (2010). The role of knowledge management strategies and task knowledge in stimulating service innovation, *Journal of Service Research*, 13(4), 397–410. <https://doi.org/10.1177/1094670510370988>
- Ettlie, J.E., & Rosenthal, S.R. (2011). Service versus Manufacturing Innovation. *Special Issue: Special Issue on Agent-Based Modeling of Innovation Diffusion*, 28(2), 285–299. <https://doi.org/10.1111/j.1540-5885.2011.00797.x>
- Tiwari, R., Buse, S., & Herstatt, C. (2007). Innovation via global route: Proposing a reference model for global innovation activities. *Proceedings of the Second International Conference on Management of Globally Distributed Work* (pp. 451–465). Bangalore: Indian Institute of Management.
- Tranfield, D., Denyer, D., & Smart, P. (2003). Towards a methodology for developing evidence-informed management knowledge by means of systematic review. *British Journal of Management*, 14, 207–222. <http://dx.doi.org/10.1111/1467-8551.00375>

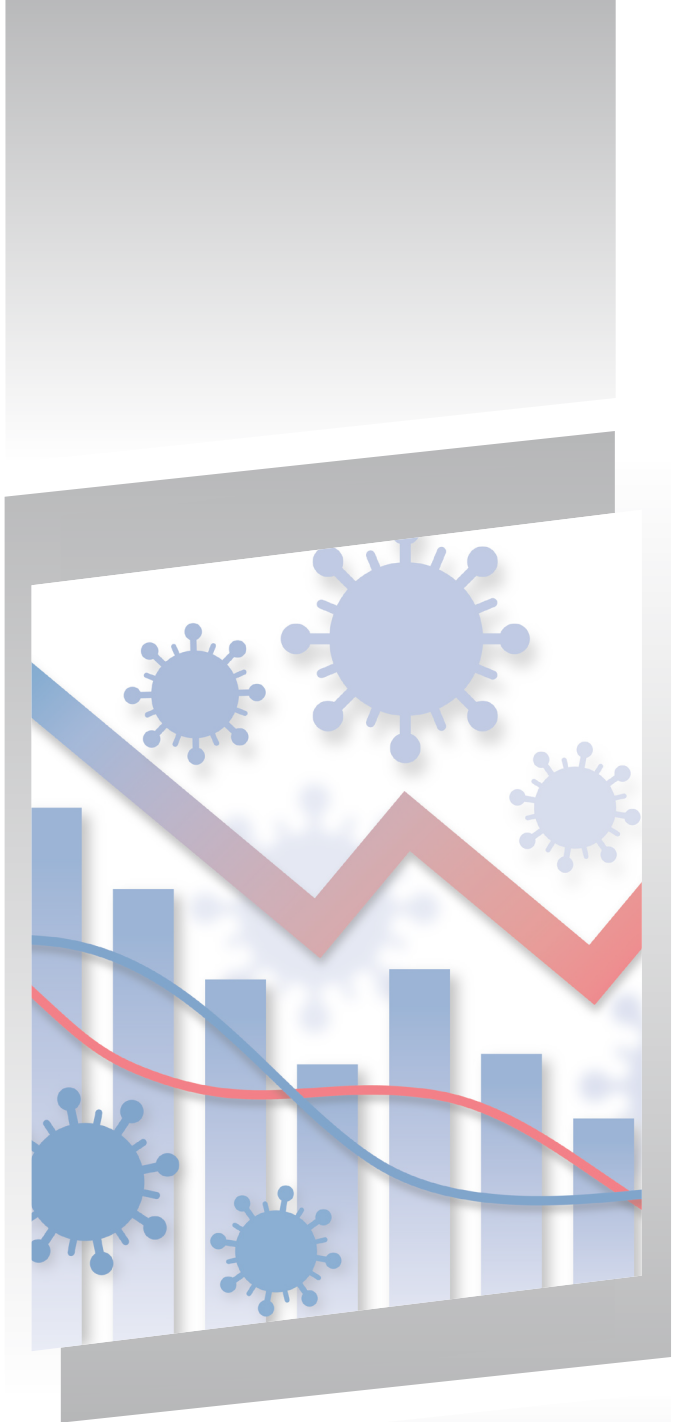
- Tyrańska, M. (2015). *Koncepcja Systemu Oceny Kompetencji Kadry Menedżerskiej w Przedsiębiorstwie*. Kraków: Uniwersytet Ekonomiczny.
- Vaccaro, I. G., Jansen, J. J.P., Van Den Bosch F. A. J., & Volberda, H.W. (2012). Management innovation and leadership: The moderating role of organizational size. *Journal of Management Studies*, 49(1), 28–51. <http://dx.doi.org/10.1111/j.1467-6486.2010.00976.x>
- Wilensky, M.L. (1967). *Organisational Intelligence*. London: Basic Books.
- Wiszniewski, E., & Wiszniewski, W. (2002). Czas na mikro – zarządzanie. *Ekonomika I Organizacja Przedsiębiorstw*, 12, 3–12.
- Wolpert, J.D. (2002). Breaking out of the innovation box. *Harvard Business Review*, 4, 76–87.
- Zaremba, M. (2015). Polityka innowacyjna kraju rozwijającego się na przykładzie Indii. *Zeszyty Naukowe Małopolskiej Wyższej Szkoły Ekonomicznej w Tarnowie*, 1, 211–221.
- Ziębicki, B. (2009). Założenia modelu oceny efektywności organizacji uczącej się. In A. Potocki (Ed.), *Globalizacja a Społeczne Aspekty Przeobrażeń i Zmian Organizacyjnych* (pp. 376–384). Warszawa: Difin.

Biographical note

Magdalena Gorzelany-Dziadkowiec was awarded Ph.D. in Economics from the Cracow University of Economics in Management Sciences. She is currently a researcher at the Cracow University of Economics, Faculty of Economics and International Relations, Department of Management Strategy and Organization Development. She specializes in issues related to the competitiveness of organizations and the competitiveness of small and medium-sized enterprises. She is also interested in change management and the development of organizations, cities, and regions. She is the author of 62 publications. In addition, she has participated in 46 conferences in Poland and abroad.

Citation (APA Style)

Gorzelay-Dziadkowiec, M. (2021). Measuring innovative management with Management Innovation Assessment Tool. In A. Ujwary-Gil & B. Godlewska-Dzioboń (Eds.), *Challenges in Economic Policy, Business, and Management in the COVID-19 Era* (pp. 245–266). Warsaw: Institute of Economics, Polish Academy of Sciences.



ISBN: 978-83-61597-80-3

eISBN: 978-83-959006-0-0

ISBN 978-83-61597-80-3



9 788361 597803