XLIX Simpozijum o operacionim istraživanjima

XLIX International Symposium on Operational Research

SYM-OP-IS 2022

Vrnjačka Banja, 19-22. septembar 2022.

ZBORNIK RADOVA
PROCEEDINGS

Urednici / Editors:

prof. dr Zorica Mladenović

dr Mladen Stamenković

UNIVERZITET U BEOGRADU
Ekonomski fakultet
UNIVERSITY OF BELGRADE
Faculty of Economics and Business

Izdavač / Publisher
Univerzitet u Beogradu – Ekonomski fakultet
Centar za izdavačku delatnost
Kamenička 6, Beograd
http://cid.ekof.bg.ac.rs/
cid@ekof.bg.ac.rs

The Publishing Centre of the Faculty of Economics in Belgrade
University of Belgrade - Faculty of Economics and Business
Kamenička 6, Belgrade, Serbia

Za izdavača / In behalf of publisher
prof. dr Žaklina Stojanović

Urednici / Editors
prof. dr Zorica Mladenović
dr Mladen Stamenković

Štampa / Printed by

Tiraž / No. of copies
50

Godina izdavanja / Publishing year
2022

ISBN: 978-86-403-1750-4

IZVRŠNI ORGANIZATOR / EXECUTIVE ORGANIZERS

Univerzitet u Beogradu – Ekonomski fakultet

University of Belgrade – Faculty of Economics and Business

SUORGANIZATORI / CO-ORGANIZERS

Rudarsko-geološki fakultet, Beograd

Ministarstvo odbrane Republike Srbije

Vojska Republike Srbije

Matematički institut, Beograd

Univerzitet u Beogradu – Matematički fakultet

Visoka građevinsko-geodetska škola, Beograd

Ekonomski institut, Beograd

Društvo operacionih istraživača Srbije

Univerzitet u Beogradu – Fakultet organizacionih nauka

Univerzitet u Beogradu – Saobraćajni fakultet

Institut Mihajlo Pupin, Beograd

Fakultet tehničkih nauka, Novi Sad

Univerzitet u Banjoj Luci

PROGRAMSKI ODBOR / PROGRAMME COMMITTEE

Zorica Mladenović, EF, Beograd, predsednik
Milan Dražić, MF, Beograd
Dragan Urošević, MI SANU, Beograd
Vule Aleksić, VGGŠ, Beograd
Mirjana Čangalović, FON, Beograd
Goran Ćirović, FTN, Novi Sad
Ivan Nikolić, EI, Beograd
Tatjana Davidović, MI SANU, Beograd
Branka Dimitrijević, SF, Beograd
Rade Doroslovački, FTN, Novi Sad
Boban Đorović, UO, Beograd
Đorđe Dugošija, UNP, Novi Pazar
Radoje Banković, VGI, Beograd
Irena Janković, EF, Beograd
Jelena Kočović, EF, Beograd
Nenad Mladenović, MI SANU, Beograd
Vera Kovačević-Vujčić, FON, Beograd
Jozef Kratica, MI SANU, Beograd
Đuro Kutlača, IMP, Beograd
Marija Kuzmanović, FON, Beograd
Duško Letić, TFZR, Zrenjanin
Dragana Makajić-Nikolić, FON, Beograd
Milan Martić, FON, Beograd
Igor Miljanović, RGF, Beograd
Snežana Mitrović, VGGŠ, Beograd
Feđa Netjasov, SF, Beograd
Dragan Nikolić, VGGŠ, Beograd
Dalibor Petrović, MO RS
Nataša Petrović, FON, Beograd
Slavica Petrović, EF, Kragujevac
Željko Praštalo, RGF, Beograd
Ljubiša Preradović, AGGF, Banja Luka
Dragan Radojević, IMP, Beograd
Aleksandar Savić, MF, Beograd
Gordana Savić, FON, Beograd
Milica Šelmić, SF, Beograd
Stanko Stanić, EF, Banja Luka
Zorica Stanimirović, MF, Beograd
Milan Stanojević, FON, Beograd
Milorad Stanojević, SF, Beograd
Dušan Starčević, FON, Beograd
Dejan Stojković, MO RS
Milija Suknović, FON, Beograd
Milorad Vidović, SF, Beograd
Mirko Vujošević, FON, Beograd
Katarina Vukadinović, SF, Beograd
Daniel Aloise, Polytechnique Montreal, Canada
Abdelhakim Artiba, Université Polytechnique Hauts-de-France, France
Emilio Carrizosa, University of Sevilla, Spain
Abraham Duarte, Universidad Rey Juan Carlos, Spain
Anton Eremeev, Omsk Branch of Sobolev Institute of Mathematics, Russia
Laureano Escudero, Universidad Rey Juan Carlos, Spain
Saïd Hanafi, INSA Hauts-de-France, France
Miroslav Hudec, University of Economics, Bratislava, Slovakia
Yuri Kochetov, Sobolev Institute of Mathematics, Russia
Martine Labbé, Université Libre de Bruxelles, Belgium
Belén Melián Batista, University La Laguna, Spain
Athanasios Migdalas, Luleå University of Technology, Sweden
José A. Moreno-Perez, University of La Laguna, Spain
Markos Papageorgiou, Technical University of Crete, Greece
Günther Raidl, Vienna University of Technology, Austria
Said Salhi, University of Kent, United Kingdom
Marc Sevaux, Université de Bretagne-Sud, France
Angelo Sifaleras, University of Macedonia,Greece
Kenneth Sörensen, University of Antwerp, Belgium

POČASNI PROGRAMSKI ODBOR / HONORARY PROGRAMME COMMITTEE

Marko Andrejić, VA, Beograd
Marko Backović, EF, Beograd
Vladan Batanović, IMP, Beograd
Siniša Borović, FMMSP, Beograd
Obrad Čabarkapa, MO RS
Dragoš Cvetković, SANU, Beograd
Branislav Đorđević, GF, Beograd
Slobodan Guberinić, IMP, Beograd
Aleksandar Ilić, MO RS
Mitar Kovač, MO RS
Slobodan Krčevinac, FON, Beograd
Katalin Mesaroš, EF, Subotica
Miodrag Mihaljević, MI SANU, Beograd
Gradimir Milovanović, SANU, Niš
Spasoje Mučibabić, MO RS
Ilija Nikolić, FGM, Beograd
Endre Pap, Univerzitet Singidunum, Beograd
Zoran Ognjanović, MI SANU, Beograd
Serafim Opricović, GF, Beograd
Radivoj Petrović, IMP, AINS, Beograd
Milan Rakić, IMP, Beograd
Slobodan Vujić, RI, Beograd
Svetozar Vukadinović, SF, Beograd
Jovo Vuleta, EF, Beograd
Tomislav Zečević, EF, Beograd

ORGANIZACIONI ODBOR / ORGANIZING COMMITTEE

Dragan Azdejković, predsednik, Univerzitet u Beogradu – Ekonomski fakultet, predsednik
Irena Janković, Univerzitet u Beogradu – Ekonomski fakultet
Đorđe Stakić, Univerzitet u Beogradu – Ekonomski fakultet
Emilija Maksimović, Univerzitet u Beogradu – Ekonomski fakultet

NOSIOCI POVELJE ZA ZASLUGE U RAZVOJU OPERACIONIH ISTRAŽIVANJA / ACKNOWLEDGEMENT FOR MERITS IN DEVELOPMENT OF OPERATIONAL RESEARCH

Božidar Kraut (1983)
Alojzij Vadnal (1983)
Dragoslav Marković (1983)
Branislav Ivanović (1984)
Ljubomir Martić (1984)
Radivoj Petrović (1984)
Jovan Petrić (1988)
Sanjo Zlobec (1990)
Radoslav Stanojević (1991)
Svetozar Vukadinović (1993)
Slobodan Krčevinac (1993)
Slobodan Guberinić (1993)
Jovo Vuleta (1993)
Vera Kovačević-Vujčić (1998)
Dušan Teodorović (1998)
Vlastimir Matejić (2000)
Mirko Vujošević (2000)
Siniša Borović (2001)
Tomislav Zečević (2001)
Slobodan Vujić (2003)
Dragan Radojević (2006)
Mirjana Čangalović (2010)
Nenad Mladenović (2010)
Spasoje Mučibabić (2010)
Milan Martić (2012)
Dragoš Cvetković (2013)
Đorđe Dugošija (2017)
Goran Ćirović (2017)
Milorad Vidović (2019)
Dragan Urošević (2021)

PREDGOVOR

Simpozijum o operacionim istraživanjima (Sym-Op-Is) održava se 2022. godine po 49. put i to u Vrnjačkoj Banji od 19. do 22. septembra. Glavni organizator 49. Sym-Op-Is-a je Ekonomski fakultet Univerziteta u Beogradu, koji 2022. godine obeležava značajan jubilej – 85 godina od osnivanja.

Zbornik radova 49. Sym-Op-Is-a sadrži 91 rad i 23 apstrakta sa ukupno 265 koautora. Većina autora radova je iz Srbije. Inostrani istraživači su iz sledećih zemalja: Bangladeš, Bosna i Hercegovina, Italija, Izrael, Kina, Rusija, SAD, Severna Makedonija, Slovenija i Španija. Radovi su grupisani u 23 tematske sekcije.

U izboru i pripremi radova Zbornika učestovalo je 39 recenzenata (od toga 27 članova Programskog odbora Sym-Op-Is-a). Dugujemo svima iskrenu zahvalnost za posvećenost recenzentskom procesu.

Na 49. Sym-Op-Is-u biće održana dva plenarna predavanja po pozivu. Predavači su cenjeni profesori visoke naučne reputacije oblasti višekriterijumskog odlučivanja: dr Salvatore Corrente, sa Univerziteta u Kataniji i dr Miłosz Kadziński, sa Tehnološkog Univerziteta u Poznanju. Takođe, predavanje po pozivu u okviru sekcije Matematičko programiranje održaće ugledni profesor oblasti matematičke logike, dr Mirjana Ilić sa Ekonomskog fakulteta Univerziteta u Beogradu.

Nadamo se da će ovogodišnji Sym-Op-Is, kao i ranijih godina, biti centar intenzivne i korisne razmene naučnih ideja operacionih istraživača.

Urednici
Zorica Mladenović
Mladen Stamenković

PREFACE

The Symposium on Operational Research (Sym-Op-Is) will be held for the 49th time in Vrnjačka Banja from September 19 to 22, 2022. The main organiser of the 49th Sym-Op-Is is the Faculty of Economics and Business, University of Belgrade, which in 2022 is celebrating a significant anniversary – 85 years since its foundation.

The Proceedings of the 49th Sym-Op-Is contain 91 papers and 23 abstracts, with 265 coauthors overall. Most of the authors are from Serbia, while foreign researchers are from the following countries: Bangladesh, Bosnia and Herzegovina, Italy, Israel, China, Russia, USA, North Macedonia, Slovenia, and Spain. The papers are grouped into 23 thematic sections.

Overall, 39 reviewers participated in the selection and preparation of the Proceedings (including 27 members of the Program Committee of Sym-Op-Is). We owe everyone sincere gratitude for their dedication to the review process.

The 49th Sym-Op-Is will include two plenary lectures by invited lecturers. The lecturers are respected professors of high scientific reputation in the field of multiple criteria decision aiding: Dr. Salvatore Corrente from the University of Catania and Dr. Miłosz Kadziński from the Poznań University of Technology. Also, a lecture by invitation within the Mathematical Programming section will be held by a respected professor of mathematical logic, Dr. Mirjana Ilić, from the Faculty of Economics and Business, University of Belgrade.

As in previous years, we hope that this year's Sym-Op-Is will be a centre for an intensive and useful exchange of scientific ideas among operational researchers.

Editors
Zorica Mladenović
Mladen Stamenković

POSLOVNA ANALITIKA

BUSINESS ANALYTICS

UNIVERZITET U BEOGRADU
Ekonomski fakultet
UNIVERSITY OF BELGRADE
Faculty of Economics
and Business

THE COVID-19 INFLUENCE ON SMES IN A DEVELOPING COUNTRY: A DELPHI METHOD

MIMOZA ARIFI[1], VIOLETA CVETKOSKA[2]

[1] Ss. Cyril and Methodious University in Skopje, Faculty of Economics - Skopje, mimozzaarifi@gmail.com
[2] Ss. Cyril and Methodious University in Skopje, Faculty of Economics - Skopje, vcvetkoska@eccf.ukim.edu.mk

Abstract: *With the decisions that enterprises make today, they write their future whether they will work successfully or will be surpassed by the competition and in the worst case will disappear from the market. However, what shifted the normal course of operation of the enterprises in the first quarter of 2020 is the coping with the health crisis caused by the COVID-19 pandemic, when many enterprises worldwide laid off their employees, and millions of new layoffs are announced. The aim of this paper is to examine the judgments of panel experts on how SMEs in the Republic of North Macedonia are coping with the crisis, what measures can help SMEs overcome the negative consequences of the pandemic, and which factors affect their decision to lay off employees the most. The research is conducted using the Delphi method. The obtained results are presented and analyzed and will serve the policy makers in shaping the needed measures to improve the operating landscape of SMEs.*

Keywords: *SMEs, COVID-19, Expert's Judgements, Delphi Method, Developing Country.*

1. INTRODUCTION

The global COVID-19 pandemic has had vast consequences for business and consumer behavior. With technology at their disposal, businesses in a variety of industries have been compelled to close their doors to their offices and shops and adapt to more remote working circumstances.

[1] analyzes 69 SME crisis-related articles before COVID-19 and proposes ways to overcome the economic downturns in the finance, strategy, and institutional environment fields. To examine the challenges of returning to work and the policy requirements imposed by COVID-19, [2] studies 4807 SMES in Sichuan Province, China. Due to a shortage of epidemic mitigation materials, employees' inability to return to work, disrupted supply chains, and diminished market demand, most SMEs were unable to continue operations. [3] examine on the early effects of COVID-19 on 367 agrifood MSMEs in 17 countries. Their findings demonstrate that the pandemic has had an impact on 94.3 % of the sample's operations, first by reducing sales and then by limiting access to inputs and finance due to lack of financial reserves. Staffing issues are also frequently mentioned.

SMEs that use predictive analytics techniques can predict what will happen in the future. In cases when no historical data is available to make the prediction, a judgmental approach can be applied. Delphi is a qualitative method that is used for forecasting the likelihood of future events and their impact on the problem of interest, taking into account a panel of experts who need to respond to a series of questionnaires, each conducted in a separate round [4].

In this paper, we examine the judgments of panel experts on how SMEs in one developing country, the Republic of North Macedonia, are coping with the crisis; what measures can help SMEs overcome the negative consequences of the pandemic; and which factors affect their decision to lay off employees the most. The research was conducted using the Delphi method and is the first of its type in our country. The obtained results have been visualized and analyzed, and they will help policymakers shape the necessary measures to improve the operating landscape of SMEs.

The paper is organized as follows. Section 2 describes the methodology and data that were used. In Section 3 are presented and analyzed the obtained results, while the conclusion is given in Section 4.

2. METHODOLOGY AND DATA

The qualitative forecasting approach places emphasis on using experience and intuition and can be applied when there is no available historical data, or when the forecast refers to a longer future period [4]. One of the most used qualitative (judgmental) forecasting methods is Delphi. This method is used to achieve

consensus for the best solution to a complex issue, and it is appropriate when there is a geographical distance between the experts or when they have conflicting opinions. So, in the first round, the facilitator will send a questionnaire with more general questions in order to collect the panel experts' opinions. Then, the facilitator should compile the responses (those that are same and those that have the same meaning but are worded differently) and calculate the frequency of the responses. The questions for round two should be formulated based on the answers from round one. Therefore, the facilitator should send the new questionnaire in round two, where each respondent should see their own answer and the answers of the other respondents, but their identity will be kept confidential in all rounds. Preserving anonymity is crucial in applying this method in order to obtain unbiased solutions. In the second round, the respondents need to prioritize the answers and give a textual explanation. Again, the facilitator collects and summarizes the data and repeats the round until a consensus is achieved. Usually there are three rounds, but this number varies depending on the consensus achieved. The respondents are allowed to revise their responses in the next round, but if they make any revisions, they are required to explain the reason for that. The output of the conducted rounds in the Delphi method is the facilitator‘s final report, and it contains the respondents' answers.

In this paper we use a Delphi-based questionnaire to achieve our main objective. The questionnaire is distributed by e-mail to five panel experts in this area (the group is heterogeneous) and after answering the questions, they should send it by e-mail to the authors. Because in the use of this method, the participants must be anonymous in order to prevail in obtaining biased answers or solutions, each participant was coded with a different color that was only explained to him/her.

The first round consists of five open questions about the identification of sectors that will have the highest losses, opinions on the operation of small and medium enterprises in North Macedonia, measures that would help SMEs overcome the negative consequences of the pandemic, and factors that influence the most those enterprises that lay off employees. After obtaining the responses, we will compile them (those that are the same and those that have the same meaning but are worded differently).

The questions for round two are formulated based on the answers from round one. Therefore, we will send the new questionnaire in round two, where each respondent should see their own answer and the answers of the other respondents, but their identity will be kept confidential in all rounds. In this round, the respondents will need to answer "I agree" or "I do not agree" to all questions, except for the industry that will have the highest losses and the factors that influence employee layoffs, where they need to give a grade from 1–5 (1 being the least important, and 5 being the most important). Again, we will collect and summarize the data and repeat the round until a consensus is achieved. The number of rounds will depend on the consensus achieved.

The first questionnaire was filled out in June 2020, and the second in the first half of July. In the third round, consensus was achieved, so the survey ended in July. It was answered by four panel experts. The obtained results are presented and analyzed in the Section that follows.

3. RESULTS AND ANALYSIS

According to the obtained results, the SMEs in the transport industry will have the most losses ($\overline{x}$ = 4.50), followed by crafts ($\overline{x} = 4.25$) and the tourism and hospitality sector ($\overline{x} = 4.00$) (Figure 1).

All respondents agree that how SMEs will cope with the crisis depends on how the neighboring countries, especially the countries with which North Macedonia has the largest trade exchange, will cope with the COVID-19 pandemic; from the capital investment projects by the state and the dynamics of their execution at the central and local levels; lack of liquidity; loss-making operations; and even if the coronavirus completely disappears, tourism and hospitality will have losses.

All of the experts agree that the reduction of work, which implies firms to be unable to pay their employees' salaries, had the greatest impact on the decision to lay off employees. In addition, three of the experts agreed that the state did not react quickly enough to help small and medium-sized enterprises with the set of measures adopted to cover the salaries of employees.

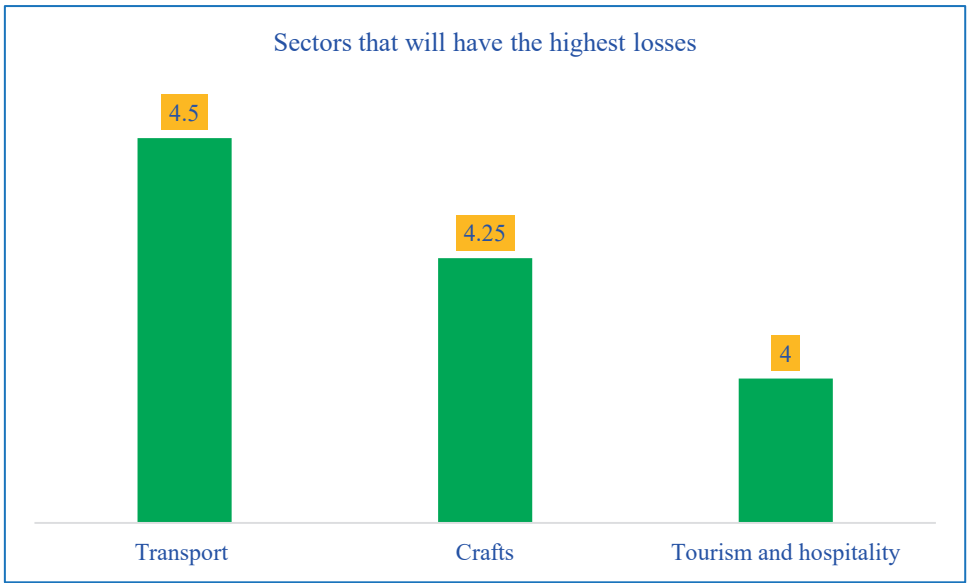

Figure 1: Average grade of importance for sectors that will have the highest losses

The measures that would help SMEs overcome the negative consequences of the crisis are: the establishment of fund to help to alleviate the negative effect of the coronavirus ($\bar{x} = 4.75$), direct assistence from the state with interest-free credit lines through the Development Bank of North Macedonia for existing businesses ($\bar{x} = 4.25$), the establishment of strategic subsidy packages ($\bar{x} = 4.00$), the renewal of the campaign for purchasing domestic products to rise public awareness about the benefits of buying domestic products and their impact on the sustainability and development of domestic companies ($\bar{x} = 4.00$), to encourage the processing industry of primary agricultural products ($\bar{x} = 4.00$), the assitance from the state to ensure the placement of basic agricultural products in foreign markets ($\bar{x} = 4.00$), etc. (Figure 2).

#	Measure	Average grade of importance
1	It is critical to establish a fund to help alleviate the negative effects of the coronavirus.	4.75
2	Direct assistance from the state with interest-free credit lines through the Development Bank of North Macedonia for existing businesses.	4.25
3	Establishing strategic subsidy packages.	4.00
4	Renewal of the campaign for purchasing domestic products to raise public awareness about the benefits of buying domestic products and their impact on the sustainability and development of domestic companies.	4.00
5	Encouraging the processing industry of primary agricultural products.	4.00
6	Assistance from the state to ensure the placement of basic agricultural products in foreign markets.	4.00
7	Encouraging domestic tourism.	3.75
8	Subsidies to return the population to rural areas by encouraging small and medium-sized businesses depending on the region.	3.75
9	Deferred payment of VAT by legal entities for the next six months.	3.50
10	Income tax exemption.	3.50
11	Encouraging cooperation among domestic SMEs by forming clusters.	3.25
12	Organizing fairs with the participation of only domestic companies.	3.25
13	Use of services from domestic companies.	3.25
14	Encouragement of infrastructure projects and other construction projects of public interest by the state in all regions at central and local levels.	3.25
15	Encouragement and planning of primary agricultural production and higher subsidies by the state for beginners without limitation on the age limit of entrepreneurs.	3.25
16	Free education and direct financial support from the state to restructure companies that will not be able to survive, especially those whose businesses are affected by the pandemic.	3.00

Figure 1: Average grade of importance for needed measures to overcome the negative consequences of the pandemic for SMEs

4. CONCLUSION

In this study, for the first time in North Macedonia we explore the opinions of a panel of experts on how SMEs in the country are dealing with the COVID-19 crisis, what measures might help SMEs overcome the negative impacts of the pandemic, and which factors have the most influence on their decision to lay off staff. The research is being carried out using a three-round Delphi method. The obtained results provide important insights for economic policymakers.

The use of digital technology by SMEs to deal with the aftermath of extraordinary events like Covid-19 is investigated in [5]. Using a mediation analysis based on nonlinear probability models, [6] study the effects of SMEs' openness to Industry 4.0 on the perceived production recovery following the COVID-19 pandemic. The number of technologies adopted serves as a gauge of a businesses readiness for Industry 4.0. The study focuses on 2622 SMEs in Italy that manufacture goods. According to their research, openness to Industry 4.0 has both a short-term (by 2021) and medium-term (within 2022 and 2023) positive and significant impact on the perception of a production recovery. The perceived medium-term production recovery can be mediated by the classical reorganization, whereas the perceived short-term production recovery can be mediated by the digital reorganization. The Covid-19 pandemic mitigates positive impact on the utilization of foreign and domestic digital platforms on their international orientation through a sample of 372 observations from 250 Chinese SMEs [7]. The findings shed light on innovation as a tool for SMEs to survive both during and after the COVID-19 contingency, and it is determined that the utilization of digital resources is the major driver for networking and research-based product design in the setting of "social distance [8]. According to findings in the developed theoretical model in [9] which was validated using a structural equation modeling (SEM) technique on data collected from 327 respondents from Indian SMEs, big data innovation aids in the sustainability of SME supply chains, as do internet of things (IoT) optimization and big data embedded supply chains. Additionally, SMEs leadership is essential for maintaining supply chain operations in times of crisis. The results of the statistical analysis conducted on data from 98 French and Algerian companies of various sizes reveal that Lean management tools and Industry 4.0 technologies tend to be strongly linked, and that understanding this relationship can enhance the organizational dimensions of leadership, strategy, operation, and production [10]. The best-practice representation of Japanese lean management concepts can be found in [11]. The 6Ps maturity model (MM), which [12] propose, intends to help manufacturing SMEs in the creation of their roadmaps toward Digitalized Manufacturing 4.0. The 6Ps maturity model is based on 36 Industry 4.0-related areas, a 5-level scale of digital maturity, and 6 primary socio-business and technical dimensions (i.e., Product-Services, Processes, Platform, People, Partnership, and Performance).

The COVID-19 pandemic is a "black swan" event, and SMEs who have embraced Industry 4.0 technologies like big data analytics, artificial intelligence, IoT, and blockchain technology can deal with it better, survive in the market over the long run, and gain a competitive advantage.

We propose to focus future study on the use of Industry 4.0 technology by SMEs in North Macedonia and its neighbors, as well as the impact on their operations and financial performance.

REFERENCES

[1] Eggers, F. (2020). Masters of disasters? Challenges and opportunities for SMEs in times of crisis. *Journal of Business Research*, 116, 199–208. doi: 10.1016/j.jbusres.2020.05.025

[2] Lu, Y., Wu, J., Peng, J., & Lu, L. (2020). The perceived impact of the Covid-19 epidemic: Evidence from a sample of 4807 SMEs in Sichuan Province, China. *Environmental Hazards*, 19(4), 323–340. doi: 10.1080/17477891.2020.1763902

[3] Nordhagen, S., Igbeka, U., Rowlands, H., Shine, R. S., Heneghan, E., & Tench, J. (2021). COVID-19 and small enterprises in the food supply chain: Early impacts and implications for longer-term food system resilience in low- and middle-income countries. *World Development*, 141, 105405. doi: 10.1016/j.worlddev.2021.105405

[4] Cvetkoska, V. (2022). Business Analytics. Skopje: Stobi Trejd Dooel.

[5] Papadopoulos, T., Baltas, K. N., & Balta, M. E. (2020). The use of digital technologies by small and medium enterprises during COVID-19: Implications for theory and practice. *International Journal of Information Management*, 55, 102192. doi: 10.1016/j.ijinfomgt.2020.102192

[6] Cugno, M., Castagnoli, R., Büchi, G., & Pini, M. (2022). Industry 4.0 and production recovery in the covid era. *Technovation*, 114, 102443. https://doi.org/10.1016/j.technovation.2021.102443

[7] Lee, J. Y., Yang, Y. S., Ghauri, P. N., & Park, B. I. (2022). The impact of social media and digital platforms experience on SME international orientation: The moderating role of covid-19 pandemic. *Journal of International Management*, 100950. https://doi.org/10.1016/j.intman.2022.100950

[8] Caballero-Morales, S.-O. (2021). Innovation as recovery strategy for SMEs in emerging economies during the COVID-19 pandemic. *Research in International Business and Finance*, 57, 101396. https://doi.org/10.1016/j.ribaf.2021.101396

[9] Chatterjee, S., Chaudhuri, R., Shah, M., & Maheshwari, P. (2022). Big data driven innovation for sustaining SME supply chain operation in post COVID-19 scenario: Moderating role of SME technology leadership. *Computers & Industrial Engineering*, 168, 108058. https://doi.org/10.1016/j.cie.2022.108058

[10] Najwa, E., Bertrand, R., Yassine, M., Fernandes, G., Abdeen, M., & Souad, S. (2022). Lean 4.0 tools and technologies to improve companies' maturity level: The COVID-19 context. *Procedia Computer Science*, 196, 207–216. https://doi.org/10.1016/j.procs.2021.12.007

[11] Helmold, M., Yılmaz, A. K., Flouris, T., Winner, T., Cvetkoska, V., & Dathe, T. (2022). Lean management, kaizen, kata and keiretsu: Best-practice examples and industry insights from japanese concepts (1st ed. 2022 edition). Springer.

[12] Spaltini, M., Acerbi, F., Pinzone, M., Gusmeroli, S., & Taisch, M. (2022). Defining the roadmap towards industry 4. 0: The 6ps maturity model for manufacturing smes. *Procedia CIRP*, 105, 631–636. https://doi.org/10.1016/j.procir.2022.02.105