

The Impact of COVID-19 on the Digital Transformation in Organizations: A Quantitative Analysis

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Abstract: The COVID-19 pandemic disrupted all aspects of life. To stop uncontrollable virus spread, the Governments declared lockdown in many countries. The economic and social consequences of the pandemic had a significant impact on organizational development. In response to the crisis, organizations had to accelerate the strategy of digital transformation to adapt to unprecedented situation. The purpose of the contribution is to measure the magnitude of the impact of COVID-19 on digital transformation in organizations. The article presents results of research dedicated to the situation in selected areas. Primary quantitative data were obtained using a questionnaire survey taking place before and after the beginning of the pandemic. The selected outputs compare the results of the digital transformation in organizations in two periods, before 2020 and after. The sample contains thousands of respondents. The results confirm the rapid transfer of organizations to become more digital toward interacting with customers and suppliers through digital technologies. The rate of adoption of digital initiatives is higher than before the crisis. Therefore, is an indisputable output of the questionnaire survey focused on the role of CIO, number of information systems, ICT investments, user comfort, and the will of managers to listen to user request.

Keywords: COVID-19; coronavirus; digital transformation; digitalization; information and communication technology

JEL Classification: M15; M21; O33

1. Introduction

In response to the worldwide COVID-19 crisis, there was a fundamental change in the way organizations are doing their business across different industries (McKinsey, 2020). Dramatic government restrictions led to inequalities in economic and social areas. Lockdown was imposed in many countries and has caused social distances mainly due to reduced mobility (Rahman et al., 2020). These drastic circumstances, leading to reduction in virus transmission, improved the pandemic situation, but not for a long period. Although the lockdown also had a positive effect, especially on the environment (Fu et al., 2020), the poor economic situation resulted in a decline of several organizations in numerous sectors. Concerns about future developments increased proportionally in response to the uncertain government range of measures and the lack of virus experience. Organizations switched to digital environment from day to day, faster than expected and found out that the inexorable

shift to digital resources began a new business path to keep connection with customers, suppliers, and employees. The disruption of pandemic situation has emphasized the adoption of a holistic approach to digital transformation in organizations with the aim of offering an enhanced customer centricity (KPMG, 2020). Leaders were forced to align an overall strategy with the digital strategy and develop and implement new creative digital solutions. The organizations accelerated the digital transformation process and adopted technologies that strengthen relationships with customers, suppliers, and employees and continue to function remotely. Thus, they also face to need to strengthen online collaboration. According to Mitchell (2021), it includes four major parts: flexibility and productivity, social connectedness and organizational culture, technology support, management, and leadership. This affected many organizations and working teams. According to Wu (2021), 47% of teams that were used to working based on one location together decreased to 15% because of the effect of COVID-19.

Organizations rethought business priorities and began investing in digital initiatives with an emphasis on competitiveness in the new economic environment (Klimková & Hornungová, 2011). The importance of technological strategy has become a critical component of the business and not just a source of cost efficiencies. The circumstances of COVID-19 indicated the importance of executive mindsets on the role of technology in business (McKinsey and Company, 2021). Technology had become an important part that helps manage the constant risk environment, particularly cyber security, and allows workplace flexibility. The shift to digital technologies such as Artificial Intelligence (AI), blockchain, Internet of Things (IoT), Internet, robotics, smart manufacturing, machine learning, predictive, and data analytics allows automation and flexible reaction on new requirements of maintaining business activities due to unprecedented situations (Soto-Acosta, 2020). Using advanced technologies speeds up experimentation and innovating during the pandemic (Chesbrough, 2020).

As of today, the COVID-19 outbreak is still a global threat, and through digital transformation, organizations can maintain business activities. The term 'digital' has begun to be increasingly bowed in several industries. Globalization and digitalization are phenomenon that can significantly contribute to the economic sustainability of organizations.

According to the study by McKinsey (2020), respondents adduced that their organizations are able to implement digital initiatives 20–25 times faster than they would have expected. Almost 50% of the respondents indicated that their organizations were the first to the market with innovations during the coronavirus pandemic and experimented with new digital technologies. Comparison the survey in 2017, half of leaders consider cost savings as the most important factor in digital strategies and in 2020 only 10% of leaders denote it in the same way. At the same time, more than half of respondents declare they are investing in technology to increase the competitiveness.

To assess the magnitude of the impact of COVID-19 on the digital transformation in organizations, we provide research focused on many aspects of digital transformation. Data analyses were undertaken in two periods to compare them, before 2020 and after. The data were obtained through the questionnaire survey using the ZEFIS portal, which provides

consultancy of the effectivity of organization with the comprehensive survey. Exploring how COVID-19 has impacted digital initiatives in organizations can help people understand how organizations can embrace the digital transformation process. Assessment of the impact of the pandemic will be more relevant to the acquisition of collected data with course of given time frames.

2. Methodology

The article deals with the research focusing on the magnitude of the impact of COVID-19 on digital transformation in organizations. The paper presents results of the research question – what is the influence of the COVID-19 pandemic on the digital transformation of organizations? Primary data were obtained through the online questionnaire survey at the ZEFIS portal that evaluates the efficiency of information systems in organizations. Its strength is the ability to compare results with other companies of similar size. Due to the fact that it is a managed portal with the need to create and verify an account, the data can be considered reliable. The data were collected from the survey taking in the period 2010–2019 and 2020–2021 (except the question relating to the significant information systems operated in the organization where are observed data are compared in periods 2018–2019 and the 2020–2021) and questions are related to the digital transformation in organizations. The sample mostly comprises more than a thousand respondents in each question (except the questions in paragraphs 3.2 and 3.3 where the sample comprises about 300 respondents) and the largest representation of the company size is 10–49 employees. Most of the respondents come from manufacturing, trade and business, provision of services, information and communication technologies sectors. Descriptive research investigates the characteristics of the sample and helps to derive the attitude about the phenomenon.

Regarding the purpose of this study, we compare the results from five questions of the survey before 2020 and after that to evaluate the impact of COVID-19 on digital transformation in organizations. Questions are developed to analyse the current status of information system in organization, especially the role of CIO, number of information systems, ICT investments, user comfort and the will of managers to listen to user requests.

The ZEFIS portal analyzes the efficiency of information system in organization in relation to information strategy, consistency of compliance with defined rules, and perception of end users of IS from various viewpoints on different levels of difficulty (Chvatalova & Koch, 2015). The portal uses questionnaire and focuses on seven aspects of efficiency: hardware, software, orgware, peopleware, dataware, customers, and operations (ZEFIS, 2021). The ZEFIS system reflects the complex view of information system in organization based on the 7 subsystems and detects the most inefficient subsystem. This developed system assesses the level of the balance of information system and determines the recommendations for balancing the weakest part. ZEFIS strives for a balance of the information system, achieving the minimal costs and maximum benefits (Koch & Chvatalova, 2017).

The results of the questionnaire survey are limited geographically and time-wise – the study is based on the answers of the respondents from Czech and Slovak companies collected between years 2010–2020. This can be considered as a great advantage of this study because

this means that more than 92% of the responses were collected before the beginning of the pandemic in 2020. It increases an accuracy of the research results due to the inability of the respondents to be affected by their experience with the pandemic.

3. Results

The objective of the article is assessment of the impact of COVID-19 on the digital transformation in organizations. How do organizations approach digital transformation initiatives in response of COVID-19? Do they prioritize investments in digital technologies? What barriers inhibit new digital strategies? For the purposes of the research, five questions related to the purpose of this paper was included in the ZEFIS portal survey. The data analysis relates to the digital transformation and is taken in November 2021.

Due to quantitative observation, we conducted an in-depth analysis of variables. Descriptive research reveals the prevailing respondent's underlying patterns and behaviour. The research was conducted in two periods, before 2020 and after, to ascertain differences.

The following part provides a concise result from defined survey areas related to the digital transformation. We focus on the sample of respondents answering these survey questions:

1. Is in your organization established a responsible manager for information systems (CIO)?
2. How many significant Information Systems are operated in the organization?
3. How many percent of the annual turnover your organization invests in Information Systems?
4. Is it true that workers lack some Information System's data or functions?
5. Do managers react to initiatives of their employees, which new functions of IS are necessary?

Given the scope collected data in the period 2010-2019 and to acquire an objective view of data we examine relative frequency of answers comparison two periods and visualize numerical outputs in percentage in histogram. Key results in the tables are highlighted in italics.

3.1. Is in Your Organization Wstablished a Responsible Manager for Information Systems (CIO)?

In Table 1 are presented results of respondents who answered the question about a responsible manager for information systems in their organization. According to the results in the period 2020–2021, the number of respondents who allege that the position is accumulated with another has increased and it can be the response to the ongoing pandemic situation and managers probably expanded the competences of an existing employee and assigned him responsibility for the information system. Comparing the results of these two periods, the observed data in the period after COVID-19 don't clearly determine that there are more responsible managers in organizations than before the pandemics. This status can be influenced by the medium to a long-term recruitment process. To determine whether COVID-19 has influenced the increase in the number of employees responsible for information systems in the organization can be reflected in an extended interval.

Table 1. Number of respondents reacting to the responsible manager for IS in organizations (ZEFIS, 2021)

Is in your organization established a responsible manager for information systems (CIO)?	2010–2019	2020–2021	2010–2019	2020–2021
	n _i	n _i	p _i	p _i
No	902	118	31%	33%
Yes	1,197	126	41%	35%
Yes, but the position is accumulated with another	818	114	28%	32%
Total	2,917	358	100%	100%

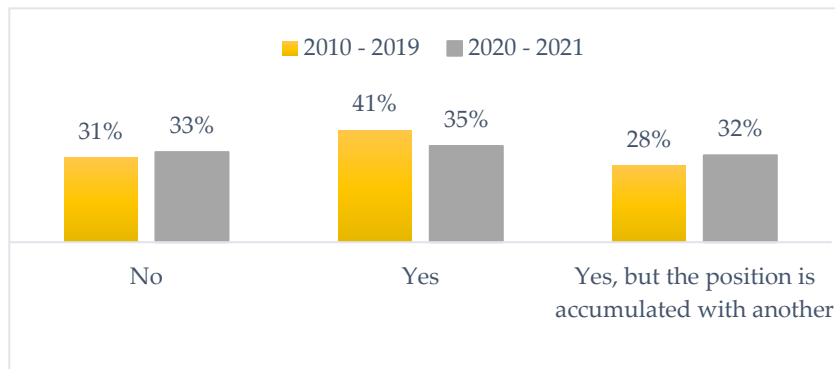


Figure 1. Number of respondents reacting to the responsible manager for IS in organizations (ZEFIS, 2021)

3.2. How Many Significant Information Systems Are Operated in the Organization?

This following model approximately copy the trend of responses from preceding model. Therefore, observed periods depict results for the question “How many significant Information Systems are operated in organization?” and identify that there is no substantial growth. In particular, this can be attributed to the fact that the implementation of the information system is a long-term process with the involvement of many employees and a thoughtful strategy.

Table 2. Number significant Information System operated in organization (ZEFIS, 2021)

How many significant Information Systems are operated in the organization	2018–2019	2020–2021	2018–2019	2020–2021
	n _i	n _i	p _i	p _i
1	104	111	30%	32%
2–5	182	180	52%	51%
6–10	41	36	12%	10%
11–20	19	10	5%	3%
More than 20	5	13	1%	4%
Total	351	350	100%	100%

3.3. How Many Percent of the Annual Turnover Your Organization Invests to Information Systems?

Table 3 summarizes organizations’ investments into Information Systems as a percentage of their annual turnover. Obtained results allow to deduce that before the crisis, organizations invested less than 10% of their turnover to IS, whereas from the

COVID-19 disruption, 30% of organizations invested between 21–30% of their turnover to IS. Although investments were rather a declining trend before the crisis, in contrast, investments since 2020 have had a gradual increase as a result of pandemic.

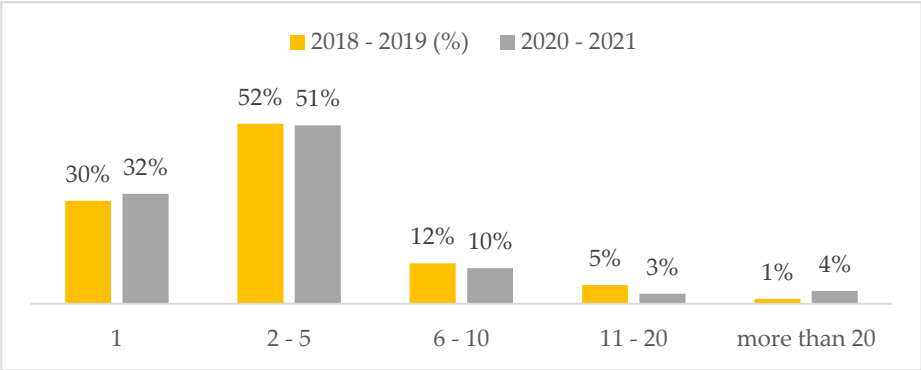


Figure 2. Number of significant Information System operated in the organization (ZEFIS, 2021)

Table 3. Number of respondents reacting to the percent of annual turnover invested in IS (ZEFIS, 2021)

How many percent of the annual turnover your organization invests to Information Systems	2018–2019	2020–2021	2018–2019	2020–2021
	n _i	n _i	p _i	p _i
0–10%	174	23	50%	7%
11–20%	102	70	29%	21%
21–30%	29	102	8%	30%
31–40%	22	68	6%	20%
41–50%	6	72	2%	21%
51–60%	5	0	1%	0%
61–70%	6	0	2%	0%
71–80%	3	0	1%	0%
81–90%	0	0	0%	0%
91–100%	0	0	0%	0%
Total	347	335	100%	100%

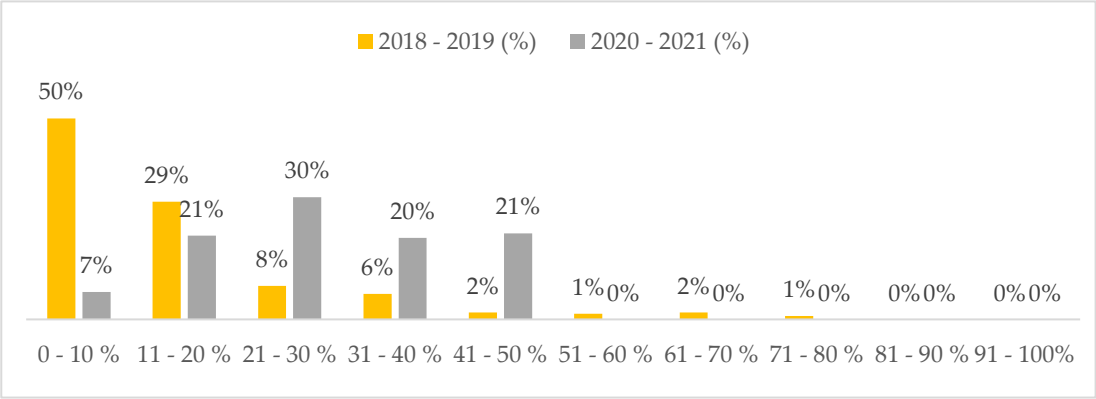


Figure 3. Number of respondents reacting to the percent of the annual turnover invested to IS (ZEFIS, 2021)

3.4. Is It True that Workers Lack Some Information System 'S Data or Functions?

Investigation whether respondents lack some function of the information system indicates that in the response of COVID-19, employees confirm desideration some information systems' data or functions. Frequent homebased working increases the claims of information systems functionality, and employees expect the high reliability of data. Inaccuracy and inconsistency of data in certain fields may cause erroneous or ambiguous decisions that lead to organizing activities improperly (Wang et al., 2011).

Table 4. Number of respondents reacting to lack some information systems' data or functions (ZEFIS, 2021)

Is it true that workers lack some Information System's data or functions?	2010–2019	2020–2021	2010–2019	2020–2021
	n _i	n _i	p _i	p _i
Yes	198	53	13%	16%
Rather yes	306	69	20%	21%
Rather not	769	148	49%	44%
Not	295	65	19%	19%
Total	1,568	335	100%	100%

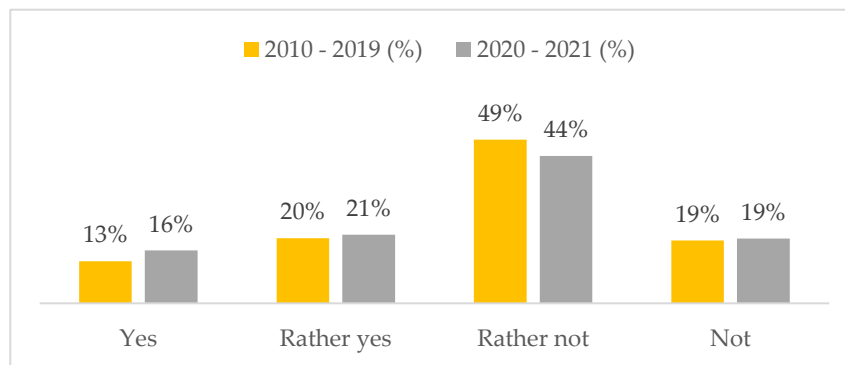


Figure 4. Number of respondents reacting to lack some Information Systems' data or functions (ZEFIS, 2021)

Table 5. Number of respondents reacting to the willingness of managers to support new functions of IS that are necessary (ZEFIS, 2021)

Do managers react to initiatives of their employees, which new functions of IS are necessary?	2010–2019	2020–2021	2010–2019	2020–2021
	n _i	n _i	p _i	p _i
Yes	404	69	27%	31%
Rather yes	697	124	47%	55%
Rather not	322	29	22%	13%
No	47	4	3%	2%
Total	1,470	226	100%	100%

3.5. Do Managers React to Initiatives of Their Employees, Which New Functions of IS Are Necessary?

The results visualize options of answers to questions about the willingness of managers to react to initiatives of their employees. The comparison of two observed periods, we can

see a similar trend as with the previous two questions that COVID-19 is causing. Respondents more evaluate managers' efforts to react to employee stimuli regarding new IS functions of IS that are necessary in the COVID-19 period.

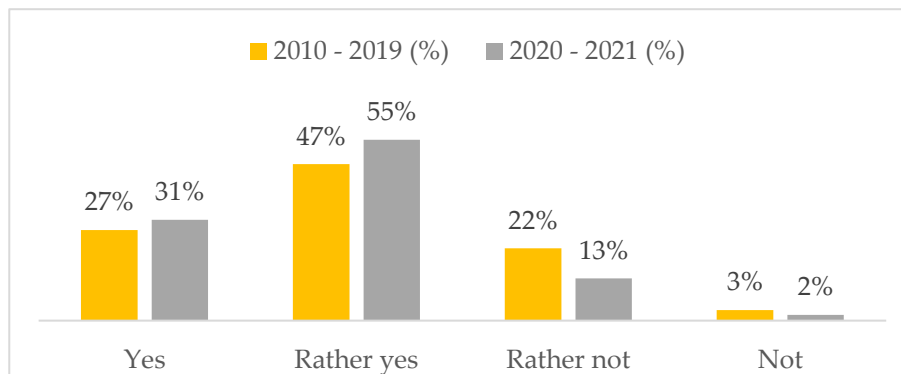


Figure 5. Number of respondents reacting to the willingness of managers supporting new functions of IS that are necessary (ZEFIS, 2021)

Barriers in the form of inhibition of implementation of digital instruments to support competitiveness and innovations that appeared in the past are slowly disappearing. Employees are more open to new digital initiatives to embrace the survival of the organization.

4. Discussion

The study is aimed on results of the survey research that assess the impact of COVID-19 on the digital transformation of companies and other organizations. The field this of study is becoming increasingly important. According to Nagel (2020), there is an increase in home office and remote collaboration, and it is believed that the digital transformation process accelerated in response to the COVID-19 pandemic. To identify the behaviour of organizations, quantitative research has been performed based on questionnaire survey through ZEFIS portal. Within the survey, five particular questions were asked. The study is based on the comparison of the survey answers in two reference periods – before and after the beginning of the pandemic. Due to the fact that the questions have been collecting since 2010, the outputs are reliable and with a high degree of validity.

Questions that are part of the research can be divided into two categories. The results of the first category are similar in the first and also in the second observed period. These outputs are related to long-term changes in the organization or sensitive issues such as human resources. These are assumed not to change within two years 2020 and 2021, which can be considered a too short period. This can be seen in the results of questions number 1 (Is in your organization established a responsible manager for information systems (CIO)?), number 2 (How many significant Information Systems are operated in the organization?) and number 4 (Is it true that workers lack some Information System's data or functions?). In the first case, the occupation of the CIO position is supposed to be a significant interference within the corporate hierarchy that cannot be done hastily. Rahman et al. (2020) in their paper speak about HR development during COVID-19 crises, but their study is focused on

examination of performance efficiency in human resource management which can be done in a short-term period. Secondly, the implementation of an information system or fundamental changes in the ICT ecosystem is a long-term project that needs to be well-planned, financed, and supported by professional team. Thirdly, optimization of the system functionalities and new automation of processes require comprehensive analysis and it also can be considered as a small or medium-sized project. These facts are assumed to play a key role in why the results of such questions did not change much before and after the beginning of the pandemic. Also, Mahmud (2021) claims that the largest transformations need to be observed in a long-term period when significant changes take some time to become apparent.

On the other hand, there are several actions that the management of the companies can arrange quite quickly. The first one is to agree on a higher budget of investments in ICT technologies that can be used in easier steps of the digital transition. There is a need to take into consideration potential state programs supporting ICT equipment during the pandemic, as mentioned by Khai et al. (2020) in the contribution of Malaysia. Except for ongoing EU subsidies, no extraordinary national grants were found within Czech and Slovak Republic. Secondly, managers and team leaders can change their mindset and be more open to the requests and wishes on how to make the use of the system use more comfortable. This can speed up some processes but also improve a teamwork among its members which can be an important aspect during unprecedented situations such as pandemic or long-lasting remote collaboration from home.

The limits of the research are determined by time-series and geographical point of view – participants of the survey are employees of Czech and Slovak organizations. An important fact is that the responses of participants come from different organizations in observed periods. It means that the survey is not based on asking the same questions to the same participants in different periods. It is recommended to repeat the survey in the course of time to confirm the short-time aspects and examine the long-term factors that have not been shown so far.

5. Conclusion

In recent two years, information systems acquire value and importance as a consequence of the pandemic situation. Research provides results related to digital transformation that is a crucial factor for effectiveness to maintain business activities. To determine the influence of COVID-19 on digital transformation, a survey of five questions was conducted aimed to the digital transformation. To ensure a reliable and valuable sample of data, the ZEFIS portal was used. By comparison of the results (representing by thousands of respondents), we have concluded that organizations pay more attention to ICT ecosystem development. The main result of the study is that organizations are aware of the need of ICT innovations driven by the accelerated situation of COVID-19. All aspects that may be reflected in a short time such as increased investments (question number 3) and a will to make some new changes and functionalities in the system (question number 5) register a noticeable increase after the beginning of the pandemic in spring 2020. Remaining factors related to HR changes,

implementation of information systems and applications, or analysis of processes that can be optimized and automated have not changed in any significant way so far.

It is important to point out that organizations emphasize the importance of increasing investments in information systems as a percentage of their annual turnover.

This research contributes to the identification of how companies and other types of organizations of every size approach the specifics of the current situation. It shows which aspects are easy to change in the short-time period and, on the other hand, points out those factors that cannot be readily changed or are not suitable to be responsibly changed in short time.

To verify the research, it is appropriate to repeat the study in long term perspective to reveal the trends and prevailing conditions that have impact on the process of digital transformation. It would help to clarify those questions that were identified as long-term changes and also confirm the trend of increasing investments in ICT as a whole.

Conflict of interest: none

References

- Fu, F., Purvis-Roberts, K. L., & Williams, B. (2020). Impact of the COVID-19 Pandemic Lockdown on Air Pollution in 20 Major Cities around the World. *Atmosphere*, 11(11). <https://doi.org/10.3390/atmos11111189>
- Chesbrough, H. (2020). To recover faster from Covid-19, open up: Managerial implications from an open innovation perspective. *Industrial Marketing Management*, 88, 410-413. <https://doi.org/10.1016/j.indmarman.2020.04.010>
- Chvatalova, Z., & Koch, M. (2015). Optimizing of Information Systems in companies: Support of Sustainable Performance. *Procedia - Social and Behavioral Sciences*, 213, 842–847. <https://doi.org/10.1016/j.sbspro.2015.11.488>
- Khai, K. G., Onn, Y. W., Zulkifli, R. B., Kandasamy, S., & Ahmad, A. B. (2020). The Necessity to Digitalize SMEs Business Model During the Covid-19 Pandemic Period to Remain Sustainable in Malaysia. *Journal of Education and Social Sciences*, 16(1), 73-81.
- Klimková, M., & Hornungová, J. (2011). The Competitiveness of Small and Medium Enterprises in the Czech and Slovak Republic. In *Proceedings of the International Conference on Business and Competitiveness of Companies 2011* (pp. 224-229). Bratislava.
- Koch, M., & Chvátalová, Z. (2017). Information Systems Efficiency Model. *Journal of Systems Integration*, 8(3), 3-9. <https://www.proquest.com/scholarly-journals/information-systems-efficiency-model/docview/1927971072/se-2>
- KPMG. (n.d.). *Digital acceleration - investing in a digital future*. KPMG. <https://home.kpmg/xx/en/home/services/advisory/management-consulting/kpmg-connected-enterprise/going-digital-faster/digital-acceleration.html>
- Mahmud, M. (2021). Covid-19 Pandemic's Repercussions On Global Digital Transformation. *Academy of Strategic Management Journal*, 20, 1-12. Retrieved October 26, 2021, from <https://www.proquest.com/scholarly-journals/covid-19-pandemics-repercussions-on-global/docview/2599947285/se-2?accountid=17115>
- McKinsey & Company. (2021, February 18). *How COVID-19 has pushed companies over the technology tipping point--and transformed business forever*. McKinsey & Company. <https://www.mckinsey.com/business-functions/strategy-and-corporate-finance/our-insights/how-covid-19-has-pushed-companies-over-the-technology-tipping-point-and-transformed-business-forever>
- Mitchell, A. (2021). Collaboration technology affordances from virtual collaboration in the time of COVID-19 and post-pandemic strategies. *Information Technology & People*, Vol. ahead-of-print (ahead-of-print). <https://doi.org/10.1108/ITP-01-2021-0003>
- Nagel, L. (2020). The influence of the COVID-19 pandemic on the digital transformation of work. *International Journal of Sociology and Social Policy*, 40(9/10), 861-875. <https://doi.org/10.1108/IJSSP-07-2020-0323>
- Rahman, M. H., Mutsuddi, P., Roy, S. K., Amin, M. A., & Jannat, F. (2020). Performance Efficiency Evaluation of Information and Communication Technology (ICT) Application in Human Resource Management during

- COVID-19 Pandemic: A Study on Banking Industry of Bangladesh. *South Asian Journal of Social Studies and Economics*, 8(4), 46-56. <https://doi.org/10.9734/sajsse/2020/v8i430218>
- Rahman, M. M., Thill, J. -C., & Paul, K. C. (2020). COVID-19 Pandemic Severity, Lockdown Regimes, and People's Mobility: Early Evidence from 88 Countries. *Sustainability*, 12(21). <https://doi.org/10.3390/su12219101>
- Soto-Acosta, P. (2020). Covid-19 pandemic: Shifting digital transformation to a high-speed gear. *Information Systems Management*, 37(4), 260-266. <https://doi.org/10.1080/10580530.2020.1814461>
- Wang, X., Huang, L., Xu, X., Zhang, Y., & Chen, J. Q. (2011). A Solution for Data Inconsistency in Data Integration. *Journal of Information Science and Engineering*, 27(2), 681-695.
- Wu, T. (2021). Digital project management: rapid changes define new working environments. *Journal of Business Strategy*. ahead-of-print. <https://doi.org/10.1108/JBS-03-2021-0047>
- ZEFIS. (2021). *ZEFIS – audit informačních systémů*. Retrieved November 15, 2021, from <https://www.zefis.cz/>