

The Adaptation of Small and Medium-Sized Enterprises in the Service Sector to the Conditions of Society 4.0



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ABSTRACT: The paper presents the results of the research focused on the small and medium-sized enterprises (SMEs) adaptation in the service sector to the implementation of principles, processes, methods, and tools of Society 4.0. This study primarily aims to demonstrate practices and tools for the adaptation of service sector SMEs to disruptive changes brought about by the principles and technologies of Industry 4.0 and Society 4.0 into company processes and the society as a whole. The presented approach to research and the results should support an effective and efficient adaptation of SMEs to changes in business environment leading to sustainable growth, new competitive advantages, the prevention and elimination or reduction of threats and risks resulting from misunderstanding the necessary transformation of current and future business processes. The proposed methodology of adaptation and the potential of its application by SMEs represent an up-to-date methodical approach supporting their stability and economic growth during the recovery from the COVID-19 pandemic. The research results can be applied and adapted to specific needs and requirements of service sector SMEs not only in the Czech Republic, but also in other countries of Central Europe, namely Slovakia, Poland, and Hungary that have similar legislation for SMEs as well as similar history and trends of SMEs transformation. The presented results can also serve as the motivation and knowledge background for SMEs when identifying and evaluating opportunities and threats in the conditions of Society 4.0.

KEYWORDS: Industry 4.0, Fourth Industrial Revolution, knowledge-intensive services (KIS), small and medium-sized enterprises (SMEs), Society 4.0.

INTRODUCTION

Our research, realized in the period of 2019–2022, was motivated by the insufficient attention paid both in theory and practice to issues related to the adaptation of micro, small and medium-sized enterprises (SMEs) in the service sector to technological, economic, social, and environmental aspects of the Society 4.0. The need to develop the Methodology for the Service Sector SMEs Adaptation (hereinafter referred to as the Methodology of Adaptation) to the implementation of Society 4.0 principles, methods and tools reacts to the demand and requirements of business practices that had been investigated and identified before the launch and during the course of the TL02000136 project called “Knowledge-intensive services sector adaptation to the conditions of Society 4.0” supported by the Technology Agency of the Czech Republic (see in more detail <https://azis.zcu.cz>, 2022). Specific requirements on the structure and content of the research results were identified and discussed in the workshops and structured interviews with owners, managers, and employees of SMEs in the knowledge-intensive services. The significant information support and feedback on project outputs were provided by six external project guarantors – the Regional Chamber of Commerce in the Pilsen Region, the regional branches of the Labour Office of the Czech Republic in Plzeň and České Budějovice, the South Bohemia Chamber of Commerce, the Regional Office of South Bohemia, and the South Bohemia Association for the Human Resources Development.

The goal of this study is to demonstrate practices and tools for the adaptation of service sector SMEs to the disruptive changes brought about by the principles and technologies of Industry 4.0 and Society 4.0 into company processes and the society as a whole. The presented approach to the research and the presented results should support an effective and efficient adaptation of SMEs to changes in business environment leading to the sustainable growth, new competitive advantages, prevention and elimination or reduction of threats and risks resulting from misunderstanding the necessary transformation of current and future business processes.

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The main goals of this paper are:

1. To present main research outcomes related to adaptation of SMEs in the service sector to the conditions of Society 4.0.
2. To introduce new insights and approaches to academic and professional community, and especially to managers of companies undergoing the transformation process to Industry 4.0 and Society 4.0 conditions.
3. To raise the level of the knowledge base in the field of SMEs adaptation to the conditions of Society 4.0.

LITERATURE REVIEW

INDUSTRY 4.0 AND SOCIETY 4.0: THE CURRENT SITUATION AND TRENDS WITH OVERLAP BEYOND TECHNOLOGIES

Since 2011, both in theory and practice, we have been meeting with terms such as the Fourth Industrial Revolution, Industry 4.0, Society 4.0 and with the related initiatives Anderson, 2013; Kagermann & Lukas, 2011; Vance, 2015; Skobelev & Borovik, 2017; Kruliš et al., 2018; Staněk et al., 2019; Keidanren, 2018, 2020) more frequently. In 2016 the Fourth Industrial Revolution was selected as the central topic of the World Economic Forum (WEF, 2016) and since then the concepts of Industry 4.0 and Society 4.0 have been analyzed, discussed, and developed in the professional community, global and national documents, strategies, and illustrated by examples of best practices.

Currently, Industry 4.0 is a rapidly developing concept in all economic sectors. Disruptive technologies as cyberphysical systems, Big Data, the Internet of Things, Services and People, artificial intelligence, robotics, virtual reality, and others are fundamentally changing the way of our lives, work, and doing business. While in Europe the term of Industry 4.0 (Industrie 4.0 in German) is commonly used, it is often referred to as the Fourth Industrial Revolution in the world – 4IR (Mařík et al., 2016; Vacek, 2017; Xu et al., 2018). Principles, practices, methods, tools, and applications of Industry 4.0 are applicable not only in manufacturing, but also penetrate other production and service sectors of national economy, the public sector and personal life. This is reflected in the term of Society 4.0. The practice usually proceeds from the so-called smart factories, as the basic feature of 4IR, to smart buildings and cities, smart transport, agriculture, health, services, etc.

The global COVID-19 pandemic from 2020 to 2021 with its health, economic and social impacts further increased and accelerated not only the need, but also the practical implementation of technologies, methods and tools of Industry 4.0 and Society 4.0 in companies of all sizes, in the public sector, and households. The impacts of COVID-19 pandemic are currently resulting in many changes in processes, technologies, organization, personal, communication, and interpersonal relations in SMEs (Donthu & Gustafsson, 2020; Fairlie, 2021; Dvořáková et al., 2021a).

The heterogenous character of Industry 4.0 and Society 4.0 is also reflected in their inconsistent perception and characteristics. At present, there are no generally accepted definitions and interpretations of them in theory and practice, even if they have been developing from the points of view of their content, goals, and characteristic features, in more detail see (Manyika et al., 2013; Kagermann et al., 2013; Dutton, 2014; Pan et al., 2015; Kovács & Kot, 2016; PwC, 2016; Morrar et al., 2017; Piccarozzi et al., 2018). Schwab (2017) states that the Fourth Industrial Revolution is characterized by the fusion of technologies connecting the physical, digital, and biological spheres.

Based on the desk and field research performed in our project, we suggest the following integrating definition of Industry 4.0 and Society 4.0 as the concept of electronization, digitization, complex automation and robotization of many current human activities, the transformation of job markets and educational systems. This concept supports the increased speed and efficiency in the production of higher quality, reliability and cheaper products and services, the more efficient usage of materials, and the environmental friendliness of production and service processes in all sectors of national economy, in households, and professional and private human life with the ultimate goal of increasing the quality of life.

METHODS

Qualitative and quantitative research methods combining the results of empirical data collection (the questionnaire survey and structured interviews) with the desk research, identification, analyses, and evaluation were applied. The empirical data were collected in the Czech Republic, namely in South Bohemia and the Pilsen region in SMEs in the knowledge-intensive services sector. Comparative methods were applied for comparisons with foreign countries. This part of the research also relied on the primary data from the external project guarantors and the secondary data from the national and international surveys.

Developing the structure and content of the Methodology of adaptation is based on the knowledge base created in the partial outputs Study 1 of the research project called "The identification, analysis and evaluation of principles, processes, methods, and tools for adaptation of the service sector to the technical, economic, social, and environmental conditions of Society 4.0" (Vacek et al., 2019), then of Study 2 called "The catalog of changes in knowledge, skills, and requirements of job competencies related to the launch and development of Society 4.0" (Hejduková et al., 2019), and of notes, remarks, and feedback obtained from Workshop 1 and its report called "The adaptation of knowledge-intensive services to the conditions of Society 4.0" (Taušl

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Procházková, 2020). The results of the field research, i.e., the questionnaire survey and structured interviews with SMEs' owners, managers and employees significantly contributed to the Methodology of adaptation; in more detail see (<https://azis.zcu.cz>).

The findings summarized above served as the starting point for the synthesis and following proposal of the Methodology and its validation in practice of the selected sample of SMEs in knowledge-intensive services. The process of the Methodology development was divided into three basic phases. The first of them focused on the formulation of the Methodology goal, the second one on the definition of issues related to the adaptation of SMEs in the service sector to Industry 4.0 and Society 4.0, and the third, final phase resulted in the creation of the catalog of measures for the adaptation (in more detail see Dvořáková et al., 2020; Dvořáková et al., 2021b).

RESULTS

Desk Research

The first desk research phase focused on the identification of the current state of research in the project target areas resulting in two studies mentioned in the previous section. Naturally, the desk research permeated all subsequent project activities and was reviewed in journal articles, conference contributions and other publications on an ongoing basis; the full list of them can be found in the Publications section of the project website.

Study 1 (Vacek et al., 2019) summarizes the present state and trends in knowledge-intensive services, including their classification as services with the great intensity of knowledge usage (OECD, 2006). Two groups, namely knowledge providers and knowledge users, are distinguished. Such companies typically use the open innovation concept with the high importance of intellectual property rights. Its second part describes the system approach to Society 4.0 with its components of Industry 4.0, Work 4.0, and Education 4.0 and presents the overview of principles, approaches, methods, and tools for the service sector adaptation. The concluding section gives the summary of technologies that can support businesses according to Likens (2019) and Tucker (2019). The theoretical part is supported by the selected case studies and best practices that can be interesting to Czech SMEs in the knowledge-intensive sector.

Study 2 (Hejduková et al., 2019) focuses on the impacts of Society 4.0 concepts on labor market, requirements on competencies, qualifications, knowledge, and skills of the workforce, including the necessity of life-long education. According to Frey & Osborne (2017), adapted to Czech conditions by Chmelař et al. (2015) jobs in services, especially in knowledge-intensive services, belong to the least susceptible to automation. Routine, repeatable jobs (not only manual ones!) will be among the first ones to be replaced by digitization, robotics, and automation. New job positions will emerge, e.g., in personal services such as recreation, leisure time, and domestic care. Companies are looking for graduates with competencies and skills demanded for work with new technologies, including artificial intelligence. The educational system, especially lifelong learning, must be substantially reformed to prepare future generations for new challenges with their opportunities and risks.

Questionnaire

The desk research was the basis for formulating the online questionnaire, which consisted of 25 questions. The target group of the questionnaire was formed by filtering the Albertina database (Bisnode, 2019) using the company size (SME) and industry sector (J and M CZ-NACE sections – see ČSÚ, 2008). The questionnaire was distributed to 1,494 companies. Unfortunately, the return rate was rather low (approx. 10 %). Nevertheless, this part of the research provided valuable insights summarized in detail in (Vacek et al., 2022). This initial survey helped to establish contacts with the sample of 20 companies, which was an extremely important factor for the continued field research requiring feedback from the companies and other stakeholders, including the guarantors.

Structured Interviews

The questionnaire survey was complemented by semi-structured interviews with the representatives of 20 SMEs - for more details see (Dvořáková et al., 2020). The purpose of those interviews was to deepen and enrich knowledge and information about the current state, preparedness, trends and needs of service sector companies concerning the implementation of methods and tools of Industry 4.0 and Society 4.0. Their outcomes contributed to deepening the insights gained in the questionnaire research.

The significant findings to be mentioned are as follows:

- More than 60 % of the surveyed companies have stated that the barrier to faster adaptation to Society 4.0 conditions is the lack of qualified workforce and financial resources needed to acquire new technologies.

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- The urgent need of competent, well-trained workers has been perceived by 50 % of the surveyed companies and they consider their shortage to be critical. The companies hiring graduates of secondary and higher education schools are often disappointed by their insufficient professional competencies and skills, including the digital ones.
- Nearly 50 % of the surveyed companies do not use financing from public resources allocated to support automation and digitization due to their administrative complexity in the preparation and implementation phases of projects and due to the lack of time and personal capacity.

Methodology of Adaptation, and Monograph

The methodology is based on the desk and field research performed in the previous project phases. It focuses on the identification of critical aspects, risks, and opportunities connected with the implementation of Society 4.0 principles and suggests the process of SMEs' adaptation to disruptive changes brought about by Industry 4.0 and Society 4.0 concepts to business processes. The goals and functionality of the methodology were tested and validated in company practice of the selected sample of SMEs in close cooperation with the project external guarantors.

The research project outcomes including the feedback provided by their validation are summarized in a monograph titled "The adaptation of service sector SMEs to the conditions of Society 4.0" (Dvořáková et al., 2021a), presenting the current state of relevant theoretical and practical issues related to the adaptation of knowledge-intensive services. It aims to contribute to the better understanding of Industry 4.0 methods and tools and to their effective, efficient, and timely application in business practice. This goal is supported by the case studies authored by the external company managers from several service sectors: accounting, taxes, and audit; tourism; marketing; retail; projects in horticulture; lifelong learning; and social enterprise.

By its character, content and structure, the monograph is primarily intended as a guide for service sector SMEs looking for inspiration, motivation, and new ideas when implementing automation, robotization, electronization, and digitization of their business processes. However, it can also be recommended to wider professional community, university students, and to anybody interested in the issues connected with Industry 4.0/ Society 4.0 and their further advancement to Industry 5.0/Society 5.0.

The practical application of the methodology should contribute to the increased productivity and quality of provided services, to gaining competitive advantage brought about by technologies and tools of Society 4.0 and to enhancing the knowledge potential and motivation of SME owners and managers. The proposed methodology represents a tool having the potential to support the economic recovery and renewed growth of SMEs in the current situation affected by the COVID-19 pandemic.

Project Sustainability, Website

The sustainability of project results is supported by the accompanying website (<https://azis.zcu.cz>) that is freely available to registered users and consists of four sections: **About the project**: basic information, membership in project teams; **Documents**: links to all project outputs; **Methods and tools**: section that can assist its users in their adaptation to the new conditions and will be amended during the project sustainability period using the feedback from users; **Discussion forum**: communication platform.

DISCUSSION

The field research outcomes have confirmed that SMEs in the KIS sector perceive the introduction and development of new technologies in companies as fundamental for their competitiveness, innovation of business processes, and higher quality of their products and services. The companies introduce new technologies gradually; however, they usually miss a strategic approach to the design, implementation, and control of related changes. The project findings form a sound basis for achieving the main project goal - their use to resolve challenges faced by the project target group, i.e., knowledge-intensive SMEs (but not only them).

The economic and social impacts of the COVID-19 pandemic have further significantly strengthened the necessity to implement new technologies. The current war in Ukraine and its consequences, including inflation, the high prices of oil, gas, and electricity, make the situation even more complicated and cannot be resolved by technologies only. It is important to realize that socio-economic research cannot rely on funding from the private sector and should be supported from public funds. Unfortunately, there is currently no long-term and reliable source of funding for such projects.

The feedback on the project course, approach and outputs gained from companies and guarantors was positive with only one exception, namely the style being too academic: the companies would prefer more user-friendly formulations, brief practical guides directly applicable to resolving problems they face. This has led to the idea of creating the Methods and Tools section of the project website intended to bridge the gap between the theory and practice.

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The role of application guarantors introduced for projects supported by TACR proved very useful for receiving feedback during the project and their role will be important in the project sustainability period.

The role of company resilience – the ability to face the unpredictable and unexpected events with potentially severe consequences, the so-called “black swans”, as termed by Taleb (2010), rapidly increases in the current turbulent and volatile environment. Resilience is strongly correlated with risk management, and great attention should be paid to it both in theory and practice, which is reflected, e.g., by consulting agencies such as McKinsey, Deloitte, PwC, and Accenture.

The concept of Society 4.0 and its components imply the increasing role of knowledge in economy, specifically tacit knowledge demanding close personal contacts. Unfortunately, the existing system of academic performance assessment undervalues the contacts and cooperation between academia and industry and the role of practitioners in education.

The smooth transition and adaptation to Society 4.0 concept imply the increased importance of lifelong learning. The segment providing company training was severely hit by the COVID-19 pandemic by abrupt restrictions and, moreover, was not included among the sectors eligible for anti-COVID support programs. Unfortunately, the possibility of application of Denmark flexicurity approach, which provides support to endangered jobs conditioned by the participation in retraining programs, was not used. The recovery of training courses demanded the adaptation to online tools both on the side of training and trained companies. The lifelong learning presents a challenge and a chance for universities.

Generally, the educational system should emphasize the necessity of interdisciplinary system approaches, uncovering the often-hidden links and complex feedback effects, increased focus on entrepreneurship and leadership in comparison with traditionally prevailing emphasis on business and management.

CONCLUSION

The research results of the service sector SMEs adaptation to Society 4.0 principles, methods, and tools present an approach leading to the identification, analysis and evaluation of potential, opportunities, and threats related to automation, robotization, electronization, digitization of company processes in SMEs, and to changes in requirements on labor force, lifelong learning, and changes in the organization and forms of work. The Methodology of adaptation including a catalog of measures in innovation, workforce, access to resources and feedback should enable their implementation and support the effective and efficient SMEs adaptation to changes in business environment, aiming at sustainable growth, new competitive advantages, they should prevent and reduce threats and risks resulting from misunderstanding the necessity of the current and future transformation of business processes.

The Methodology of adaptation and the potential of its application in SMEs represent the up-to-date methodical approach supporting their stability and economic growth during the recovery from the COVID-19 pandemic. The Methodology of adaptation can be applied and adapted according to specific needs and requirements of the service sector SMEs not only in the Czech Republic, but also in other countries of Central Europe, namely in Slovakia, Poland, and Hungary, as they have similar legislation for SMEs, similar history and trends of SMEs transformation.

The presented research results can also serve as the motivation and knowledge background for SMEs in identifying and evaluating opportunities and threats in the conditions of Society 4.0. The road to Society 4.0 represents the extensive society-wide challenge. The advent of new technologies changes the whole value chains, creates conditions for new business models, but it also places pressure on flexibility and the personalization of production and services, increased demands on cyber security and interdisciplinarity in all business sectors. The key to the successful and practical implementation of Society 4.0 not only in the service-oriented SMEs, but in all segments of national economy can primarily be seen in interdisciplinary, systemic, and innovative content and approach to education emphasizing flexibility and creativity at all levels of the educational system, and in the lifelong learning, resulting in the change in thinking of the whole society – the so-called Thinking 4.0.

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REFERENCES

- 1) Adaptace sektoru znalostně náročných služeb na podmínky Společnosti 4.0. Projekt Technologické agentury ČR (2022). <https://azis.zcu.cz>
- 2) Anderson, C. (2013). *Makers: The New Industrial Revolution*. Cornerstone.
- 3) Bisnode (2019). *Bisnode Albertina*. <https://www.bisnode.cz/produkty/albertina/>

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- 4) ČSÚ (2008). *Klasifikace ekonomických činností (CZ-NACE)*.
<https://www.czso.cz/documents/10180/20565267/021608.pdf/2f45895b-4c51-435b-a52a-0c7164dbf371>
- 5) Donthu. N., & Gustafsson, A. (2020). Effects of COVID-19 on Business and Research. *Journal of Business Research*, 117, 284–289. <https://doi.org/10.1016/j.jbusres.2020.06.008>
- 6) Dutton, H. W. (2014). Putting things to work: Social and policy challenges for the Internet of things. *Info*, 16(3), 1–21. DOI:10.1108/info-09-2013-0047
- 7) Dvořáková, L., Vacek, J., Hinke, J., Taušl Procházková, P., Černá, M., Hejduková, P., Vallišová, L., Caha, Z., Horák, J., Machová, V., Rain, T., Hořícký, M., Janeček, P., Petrtyl, J., Písař, P., Brabcová, J., & Machová, K. (2021a). *Adaptace malých a středních podniků v sektoru služeb na podmínky Společnosti 4.0*. Vydavatelství a nakladatelství Aleš Čeněk.
- 8) Dvořáková, L., Horák, J., Caha, Z., Machová, V., Hašková, S., Rowland, Z., & Krulický, T. (2021b). Adaptation of small and medium-sized enterprises in the service sector to the conditions of Industry 4.0 and Society 4.0: evidence from the Czech Republic. *Economic Annals-XXI*, 191(7-8(1)), 67-87. doi: <https://doi.org/10.21003/ea.V191-06>
- 9) Dvořáková, L., Vacek, J., Černá, M., Hejduková, P., Hinke, J., Taušl Procházková, P., Vallišová, L., Horák, J., Caha, Z., & Machová, V. (2020). *Metodika adaptace malých a středních podniků v sektoru služeb na implementaci principů, postupů, metod a nástrojů Společnosti 4.0*. Západočeská univerzita v Plzni, Fakulta ekonomická a Vysoká škola technická a ekonomická v Českých Budějovicích. <https://doi.org/10.24132/ZCU.2020.09532>
- 10) Fairlie, R. (2020). The impact of COVID-19 on small business owners: Evidence from the first three months after widespread social-distancing restrictions. *Journal of Economics & Management Strategy*, 29(4),727–740. <https://doi.org/10.1111/jems.12400>
- 11) Frey, C. B., & Osborne, M. A. (2017). The future of employment: How susceptible are jobs to computerisation? *Technological forecasting and social change*. 114(C), 254-280. DOI: 10.1016/j.techfore.2016.08.019
- 12) Hejduková, P., Hinke, J., Horák, J., Machová, V., Taušl Procházková, P., Vallišová, L., & Vokoun, M. (2019). *Katalog změn znalostních a dovednostních kvalifikačních požadavků na zaměstnanecké pozice ve Společnosti 4.0*. ZČU, Fakulta ekonomická a VŠTE v Českých Budějovicích. <https://azis.zcu.cz>
- 13) Chmelař, A., Volčík, S., Nechuta, A., & Holub, O. (2015). *Impacts of digitization on the labour market in the Czech Republic and the EU* (in Czech). OSTEU Discussion paper 12/2015. <https://www.vlada.cz/assets/evropske-zalezitosti/analyzy-EU/Dopady-digitalizace-na-trh-prace-CR-a-EU.pdf>
- 14) Kagermann, H., & Lukas, W. D. (2011). *Industrie 4.0: Mit dem Internet der Dinge auf dem Weg zur 4. industriellen Revolution*.
<https://www.vdi-nachrichten.com/Technik-Gesellschaft/Industrie-40-Mit-Internet-Dinge-Weg-4-industriellen-Revolution>
- 15) Kagermann, H., Wahlster, W., & Helbig, J. (2013). *Recommendations for Implementing the Strategic Initiative INDUSTRIE 4.0: Final Report of the Industrie 4.0*. Working Group. Munich: National Academy for Science and Engineering. http://forschungsunion.de/pdf/industrie_4_0_final_report.pdf
- 16) Keidanren – Japan Business Federation (2018). *Society 5.0 - Co-creating the future*. Accessed on 22 August 2022. Available at: <https://www.keidanren.or.jp/en/policy/2018/095.html>
- 17) Keidanren – Japan Business Federation. (2020). *Digital Transformation - Opening Up the Future through Co-creation of Values*. https://www.keidanren.or.jp/en/policy/2020/038_summary.pdf
- 18) Kovács, G., & Kot, S. (2016). New logistics and production trends as the effect of global economy changes. *Polish Journal of Management Studies*, 14(2), 115–126. DOI:10.17512/pjms.2016.14.2.11
- 19) Kruliš, K., Hajba, M., Frenkel, M., & Reguli, M. (2018). *Digital New Deal: Researching V4's Strategies for Society 4.0*. https://www.amo.cz/wp-content/uploads/2018/04/AMO_digital-new-deal-researching-V4s-strategies-for-society-4.0_1.pdf
- 20) Likens, S. (2019). *The Essential Eight*. <https://www.pwc.com/gx/en/issues/technology/essential-eight-technologies.html>
- 21) Manyika, J., Chui, M., Bughin, J., Dobbs, R., Bisson, P., & Marrs, A. (2013). *Disruptive technologies: Advances that will transform life, business, and the global economy*.
https://www.mckinsey.com/~media/McKinsey/Business%20Functions/McKinsey%20Digital/Our%20Insights/Disruptive%20technologies/MGI_Disruptive_technologies_Full_report_May2013.pdf
- 22) Mařík, V. et al. (2016). *Průmysl 4.0: Výzva pro Českou republiku*. Management Press.
- 23) Morrar, R., Arman, H., & Mousa, S. (2017). The Fourth Industrial Revolution (Industry 4.0): A Social Innovation Perspective. *Technology Innovation Management Review*, 7(11), 12–20. <http://doi.org/10.22215/timreview/1117>
- 24) OECD (2006). *Innovation and Knowledge-Intensive Service Activities*. Paris: OECD Publishing.

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DOI: 10.1787/9789264022744-en

- 25) Pan, M., Sikorski, J., Kastner, C. A., Akroyd, J., Mosbach, S., Lau, R., & Kraft, M. (2015). Applying Industry 4.0 to the Jurong Island Eco-industrial Park. *Energy Procedia*, 75, 1536–1541. <https://doi.org/10.1016/j.egypro.2015.07.313>
- 26) Piccarozzi, M., Aquilani, B., & Gatti, C. (2018). Industry 4.0 in Management Studies: A Systematic Literature Review. *Sustainability*, 10(10), 3821. <https://doi.org/10.3390/su10103821>
- 27) PwC. (2016). *Strategy & Industry 4.0: How digitization makes the supply chain more efficient, agile, and customer-focused*. <https://www.strategyand.pwc.com/gx/en/insights/2016/industry-4-digitization/industry40.pdf>
- 28) Schwab, K. (2017). *The Fourth Industrial Revolution*. Penguin UK.
- 29) Skobelev, P. O., & Borovik, S. Yu. (2017). On the way from Industry 4.0 to Industry 5.0: From digital manufacturing to digital society. *International Scientific Journal „Industry 4.0“*, 2(6), 307–311. https://www.researchgate.net/publication/356284207_On_the_way_from_Industry_40_to_Industry_50_from_digital_manufacturing_to_digital_society
- 30) Staněk, P., Mařík, V., Doliak, D., & Ondrovič, A. (2019). *Fakty a mýty o společnosti 5.0: Zamyslenie sa nad budúcnosťou*. Wolters Kluwer.
- 31) Taleb, N. N. (2010). *The Black Swan: The Impact of the Highly Improbable* (2nd ed.). Penguin.
- 32) Taušl Procházková, P. (2020) Zpráva z workshopu Adaptace sektoru znalostně náročných služeb na podmínky společnosti 4.0. <https://azis.zcu.cz>
- 33) Tucker, R. B. (2019). *These Nine Powerful Technologies Are Now Ready for Rollout*. <https://www.disruptorleague.com/blog/2019/02/26/these-nine-powerful-technologies-are-now-ready-for-rollout/>
- 34) Vacek, J. (2017). On the Road: From Industry 4.0 to Society 4.0. *Trendy v podnikání*, 7(4), 43–49.
- 35) Vacek, J., Dvořáková, L., & Skřivan, L. (2022). Small and Medium-Sized Enterprises in the Service Sector in the Conditions of Industry 4.0 and Society 4.0: Evidence from the South-West Region of the Czech Republic. *Ekonomika regiona / Economy of regions*, 18(4), 1031-1045. <https://doi.org/10.17059/ekon.reg.2022-4-5>.
- 36) Vacek, J., Dvořáková, L., Černá, M., Horák, J., Caha, Z., & Machová, V. (2019). *Identifikace, analýza a hodnocení principů, postupů, metod a nástrojů pro adaptaci sektoru služeb na technické, ekonomické, sociální a environmentální podmínky Společnosti 4.0*. NAVA.
- 37) Vance, A. (2015). *Elon Musk: Tesla, SpaceX a hledání fantastické budoucnosti*. Jan Melvil Publishing.
- 38) WEF (2016). *World Economic Forum Annual Meeting 2016: Mastering the Fourth Industrial Revolution*. <https://www.weforum.org/reports/world-economic-forum-annual-meeting-2016-mastering-the-fourth-industrial-revolution>
- 39) Xu, M., David, J., & Kim, S. (2018). The Fourth Industrial Revolution: Opportunities and Challenges. *International Journal of Financial Research*, 9(2), 90–95. <https://doi.org/10.5430/ijfr.v9n2p90>



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