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KNOWLEDGE INTENSIVE SMES IN TRANSITION TO SOCIETY 4.0: EVIDENCE FROM THE CZECH REPUBLIC

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Abstract

SMEs have significant role in the area of economy, social and environmental area and also in the areas of social and regional development. The dawn of the Society 4.0 driven by the exponential growth of performance of disruptive technologies of Industry 4.0 is reinforcing the role of knowledge intensive services. University of West Bohemia in partnership with the Institute of Technology and Business in České Budějovice focused on the adaptation of this segment of businesses in the project „Knowledge-intensive services sector adaptation to the conditions of Society 4.0“, supported by the Technology Agency of the Czech Republic. The paper aims to attract attention of the broader community to the project findings and outcomes, to present main research outcomes related to adaptation of SMEs in the service sector, to introduce new insights and approaches to academic and professional community, especially to managers of companies undergoing the transformation process to Industry 4.0 and Society 4.0 conditions, and to raise the level of the knowledge base in the field of SMEs adaptation. The results of qualitative and quantitative research show that most of the companies that answered the questionnaire and participated in interviews were small and micro companies with positive approach to the forthcoming changes, however, there still remains a lot of space for improvement. Companies often use open innovation model to apply knowledge from external resources, as they miss the necessary capacities and face difficult access to financial resources for demanding investments in new technologies and, sometimes, lack of necessary competencies. Relatively low attention is paid to risk management, whose role in current volatile situations becomes extremely important and the company resilience often determines the company failure or success. The project contributed to development of proposals of activities, methods and tools that can contribute to reducing barriers on the road to Society 4.0 related not only to new technologies, but also to broader socioeconomic context, including transformations of jobs and job market. The unavoidable changes of the structure of economy, supply chains, education and training were further emphasized by covid pandemics and current war in Ukraine.

Keywords

Knowledge-Intensive Services (KIS), Society 4.0, Industry 4.0, Small and Medium-Sized Enterprises (SMEs).

JEL classification: L21, M19

1. INTRODUCTION

The road from Industry 4.0 to Society 4.0 presents the substantial society-wide challenge. The emergence of new technologies changes value chains, open ways to new business models, emphasizes the necessity on flexibility, personalization and automation of products and services. However, it also increases requirements to cybersecurity and interdisciplinarity in all economic sectors. The research performed in project “Knowledge-intensive services sector adaptation to the conditions of Society 4.0” in 2019-2021 and subsequent technology transfer and implementation of the project outcomes was motivated by insufficient attention of both theory and practice to adaptation of small and medium sized enterprises (SMEs) in the service sector on technological, economic, and social aspects of Society 4.0.
This contribution goals are:

1. To present main research outcomes related to adaptation of SMEs in the service sector.
2. To introduce new insights and approaches to academic and professional community, 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.

Main project goals aimed to contribute to development and follow-up knowledge transfer related to significant technological and structural changes having fundamental influence on processes in service sector SMEs, to support effective and efficient adaptation of SMEs on changes in business environment, reduce risks resulting from inadequate understanding of necessary transformation of business processes, develop and validate the methodology of adaptation of target group of SMEs on economic, social and environmental conditions of Society 4.0 with special attention paid to knowledge intensive services (KIS, see 4.2) as knowledge providers and users. Statistical data presented by the ČSÚ document the increasing number and economic impact of the KIS sector (ČSÚ, 2021a; ČSÚ, 2021b).

The literature review and results of the field research resulted in understanding of Industry 4.0 and Society 4.0 as concepts of digitization, complex automation and robotization of a broad variety of many current human activities, transformation of job markets and educational systems. These concepts support the faster pace and efficiency in production of high quality, reliable and cheaper products and services, more efficient use of natural resources, and improved ecological impact of manufacturing and service processes in all sectors of national economy, homes, and in professional and private life with final goal of improving life quality (Vacek et al., 2019).

2. THEORETICAL BACKGROUND

In the Czech Republic, the main emphasize is given to development of technologies applicable in industrial applications, corresponding more to the term “manufacturing”, while the English term “industry” covers much broader spectrum. It should be taken into account that technology is a necessary, but not sufficient condition of success in the rapidly changing world and while it is the important tool, it cannot be a goal in itself.

It can be expected that, similarly to other developed economies, the focus in the ČR will shift to service sector and its role in the economy and employment will be increasing. Incoming wave of digitization, automation, artificial intelligence, and other components of the 4th Industrial Revolution will put additional emphasize on the knowledge intensive services (KIS) – see section 4.2. We can also expect the increasing importance on pre-production and post-production phases bringing higher added value than the production phase itself, as illustrates the “smiling curve” of Stan Shih (Chaitravi, 2010). While applications of technologies as robotics, automation, etc., in production phases is rather straightforward, it is not the case of the front- and back-end processes provided by knowledge intensive services.

3. METHODOLOGY

Methodological approach in realized research and follow-up technology transfer in the project sustainability period 2022-2024 is based on the mixed design strategy and is subdivided into six phases: I. Descriptive research – analysis of theoretical basis; II. Field research; III. Development of methodology of adaptation of SMEs in service sector to implementation of principles, processes, methods and tools, and its validation in business practice; IV. Examples of good practice of SMEs adaptation; V. The future trends and necessary changes, taking into account the current society situation; VI. Knowledge transfer and dissemination, implementation of project outcomes.

Dynamically oriented mixed research combines qualitative and quantitative approaches that are in mutual interaction in research design, data collection, analysis and evaluation, interpretation of results and their practical implementation. In applied exploratory sequential design, the qualitative data collection and analysis created the base for quantitative data collection and analysis, resulting in interpretation of findings and finally to formulation of future trends in SMEs in service sector.

4. RESULTS

4.1 Questionnaire, structured interviews

Due to the location of two project partners the questionnaire focused on the situation in the NUTS2 region Southwest joining two regions – Pilsen a South Bohemia. Potential respondents were identified by filtering the database Albertina (Bisnode, 2019). The following selection criteria were used in our search: company location - Pilsen and South Bohemia regions; company size - SMEs according to the EU definition of the SME; industry sector - prevailing NACE, sections J – information and communication activities, and M – professional, scientific, and technical activities. The online questionnaire was completed by total of 141 respondents. This initial survey helped to establish connections with the broader sample of relevant companies, what is the extremely important factor for the continued research requiring feedback from the companies and other stakeholders, including application guarantors. The detailed results of the questionnaire survey were accepted for publication (Vacek,

Dvořáková & Skřivan, 2022) and allow to formulate basic characteristics of knowledge intensive companies participating in our research.

The questionnaire survey was complemented by semi-structured interviews with 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 on the implementation of methods and tools of Industry 4.0 and Society 4.0. Their outcomes contributed to deepen the insights gained in the questionnaire research.

Among significant augmenting findings can be mentioned the following:

- More than 60 % of investigated companies states that the barrier of faster adaptation to Society 4.0 conditions they see in the lack of qualified workforce and financial resources needed to acquisition of new technologies.
- Urgent need of competent, well trained workers is perceived by 50 % of investigated companies and they feel their shortage as critical. The companies hiring graduates of secondary and higher education schools are often disappointed by their insufficient professional competencies and skills, including digital ones.
- Nearly 50 % of investigated companies do not use financing from public resources allocated to support of automation and digitization due to their administrative complicacy in the preparation and execution of projects and lack of time and personal capacity.

4.2 Study 1: Identification, analysis and evaluation of principles, procedures, methods and tools for adaptation of the service sector to the technical, economic, social and environmental conditions of Society 4.0

The study (Vacek et al., 2019) resumes results of the following project findings:

- **The present state and trends in KIS:** not all managers realize that without timely preparation their companies will not be able to keep pace with digitization. Nearly half of population is afraid of disappearance of jobs.
- **Classification of KIS.** Among KIS we include services with great intensity of knowledge usage. In their classification we adopted the OECD approach (OECD, 2006). Classification CZ-NACE (ČSÚ, 2008) ranks here information and communication services (section J) and professional, scientific, and technical activities (section M).
- **Knowledge services and innovation:** The open innovation concept is typical for KIS, what implies the importance of protection of intellectual property rights. KIS can play the important role as:
  - Innovation resources, if they act in initialization and development of clients´ innovation activities.
  - Innovation facilitators, supporting organizations in their innovation processes.
  - Innovation brokers and intermediaries, if they transfer knowledge among organizations.
- T**he road from Industry 4.0 to Society 4.0 and Society 5.0:** In the broader context of the 4th Industrial Revolution (4IR) the road can start by Industry 4.0, but must by followed through concepts of Work 4.0 and Education 4.0, resulting in systems approach to Society 4.0 with prospective outlook to Society 5.0. Forthcoming changes will not affect only industry and services, but also jobs and employment structure, social systems and education, they penetrate into company processes and even to personal life.
- **Principles, approaches, method and tools for the service sector adaptation:** This chapter focuses on overview of principles, approaches, method and tools for the service sector adaptation. Briefly characterized are technologies that can support entrepreneurship and convergence of which can lead to exploitation of their synergetic effects and emergence of new phenomena. Likens (2019) identifies eight essential technologies that matter for most businesses today and their convergence and synergic effects and Tucker (2019) provides the overview of technologies prepared for broader use.
- **Case studies, examples of best practice:** The concluding chapter presents selected case studies and best practices that can be interesting to Czech SMEs in the knowledge intensive sector.

4.3 Study 2: The catalogue of changes in knowledge and competency job requirements in Society 4.0

The study (Hejduková et al., 2019) introduces the reader to the issues related to Society 4.0 mainly from the point of view of impacts on labor market, requirements on competencies, qualifications, knowledge, and skills of the workforce, including a necessity of life-long education. It starts with description of current state and continues by identification of jobs endangered and newly emerging as a result of technological and socio-economic changes.

According to Frey & Osborne (2017) jobs in services, and especially in knowledge intensive services, are among least susceptible to automation. Similar conclusions for the Czech Republic were confirmed by Chmelař et al. (2015) and Kohout & Palíšková (2017).

The conclusions and recommendations of the study can be resumed as follows:

- Routine, repeatable jobs (not only manual ones!) will be among the first to be replaced by digitization, robotics, and automation. New job positions, hardly imaginable today, will emerge. Additional jobs will be created in personal services as recreation, leisure time, domestic care.

- The work character will undergo deep transformation. The demand of highly qualified jobs will be increasing. Companies are looking for graduates with competencies and skills demanded for work with new technologies, including artificial intelligence. The educational system must be substantially reformed to prepare future generations on new challenges with their opportunities and risks.
- Digitization will positively influence global competitiveness of workers with advanced digital literacy. Digital literacy should be promoted in the whole population. It can significantly increase the efficiency of the public sector.
- Multiplications effects will emerge as a result of the combination of advanced technologies and interdisciplinary research.

4.4 Methodology of service sector SMEs adaptation to the conditions of Society 4.0, monograph

Methodology presented in Dvořáková et al. (2020) suggests process of SMEs adaptation on disruptive changes brought by Industry 4.0 and Society 4.0 concepts to business processes. Synthesis of findings results in approach leading to identification, analysis, and evaluation of potential, opportunities and threats induced by automation, robotization, electronization, and digitization of SMEs´ business processes. It identifies changing requirements to workforce, life-long training and changes of work organization and forms. The methodology builds on field research and focus on identification of critical aspects, risks and opportunities connected with implementation of Society 4.0 principles.

Goals and functionality of the methodology were tested and validated in company practices of selected sample of SMEs whose prevailing activities are provision and usage of knowledge intensive services, in close cooperation with the project external application guarantors. The practical application of the methodology should contribute to increased productivity and quality of provided services, gaining competitive advantage brought by technologies and tools of Society 4.0, and enhancing knowledge potential and motivations of SMEs owners and managers. The proposed methodology represents a tool having potential of supporting the economic recovery and renewed growth of SMEs in current situation affected by the COVID-19 pandemic.

The project research outcomes were summarized in monograph "Adaptation of SMEs in service sector on conditions of Society 4.0" (Dvořáková et al., 2021) that presents the current state of relevant theoretical and practical issues related to adaptation of knowledge intensive services. It aims to contribute to 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 presenting case studies from several service sectors: accounting, taxes and audit; tourism; marketing; retail and projects in horticulture; lifelong learning; social enterprise.

The monograph character, content and structure based on multidisciplinary research and practice is primarily intended as a guide for service sector SMEs looking for inspiration, motivation and new ideas for implementation of automation, robotization, electronization, and digitization of their business processes. However, it can be recommended also to broader professional community, university students and, generally speaking, to anybody interested in issues connected with Industry 4.0/ Society 4.0 and their further advancement to Industry 5.0/Society 5.0.

4.5 Project website

Project is accompanied by the website https://azis.zcu.cz created in WordPress in Czech. The website is freely available to registered users and consists of four sections: ***About the project***: basic information, project teams; ***Documents***: links to all project outputs; ***Methods and tools*** that can help the users in their adaptation to the new conditions - this section will be amended during the project sustainability period using the feedback from users; ***Discussion forum***: communication platform.

5. DISCUSSION

Documented outcomes of the field research confirmed that SMEs in the KIS sector perceive introduction and development of new technologies in companies as important for their competitiveness, innovation of business processes, and higher quality of their products and services. More than half of investigated companies introduce new technologies gradually. However, they usually miss strategic approach to design, implementation and control of related changes. The findings of presented project activities together with the feedback from companies and other project stakeholders combined with continued desk and field research form a sound basis for achievement of the main project goal - now entering the next stage – the use of gained insight for resolving challenges faced by the project target group.

Economic and social impacts of the COVID-19 pandemic further significantly strengthen the necessity of implementation of new technologies. And the current war in Ukraine and its consequences, including inflation, high prices of oil, gas and electricity, make the situation even more complicated and cannot be resolved by technologies only. The challenges faced by society demand intensive applied socio-economic research. This is stressed out in many strategic documents - e.g. (Mařík, 2016, p. 85) writes: "An extremely important and irreplaceable role in the implementation of the initiative Industry 4.0 will play social science research …". It is

important to realize that socio-economic research cannot rely on funding from private sector as the technology oriented applied research.

6. CONCLUSION

The project was realized in the turbulent period of COVID-19 pandemic, during which the government regulations, economic and social impacts significantly influenced business environment, processes, technologies, supply chains not only in service sector, but in all economic sectors. The changes and challenges became a new norm for businesses and individuals, professional and private lives. Pandemics impacts influenced not only conditions of business, but also significantly accelerated motivation, interest, needs, and thinking of both SMEs managers and employees to effective and efficient application of principles, processes, methods, and tool brought to business, job market, new requirement to labor force, education and training and other areas of human life by Industry 4.0 and Society 4.0 concepts. From the point of view of scientific objectivity can be concluded that the realized research used the systems approach, aiming on its application in knowledge intensive SMEs. Follow up research should focus on future direction and development of Society 4.0 potential, influenced by the state of economic maturity and standard of living in relevant territory and with predicted demographic and environmental changes.

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Works Citation

Bisnode. (2019). *Bisnode Albertina*. https://www.bisnode.cz/produkty/albertina/

Chaitravi (2010). *The Smiling Curve: Stan Shih*. https://chaitravi.wordpress.com/2010/02/10/the-smiling-curve-stan-shih/

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

ČSÚ. (2008). *Klasifikace ekonomických činností (CZ-NACE).* https://www.czso.cz/documents/10180/20565267/021608.pdf/2f45895b-4c51-435b-a52a-0c7164dbf371

ČSÚ. (2021a). *MSP v ČR v sekci J – Informační a komunikační činnosti (CZ-NACE, oddíly 58-63).* https://www.czso.cz/csu/czso/dicvfu_cr_cz_nace

ČSÚ. (2021b). *MSP v ČR v sekci M – Profesní, vědecké a technické činnosti (CZ-NACE, oddíly 69–85).* https://www.czso.cz/csu/czso/trszvfu_cr

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

Dvořáková, L., Vacek, J., Hinke, J., Taušl Procházková, P., Černá, M., Hejduková, P., Vallišová, L., Caha, Z., Horák, J., Machová, V., Rain, T., Hořický, M., Janeček, P., Petrtyl, J., Písař, P., Brabcová, J., & Machová, K. (2021). *Adaptace malých a středních podniků v sektoru služeb na podmínky Společnosti 4.0.* Vydavatelství a nakladatelství Aleš Čeněk.

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.* https://doi.org/10.1016/j.techfore.2016.08.019

Hejduková, P., Hinke, J., Horák, J., Machová, V., Taušl Procházková P., Vallišová, L., & Vokoun, M. (2019). *The catalogue of changes in knowledge and competency job requirements in Society 4.0* (in Czech). Západočeská univerzita. https://azis.zcu.cz

Kohout, P., & Palíšková, M. (2017). *Impact of digitalization on employment and social security of employee.* https://ipodpora.odbory.info/soubory/dms/wysiwyg_uploads/bba5a5c7366cdaf3/uploads/Studie_Dopady_digitalizace.docx

Likens, S. (2019). *The Essential Eight.* https://www.pwc.com/gx/en/issues/technology/essential-eight-technologies.html

Mařík, V. a kol. (2016). *Průmysl 4.0: Výzva pro Českou republiku*. Management Press.

OECD. (2006). *Innovation and Knowledge-Intensive Service Activities*. OECD Publishing. https://doi.org/10.1787/9789264022744-en

Tucker, R. B. (2019). *These Nine Powerful Technologies Are Now Ready for Rollout.* https://www.innovationexcellence.com/blog/2019/02/26/these-nine-powerful-technologiesare-now-ready-for-rollout/

Vacek, J., Dvořáková, L., Černá, M., Horák, J., Caha, Z., & Machová, V. (2019). *Identification, analysis and evaluation of principles, approaches, methods and tools for adaptation of service sector to the technical, socioeconomical and environmental conditions of Society 4.0*. NAVA.

Vacek, J., Dvořáková, L., & Skřivan (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*. Accepted for publication in *Economy of Regions*, https://www.economyofregions.org