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Lilia Dvořáková
CSc. (Economics), Professor,
Finance and Accounting Department,
Faculty of Economics,
University of West Bohemia
8 Univerzitní Str., Pilsen, 301 00,
Czech Republic
ldvorako@kfu.zcu.cz
ORCID ID:
<https://orcid.org/0000-0001-6389-381X>



Jakub Horák
Ing. (Economics),
School of Expertness and Valuation,
Institute of Technology and Business
in České Budějovice
517/10 Okružní, České Budějovice, 370 01,
Czech Republic
horak@mail.vstecb.cz
ORCID ID:
<https://orcid.org/0000-0001-6364-9745>



Zdeněk Caha
PaedDr., Ph.D. (Economics), Faculty of
Corporate Strategy,
Institute of Technology and Business
in České Budějovice
517/10 Okružní, České Budějovice, 370 01,
Czech Republic
caha@mail.vstecb.cz
ORCID ID:
<https://orcid.org/0000-0003-2363-034X>



Veronika Machová
Ing. (Economics),
School of Expertness and Valuation,
Institute of Technology and Business in České Budějovice
517/10 Okružní, České Budějovice, 370 01, Czech Republic
machova@mail.vstecb.cz
ORCID ID: <https://orcid.org/0000-0001-5479-6655>



Simona Hašková
Ph.D. (Economics),
School of Expertness and Valuation,
Institute of Technology and Business in České Budějovice
517/10 Okružní, České Budějovice, 370 01, Czech Republic
haskova@mail.vstecb.cz
ORCID ID: <https://orcid.org/0000-0002-4971-7972>



Zuzana Rowland
PhD. (Economics),
School of Expertness and Valuation,
Institute of Technology and Business in České Budějovice
517/10 Okružní, České Budějovice, 370 01, Czech Republic
rowland@mail.vstecb.cz
ORCID ID: <https://orcid.org/0000-0002-7792-8873>



Tomáš Krulický
Ing. (Economics),
School of Expertness and Valuation,
Institute of Technology and Business in České Budějovice
517/10 Okružní, České Budějovice, 370 01, Czech Republic
krulicky@mail.vstecb.cz
ORCID ID: <https://orcid.org/0000-0002-0378-2699>

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

Abstract

Research background. The need for an in-time, efficient and effective adaptation of small and medium-sized enterprises in the service sector to the technical, economic, social and environmental conditions of Industry 4.0 and Society 4.0 is a current problem caused by the introduction of new information

and communication technologies, cyber-physical systems and artificial intelligence into all economic industries and areas of human life. The advent of new technologies is changing the entire value chains of Industry 4.0 - Labor 4.0 - Education 4.0 - Thinking 4.0, creating conditions for new business models but also pressure on flexibility and personalization of services or triggering new requirements for cyber security and the interdisciplinarity of access of small and medium-sized enterprises - providers and users of services. The current global COVID-19 health pandemic (2020-2021), with its economic and social impacts on all economic industries, has accelerated the use of disruptive technologies, principles, procedures, methods and tools of Industry 4.0 and Society 4.0 and the need for the support of small and medium-sized enterprises in the service sector in adapting to changes in the business environment.

Purpose of the article. The main objective of the research is to validate, evaluate and discuss the functionality and content of the created methodology of adaptation of small and medium-sized enterprises in the service sector to the implementation of the principles, procedures, methods and tools of Society 4.0 and its applicability in business practice, specifically focusing on small and medium-sized enterprises in the area of knowledge-intensive services. An integral part of the research is to assess selected negative and positive impacts of the COVID-19 pandemic on business processes in the context of issues being tackled.

Methodology. The methodological procedure to validate the functionality and content of the created methodology of the adaptation of small and medium-sized enterprises in the service sector to the conditions of Society 4.0 is based on the strategy of mixed research. An explorative sequence design was used as a key design of mixed dynamically oriented research, during which quantitative data collection, analysis and evaluation formed the basis for qualitative analysis and evaluation, which resulted in the interpretation and discussion of the research results and, at the end of the paper, the formulation of the issues that will be the next area of scientific research activity of the author's team. In the quantitative part of the research, Fisher's exact test was used for the verification of difference statistics in data obtained from testing a sample of micro, small and medium-sized enterprises and from external project application sponsors providing services to this category of enterprises. In the qualitative part of the research, the Atlas.ti software was used for the evaluation of information obtained with respect to the methodology of adaptation of small and medium-sized enterprises for encoding, processing and interpretation of qualitative data and semantic networks were created for the individual sub-categories of evaluation.

Findings & Value Added. The research result proved that the adequacy of the content and functionality of the checked methodology of adaptation of SMEs strongly corresponds to the needs and requirements of micro and small enterprises in particular that conduct business in the area of knowledge-intensive services. Barriers, limits, needs and potential in individual categories of micro, small and medium-sized enterprises were identified which are related to the use of technologies and tools of Society 4.0, to new requirements for knowledge and skills qualifications of labor and to the relation of SMEs to innovations in business processes. The results of validation of the methodology of adaptation of SMEs in the knowledge-intensive service sector confirmed that the created methodology of adaptation of small and medium-sized enterprises is applicable to the implementation of the principles, procedures, methods and tools of Society 4.0. in the real conditions of business practice.

Keywords: Industry 4.0; Society 4.0; Small and Medium-sized Enterprises (SMEs); Methodology of Adaptation of Small and Medium-sized Enterprises; Knowledge Intensive Services

JEL Classifications: L21; L80; M19; O14

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1. Introduction

Disruptive changes caused by the introduction of new technologies, cyber-physical systems and artificial intelligence into all sectors of the economy, with impacts on all areas of society, i.e. impacts on the labor market, education, science and research, legislation, cyber security, ethics etc., are, both in practice and theory, described by terms such as Fourth Industrial Revolution, Industry 4.0 and, in the context of changes and impacts on the entire society, Society 4.0 (Schlechtendahl et al., 2015; Mařík et al., 2017; Frey & Osborne, 2017; Oztemel & Gursev, 2020). The key focus in monographies, professional articles and studies and best practices with respect to these issues is today mostly on industrial applications in large enterprises, although an in-time and efficient implementation of the concepts of Industry 4.0 and Society 4.0 is an existential challenge also for small and medium-sized enterprises (the «SMEs») in the service sector, aiming to reinforce their development, competitiveness and sustainability in the national and global context (Castelo-Branco et al., 2019; Szalavetz, 2019; Xu et al., 2018).

The current need for an in-time and effective adaptation of SMEs in the area of knowledge intensive services to the technical, economic, social and environmental conditions of the concepts of Industry 4.0 and Society 4.0 was confirmed by field research conducted from 2019 to 2020 in the Czech Republic (the «CR»). Using a questionnaire inquiry, the results of which were further supported by structured interviews with SME owners and managers, and based on the established needs and comments arising from the discussions with SME representatives in workshops in the CR, it was established that SMEs in the knowledge intensive service sector lack any methodology for their adaptation to the implementation of principles, procedures, methods and tools to the conditions of Society 4.0. The identified minor attention in the field of theory and practice dedicated to the issues of the adaptation of micro, small and medium-sized enterprises to the conditions of Society 4.0 led to the creation of an innovative methodological tool - Methodology of adaptation of small and medium-sized enterprises in the service sector to the implementation of principles, procedures, methods and tools of Society 4.0 (Dvořáková et al., 2020).

The main objective of the research is to validate, evaluate and discuss the functionality and content of the created methodology of adaptation of small and medium-sized enterprises in the knowledge intensive service sector to the implementation of principles, procedures, methods and tools of Society 4.0 and its applicability in business practice. With respect to the main objective, the following research questions 1 to 4 were formulated.

RQ1. What are the reasons for creating a methodology for the adaptation of small and medium-sized enterprises in the knowledge intensive service sector to the conditions of Society 4.0 in the CR?

RQ2. How does the selected sample of enterprises evaluate the methodology for adaptation of small and medium-sized enterprises in the knowledge intensive service sector to the conditions of Society 4.0 in the CR in terms of its practical use, extent and potential?

RQ3. To what level is working from home supported, considering the current COVID-19 situation in the knowledge intensive service businesses in the CR?

RQ4. What limits and barriers do the knowledge intensive SMEs encounter when adapting to the conditions of Society 4.0 in the CR?

The research results help fill the gap in the small attention paid in theory and practice to the adaptation and transformation of business processes of SMEs in the service sector in the context of use of computerization, digitization and robotization and other methods and tools of Industry 4.0 and Society 4.0 including their impacts on knowledge and skills qualification requirements on labor, the labor market, education etc. Moreover, the COVID-19 pandemic prompted the need of using such technologies, methods and tools in SMEs and the economic and social impacts of the pandemic are causing several process, organizational, personal, communication and interhuman changes in SMEs' business environment (Donthu & Gustafsson, 2020; Fairlie, 2021).

The presented research results are being implemented by a multidisciplinary project team from the University of West Bohemia in Pilsen and the Technical and Economic University in České Budějovice and as part of a professional cooperation with external application guarantors (regional, national and professional institutions in the Czech Republic: Regional Chamber of Commerce in the Pilsen Region; Labor Office of the Czech Republic, Regional Branch in Pilsen; Regional Office of the South Bohemian Region; Labor Office of the Czech Republic, Regional Branch in České Budějovice; South Bohemian Chamber of Commerce; South Bohemian Society for the Development of Human Resources). The project results may be used in business practice and the academic sphere through public and free-of-charge access to the project website (for details, see the Adaptation of Knowledge Intensive Service Sector to the Conditions of Society 4.0, official project website, 2019).

2. Brief Literature Review

In the last ten years, the topics of the Fourth Industrial Revolution, Industry 4.0 and Society 4.0 have been becoming more and more frequented both in theory and in practice, together with the initiatives reacting to the Fourth Industrial Revolution (Peraković, Periša, & Zorić, 2020; Staněk et al., 2019; Kruliš et al., 2018; Skobelev & Borovik, 2017; Vacek, 2017; Vance, 2015; Ministry of Trade and Industry of the Czech Republic, 2016; Anderson, 2012; Kagermann, Lukas, & Wahlster, 2011). Since 2016, when the topic of the Fourth Industrial Revolution was selected as the central topic for the World Economic Forum (World Economic Forum, 2016), the vision and concepts of Industry 4.0 and Society 4.0 have been analyzed and developed by the professional public, in governmental documents and

regulatory measures and presented in good practice examples, in particular in the environment of large enterprises and institutions (Ministry of Labor and Social Affairs of the Czech Republic, 2016; Tomek & Vávrová, 2017; Office of the Government of the Czech Republic, 2017; Atik & Ünlü, 2019; Keidanren, 2020).

Today, the Fourth Industrial Revolution is a permanently developing concept where disruptive technologies such as Cyber-Physical Systems, Big Data, Internet of Things, Internet of Services, Internet of People, artificial intelligence, virtual reality, robotics and many others essentially change the way we make business, work and live. In Europe, the concept has been called Industry 4.0 and in other parts of the world, it has been referred to as the Fourth Industrial Revolution. Industry 4.0 already has an impact on today's society and it has the potential to influence the form and functioning of the future society. The principles, procedures, methods and tools of Industry 4.0 are applicable not only in industrial production but also in all production and non-production economic industries, in public administration as well as in the professional and personal lives of the individual. For these reasons, this society has been referred to as Society 4.0. (Morrar, Arman, & Mousa, 2017; Xu et al., 2018; Vacek et al., 2019; Taušl Procházková et al., 2019).

The Fourth Industrial Revolution grows upon the foundations of the first, second and third industrial revolutions and it is regarded as a brand-new era thanks to the explosive rate of development and revolutionary innovative factor of applied technologies. Schwab (2017) draws attention to the unprecedented rate of technological breakthroughs and to the impacts of these changes on the entire society. We agree and we want to add that the paradigmatic change involves an integrated and combined use of disruptive technologies and changing the way that people think, the so-called Thinking 4.0. The Fourth Industrial Revolution - Industry 4.0 is now a highly global and heterogeneous concept today. It is connected both with universal challenges as well as many risks or threats. The most frequently discussed are the impacts on the elimination of many job positions or the extinction of entire professions, impacts on the content, scope and forms of education, impacts on data and IT systems security both nation-wide and world-wide (Chmelař et al., 2015; Ministry of Labor and Social Affairs of the Czech Republic, 2014; Office of the Government of the Czech Republic, 2015; OECD, 2016; Santos et al., 2017; Keidanren, 2018; Dvořáková, 2019).

The definitions, characteristics and content of the Fourth Industrial Revolution and concepts of Industry 4.0 and Society 4.0 have not been clearly defined in professional literature as of yet. Since 2011, their notion and definition in terms of objectives and content have been in development (for more details, see Buguin et al., 2013; Dutton, 2014; Kagermann & Wahlster, 2014; Pan et al., 2015; Almada-Lobo (2015); Kovács & Kot, 2016; Morrar et al., 2017; PwC, 2017; Piccarozzi et al., 2018). According to Inkermann et al. (2019), the term Industry 4.0 has gone through an inflation of meaning and is almost ever-present. We need to emphasize that this applies not only to various professional articles of authors from 2011 to 2021 but even more so to the comparison of sources from different years. It is only natural that today's opinions as to what technologies, methods and tools are the pillars of Industry 4.0 and Society 4.0 and what their objectives are might significantly differ from the opinions expressed in 2011 when the term «Industry» was first presented at the Hannover Fair in the Federal Republic of Germany. Schwab (2016) states that the Fourth Industrial Revolution is characterized by a fusion of technologies that connects the lines between the physical, digital, and biological spheres. If we look at the definition of Industry 4.0 formulated by the German organization GTAI (Germany Trade & Invest, 2014), we can learn that the term «Industry 4.0» refers to an advanced technological revolution which supports the interaction of real and virtual worlds in a new way, creating new aspects which are to change the production sector completely. The essential element of the said definition is that it emphasizes the cooperation of man and technology and the new form of man - machine interaction, such as touch interfaces, symbolized by advanced robotics and 3D printing.

Based on a systematic literary research and results of their research, the authors of this article define the concepts of Industry 4.0 and Society 4.0 concepts for digitization, computerization, full automation and robotization of many of the current human activities, transformation of the labor market and education. These concepts help provide a higher rate and efficiency of the creation of more accurate, reliable and cheaper products and services, a more effective use of materials and environmentally-friendly production and non-production processes in all sectors of the economy, in households and in professional and private human lives, ultimately striving to improve the quality of life.

Small and medium-sized enterprises play a significant and irreplaceable role in the European economy (Vojík, 2010; Hillary, 2000). They represent more than 99% of European businesses, provide two-thirds of jobs in the private sector and contribute to the creation of the aggregate added value created by businesses in the EU by more than one half (European Commission, 2021). For the last thirty years, the Czech Republic (the «CR») has also been one of the countries with a major market share of SME segments (in terms of their number, employed people, share in the creation of added value and other macroeconomic indexes). As demonstrated by the macroeconomic data of the Czech Statistical Office (2021a), the share of SMEs in the total number of active businesses amounted to 99.8%; the share of SMEs' employees in the total number of employees in the business sphere in the CR was 58% and the share of SMEs in the creation of added value was 55% in 2019. In terms of SME size categories (micro, small and medium-sized enterprises), statistical data processed from the sources of the European Commission document the dominant representation, in terms of their numbers, of the role and significance of micro, small and medium-sized enterprises both in the Czech economy and in the EU economy (European Commission, 2020). In the overall structure of the number of businesses according to individual size categories, micro enterprises significantly prevail (96% in the CR, 93% in the EU); small enterprises represent a 3% share in the CR and 6% share in the EU; medium-sized enterprises have a 0.8% share both in the CR and EU. The fact that large enterprises only have a 0.2% share in the number of all enterprises, both in the CR and EU, confirms the irreplaceable role of SMEs not only in terms of the economy but also in terms of social and regional development. This fact played an important part in the decision to focus our research on SMEs.

According to Vojík (2010), Chládková (2010) and Straková et al. (2020), the advantage of SMEs is mainly their relative flexibility (including the formation and termination of companies), a relatively high absorption capacity of labor force due to flexibility and a capacity to fill the gap in the structure of business relationships and the response time to changes of conditions. The disadvantages include more difficult access to capital, new knowledge and information and diminished capacity to eliminate the consequences of fluctuations of external influences mainly in the initial stages of SMEs' development. Their relatively limited resources (such as human, time or financial) may also restrict their access to new technologies, methods and tools of Industry 4.0, to the introduction of innovations or subsidy and support programs.

In this research, we categorized businesses as SMEs based on Commission Recommendation No. 2003/361/EC of 6 May 2003 concerning the definition of micro, small and medium-sized enterprises. This Recommendation (European Commission, 2003) presents a division using a combination of quantitative criteria (number of employees, yearly turnover, yearly balance sheet - assets) and qualitative criteria (independence of the business). Not exceeding the number of employees is mandatory, however, a small or medium-sized enterprise can choose the turnover or balance sheet limit, choosing only one criterion which is more beneficial for the enterprise. A micro enterprise is defined as an enterprise with fewer than 10 employees and a yearly turnover and/or yearly balance sheet below EUR 2 million. A small enterprise is defined as an enterprise with fewer than 50 employees and a yearly turnover and/or yearly balance sheet below EUR 10 million. An enterprise is categorized as a medium-sized enterprise when it employs less than 250 people and has a yearly turnover less than EUR 50 million and/or a yearly balance sheet less than EUR 43 million. The European Commission created the said categorization of micro, small and medium-sized enterprises to provide for a focused and efficient targeting of subsidy and support measures for SMEs.

In terms of the national economy and market sectors, traditional three-sector divisions of the economy (primary, secondary and tertiary sectors) are used in professional literature and for statistical processing of data. In the 1950s, a quaternary (knowledge) sector was split from the tertiary sector and since the 1980s, a quinary sector has been split (H-tech research and advanced information technologies, biotechnologies, nanotechnologies). The service sector (tertiary sector) includes all branches of human activities based on the provision of services, i.e., provision of work, knowledge, financial means, infrastructure or products or their mutual combinations. Vargo and Lusch (2014) take a holistic approach to the definition of a service, presenting it as an application of competencies for the benefit of other people. The tertiary sector is considered to be the most dynamic part of the economy and its share in the economy to be the characteristics of a country's level of development. Since the 1980s, there has been a significant shift of business activities into the tertiary sector. In terms of macroeconomic indexes, the service sector represents a major part of

the national economies of the Czech Republic and other European countries. The tertiary sector in the CR created 63% of gross added value in 2019, which is approximately 10% less in comparison to the average attained in the EU countries. The share of services in the total gross added value in the EU-28 countries was 73.9% in 2019, compared to 69.9% in 2018. Services have an especially high relative importance in Luxembourg, Malta, Cyprus, France, Greece, The Netherlands, Belgium and Portugal. At least three fourths of the aggregate added value were attributed to them. In the Czech Republic, Ireland, Romania, Poland, Slovakia, Slovenia and Hungary, the shares of services in the gross added value were from 61% to 66% (Czech Statistical Office, 2021a).

For a more detailed division of economy sectors into individual branches and into individual economic activities, classifications of human activities at the national, European and international levels were created in the 20th century. We based the selection of businesses into our tested sample of SMEs in the area of knowledge intensive services on the categorization of the business according to the CZ-NACE classification (Czech Statistical Office, 2008). It is the Classification of Economic Activities introduced by the Czech Statistical Office on 1 January 2008 and this classification is fully compliant with the Statistical Classification of Economic Activities in the European Community, specifically with its revision two (NACE Rev. 2). In the field research we performed, SMEs providing and using knowledge intensive services were the specific target group. Under the applied classification of economic activities, CZ-NACE, these are primarily information and communication activities (services in section J) and profession, scientific and technical activities (services in section M of the classification). Knowledge Intensive Services represent services requiring a high intensity of the use of knowledge (Miles et al., 2019, Hinke et al., 2019). They are knowledge providers - businesses whose main form of activities is the creation of new knowledge, and knowledge users - business that use knowledge created by its providers to innovate products, services and processes as part of their activities. In many cases, working with knowledge has a mixed form, i.e. the business is both the provider and user of knowledge. Such a way of work gets reflected in so-called open innovations (Chesbrough, 2006).

The literary research focused on the issues of the adaptation of micro, small and medium-sized enterprises in the area of knowledge intensive services to the conditions of 4.0 shows that very small attention is paid to these issues in theory. Kagermann, Wahlster & Helbig (2013) state, in the Final Report of the Industry 4.0 Working Group, their recommendations for the implementation of the German strategic initiative Industry 4.0 and priority activities to assure the future of German manufacturing industry. They compare and evaluate the condition and initiatives for the support and financing of industrial politics in Germany to selected countries and parts of the World (Western Europe, EU, China, USA, India and others) and they state that Germany has a potential to become a leading market and leading supplier for Industry 4.0. Müller (2019) is one of the few authors who examines Industry 4.0 in the context of small and medium-sized enterprises and the business model. His research paper used an exploratory research design based on 43 in-depth expert interviews within the three most important German industry sectors, mechanical and plant engineering, electrical engineering and automotive suppliers. The author defines different characteristics for the providers and users of Industry 4.0 and discovers that key resources and value proposition are among the most affected elements of the business model, whereas channels are the least affected. Sommer (2015) examines the awareness, readiness and ability of companies to face the challenge of Industry 4.0, taking into account the special role of SMEs. Based on the review and comparison of nine studies, he states that there is usually awareness about the topic relevance and he finds that the preparedness and ability to face the challenges of Industry 4.0 strongly depend on the size of SMEs and he deepens the knowledge of the adaptation deficits of German SMEs. The smaller SMEs are, the higher the risk that they will become victims instead of beneficiaries of the Fourth Industrial Revolution. Ingaldi & Ulewicz (2020) resolve, as part of their research, the issues of implementation of Industry 4.0 into SMEs in Poland and they map the level of SMEs' readiness for sustainable development through technological transformation. They indicate the lack of financial resources and specialized support in procuring new technologies as the main problems of SMEs' adaptation. Vanhaverbeke et al. (2020) focus on the research of open innovations in SMEs, they indicate sectoral patterns of open innovation in SMEs and they deal with the measuring, evaluation and stimulation of open innovation in SMEs. Open innovation and open business models are one of the frequently discussed topics of the last years and they also represent a source of solution, ideas and opportunities in the process of adaptation of SMEs in the knowledge intensive sectors to the conditions of Society 4.0.

3. Purpose

The purpose of the research is to validate, assess and discuss the functionality and content of the created methodology of adaptation of SMEs in the knowledge intensive service sector to the implementation of principles, procedures, methods and tools of Society 4.0 and its applicability in business practice. The evaluation and discussion of results are also oriented on extending the knowledge potential in the area of using philosophy, vision and concepts of Society 4.0 in the real business conditions of SMEs in the service sector in the context of the global COVID-19 pandemic.

SMEs in the service sector in the CR today are not able to find any user-accessible methodological tool or best practices which would have been validated in theory and in practice and which would support and facilitate an effective and in-time adaptation of SMEs in the service sector to changes in the business environment associated with the advent and development of the concepts of Industry 4.0 and Society 4.0.

4. Research Methodology

The research in 2019 to 2021 was motivated by the current need of an in-time and effective adaptation of SMEs in the service sector in the CR to the technical, economic, social and environmental conditions of the concepts of Industry 4.0 and Society 4.0, with a specific focus on SMEs in the sector of knowledge intensive services. The SMEs' current need was corroborated by field research (questionnaire survey, structured interviews with SMEs' owners and managers in the South Bohemian and Pilsen Regions in the Czech Republic, two workshops for SMEs in the service sector) and led to the formulation of the methodology of adaptation of SMEs in the service sector to the conditions of Society 4.0. The structure and content of proposed Methodology of Adaptation of SMEs were drafted based on the pre-research carried out which included the following: creation of two critical studies focused on the analysis and evaluation of the technological and social impacts of Industry 4.0 (Vacek et al., 2019; Taušl Procházková et al., 2019); a questionnaire survey and structured interviews in SMEs in the sector of knowledge intensive services from 2019 to 2020.

Validation of the Methodology alone will be divided into main parts - the quantitative part and the qualitative part. The data file based on which both these parts will be processed will contain a total of 42 businesses, out of which there will be 14 micro enterprises, 14 small enterprises and 14 medium-sized enterprises. For the purpose of confirmation and descriptive statistics, typology based on the size of an enterprise and its subject of business will be applied, where groups of approximately the same sizes will be formed through categorization. The following categories will be chosen:

- 1) IT - companies focused mostly on software development.
- 2) Consultancy - companies of financial consultants, HR consultants and accountants, tax advisors and auditors.
- 3) Project activities involving various topics - companies offering translations, marketing, educational projects, management or product testing services.
- 4) Production - companies manufacturing and distributing their own products, building companies.

The quantitative part will be focused on the evaluation issues with respect to the Methodology, in particular on the evaluation of whether the structure and content are adequate and whether the Methodology is adequate for business, practice, interest in cooperation, the willingness to share experience, representation of technologies, requalification, interest in workshops, utilization of outsourcing, automation, representation of innovations and an increase of the share of working from home. To that end, IBM SPSS statistical software will be used, where the available data will be processed in the form of contingency tables in which the existing differences will be checked using Fisher's exact test. The sizes of contingency tables for individual partial calculations will be in the following formats: 2x3, 3x3 and 3x4. Answers to the questions concerning the evaluation of the Methodology will be in the format of four-level nominal data, i.e. 1 = No; 2 = Rather not; 3 = Rather yes; 4 = Definitely yes. In all cases when the answer is not «No», three answer options will be used for the depiction of statistical analysis, too, since a relevant statistical evaluation would not otherwise be possible. The results of statistical processing will then be transformed and processed in Microsoft Excel, where they will be visualized in the form of graphs. For the purpose of descriptive interpretation, classical column graphs, group column graphs and compound column graphs will be used (for all categories of the given area together). Based on the Fisher's test calculations, separate descriptive tables will be created for all interactions in the respective section.

To create the qualitative part, a software for qualitative data analysis, ATLAS.ti, will be used. A more detailed description of the enterprises involved will be included here. This part will in particular include the topics processed in the following categories: working from home, requalification, outsourcing, automation, technology, innovation and COVID-19 impacts on the business. The evaluation questionnaire will be complemented by imported comments which will be encoded using overt coding and then interlinked with the topics above. The codes will be interlinked using axial coding and a secondary classification will be made. As part of the analysis of the main part of the qualitative comments on the evaluation of Methodology, semantic networks will be created for individual partial categories which will be represented graphically and which can be used for secondary evaluation. Specifically, there will be the following categories: the professional level of the text, practicality, the extent of the text, recommendations, evaluation, applicability.

5. Results

5.1. More detailed description of the creation of methodology and validation procedure

As already mentioned above, the methodology was formulated based on the prior outputs from the project in 2019 and 2020 and based on two studies (study 1 - Identification, analysis and evaluation of the principles, procedures, methods and tools for the adaptation of service sector to the technical, economic, social and environmental conditions of Society 4.0.; study 2 - Catalogue of changes of knowledge and skills qualification requirements for jobs in connection with the advent and development of Society 4.0), based on the motions, comments and feedback from Workshop No. 1 and Workshop No. 1 Report - Adaptation of the sector of knowledge intensive services to the condition of Society 4.0.

For the research aimed at the formulation of this methodology, both qualitative and quantitative research methods were applied, combining empirical data collection (the questionnaire survey and structured research) and desk research methods. To compare the issues being tackled in the Czech environment and abroad, comparative methods were applied. For this part of the research, secondary aggregated data (Czech and international statements) and the primary data of the external application guarantors (Regional Chamber of Commerce in the Pilsen Region; Labor Office of the Czech Republic, Regional Branch in Pilsen; Labor Office of the Czech Republic, Regional Branch in České Budějovice; South Bohemian Chamber of Commerce; Regional Office of the South Bohemian Region; Jihočeská společnost pro rozvoj lidských zdrojů, o.p.s. (South Bohemian Society for the Development of Human Resources)) were used; these guarantor focus on working with SMEs in the service sector.

In the preparation and implementation of empirical survey, we also cooperated with the above-mentioned external application guarantors of the project and we used the Bisnode's Albertina database and database of the Technological Agency of the CR (Czech Republic) concerning the supported projects focusing on Industry 4.0 and Society 4.0. The primary objective of the empirical survey was to establish what the attitude of SMEs to innovations with respect of technological, economic and social changes brought by Industry 4.0 and Society 4.0 is. By the empirical survey, we also tried to establish the current state of affairs and strategy in this field in SMEs in the service sector and the barriers and limits to the development of SMEs in the service sector. The questionnaire survey was carried out from 5 June to 15 November 2019 and a total of 141 respondents took part. Structured interviews were conducted with a total of 20 representatives of businesses in the service sector.

Upon consultations about the proposal of the Methodology which was formulated based on the collected information, the Methodology was first created and then validated and tested in corporate practice, which is also the subject of this article. The validation was made in cooperation with the external application guarantors who confirmed that the content and procedures of the proposed Methodology correspond to the needs and requirements of SMEs in the service sector. The data sample used for validation of the Methodology included a total of 42 enterprises, out of which there were 14 micro enterprises, 14 small enterprises and 14 medium-sized enterprises. For the purposes of statistics, typology based on the size of an enterprise and its subject of business was applied, where groups of approximately the same sizes were formed based on the categorization. The methodology validation was split into two parts - the qualitative part and the quantitative part; both these parts were described in detail in the methodology of this article. The basic information about enterprises involved according to the size and subject of business is incorporated in [Figure 1](#).

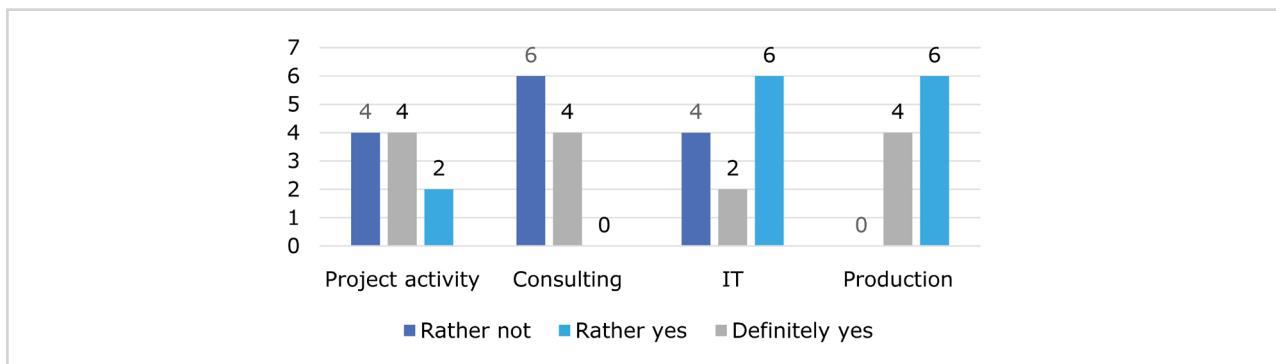


Figure 1:
Involvement of enterprises according to size and subject of business
Source: Calculated by the authors

5.2. Evaluation of the Methodology (practicality, extent and potential thereof) by the selected sample of enterprises

Below, you can find a graphical expression of how the selected sample of enterprises evaluated the Methodology for adaptation of SMEs in the service sector in the CR to the conditions of Society 4.0 in terms of its practicality, extent and potential. The results are provided according to the category of size of the enterprise and according to the type of business of the enterprise. Figure 2 shows the results of evaluation of the applicability of the Methodology in practice.

As you can see in the Figure above, micro enterprises were the ones with the highest proportion of the answer «Definitely yes» (57%), while it was always only 2 enterprises which gave this answer in the other size categories. «Rather yes» was a dominant answer given by twelve small enterprises (86%) and ten medium-sized enterprises (71%). The answer «Rather not» was given only by two micro enterprises and two medium-sized enterprises. The potential of Methodology for its applicability in practice is especially important; the applicability is shown in Figure 3.

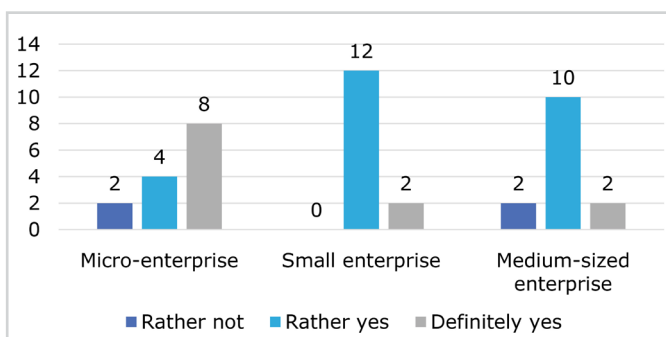


Figure 2:
Evaluation of the Methodology (practicality, extent and potential thereof) by the selected sample of enterprises
Source: Calculated by the authors

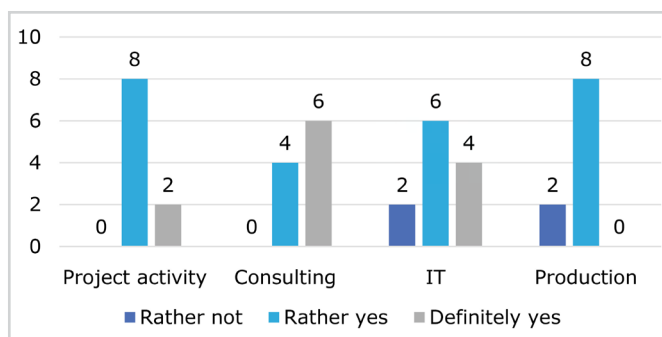


Figure 3:
Evaluation of the applicability of the Methodology in practice according to the type of activities
Source: Calculated by the authors

According to Figure 3, six consultancy companies (60%), four IT companies (33%) and two companies involved in project activities (20%) answered «Definitely yes». «Rather yes» was the most frequent answer which was given by 80% of companies involved in project activities, 80% of the production businesses and 50% of IT companies. Two IT companies and two production businesses answered «Rather not».

The results of Fisher's test by which differences were tested showed the following values, i.e. for the enterprise size ($V = 5.67$, $p = .22$) and subject of business ($V = 5.95$, $p = .47$).

Based on the comments obtained as part of the qualitative evaluation of the practicality of methodology by the selected sample of enterprises, the enterprises perceived a certain lack of practical procedures and instructions. By way of example, a representative of an adult education and marketing business says the methodology has been processed very well, however, it is not very practical for direct application in SMEs. Internal processes, possibilities of the application of

automation and utilization of successful practice examples were identified as the chief areas for the application of instructions.

For the evaluation of the extent of Methodology by the selected sample of enterprises, see Figure 4.

As you can see, a total of six micro enterprises (43%) and six small enterprises (43%) answered «Definitely yes». The remaining small enterprises all answered only «Rather yes», while two micro enterprises and four medium-sized enterprises answered «Rather not»; the answer «Rather yes» was prevalent with medium-sized enterprises. In Figure 5, the results of the evaluation of adequacy of the extent for enterprises according to the type of activities are shown.

As you can see in Figure 5, the extent is seen as adequate mainly by consultancy companies that mostly answered «Definitely yes» (80%); this answer was given only marginally by other businesses. All enterprises involved in project activities answered «Rather yes». IT companies and production enterprises, two representatives of each answered «Definitely yes» and six of each answered «Rather yes» (50% for IT, 57% for production).

The results of Fisher's test by which differences were tested showed the following values, i.e. for the size of an enterprise ($V = 5.54$, $p = .24$) and subject of business ($V = 9.74$, $p = .06$). Based on these facts, we can say that the adequacy of the extent and subject of business come very close to the determined significance level. In case of a larger sample of enterprises, a statistically provable difference might be expected.

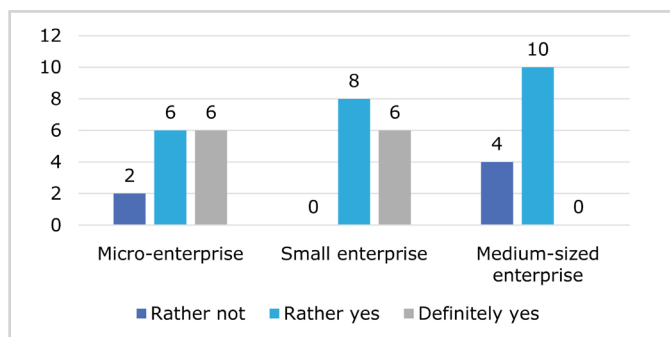


Figure 4:

Evaluation of the adequacy of the extent for enterprises according to size

Source: Calculated by the authors

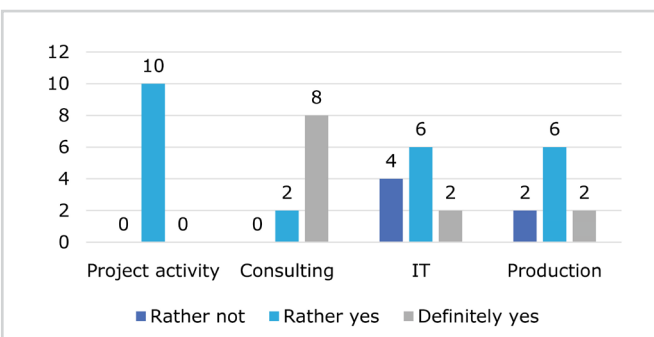


Figure 5:

Evaluation of the adequacy of extent for enterprises according to the type of activities

Source: Calculated by the authors

The opinions (as expressed in the comments) on the extent of text of the methodology are varied, which is only natural. Although the extent is positively appreciated by most, commenting that the methodology is extensive and covers all fields relating to the issues at hand, others criticize that some parts are in too much detail, while other parts are in less detail or no detail at all. The opinions on the extent vary depending on whether the basic needs of the particular user of the Methodology were addressed, or not. By way of example, one of the accounting and tax firms believes that the innovation section is too extensive, while there is no section dedicated to the particular methods of processes digitization which would be of interest to the firm. Based on the recommendations with respect to the extent, motions were included to create a brief summary version for practical work, best in the form of a workbook.

In Figure 6, the evaluation of the adequacy potential of the Methodology for enterprises is represented.

Small enterprises appreciated the applicability of the Methodology potential for enterprises positively, all of them answering «Rather yes». Micro enterprises also demonstrated a positive appreciation, most frequently answering «Definitely yes»; this answer was given by six of them (43%). Only four micro companies (29%) answered «Rather not». Medium-sized enterprises answered «Rather not» or «Rather yes» equally, six of them giving the former answer and six of them giving the latter answer (43%). Figure 7 shows the evaluation of the applicability of the Methodology for enterprises according to the type of activities.

All enterprises involved in project activities answered «Rather yes» when evaluating the applicability of Methodology. This was also the most frequent answer given by IT companies. Four consultancy companies (40%) and four IT companies (33%) answered «Definitely yes».

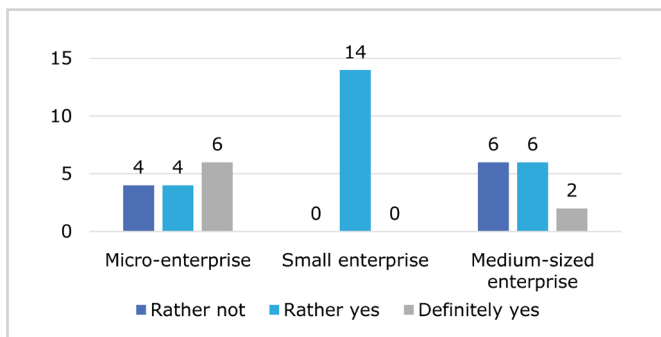


Figure 6:

Evaluation of the applicability of the Methodology for enterprises according to size

Source: Calculated by the authors

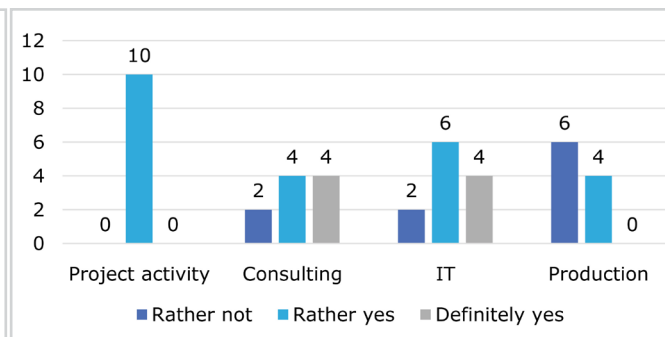


Figure 7:

Evaluation of the applicability of the Methodology for enterprises according to the type of activities

Source: Calculated by the authors

An absolute majority of production enterprises answered «Rather not» and the rest (40%) answered «Rather yes».

The results of Fisher's test by which differences were tested showed the following values, i.e. for the size of an enterprise ($V = 8.65$, $p = .04$) and subject of business ($V = 8.04$, $p = .17$). As you can see, the appreciation of adequacy for an enterprise differs significantly, depending on the size.

General evaluations and appreciations of the potential of methodology were mostly positive in the comments and the reminders depended on the options provided to the particular enterprise. The applicability of and the need for this methodology were mentioned many times. By way of an example, a company providing consultancies with respect to human capital management considers the methodology to be highly beneficial, since to its knowledge, there are no such detailed instructions which the companies might use (without having to study all the available literature, often written in a foreign language). Based on the evaluation received, the acceptance of the methodology was a success, as expected.

5.3. Limits encountered by the selected sample of enterprises

The limits which an enterprise can encounter include the introduction of new technologies, representation of requalification, outsourcing, representation of automation and innovation.

As far as modern technologies are concerned, the selected sample of enterprises has already been using them to a large extent. They see the implementation of technologies mainly in connection with innovation and extending the options of business activities into all segments. A boom in the use of modern technologies was experienced in particular in the field of artificial intelligence. The businesses, and small enterprises especially, perceive the financial costs needed as the primary problem relating to the introduction of new technologies. The application of modern technologies also requires trained employees motivated to accept new procedures. Enterprises are often motivated for technological development in narrow fields only. In Figure 8, the use of technologies in enterprises according to size.

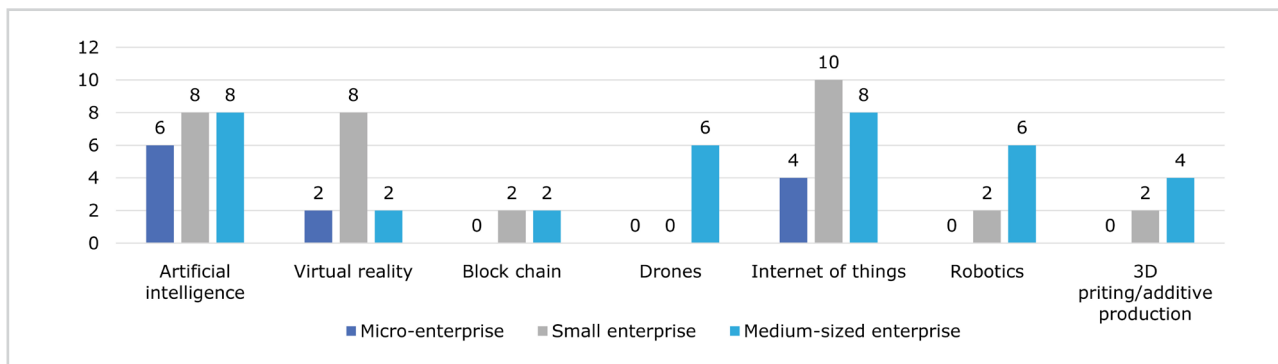


Figure 8:

Use of technologies in enterprises according to size

Source: Calculated by the authors

Figure 8 shows that micro enterprises and small enterprises use mainly artificial intelligence, virtual reality and Internet of Things, which might be quite surprising. Medium-sized companies focus more on 3D/additive manufacturing and artificial intelligence, Internet of Things, drones and robotics. Table 1 of the Fisher’s test shows an interesting summary of difference statistics with respect to the use of technologies relating to the evaluation of Methodology.

As part of the evaluation of content, the test shows the influence of the application of the Internet of Things, with no distinctive values recorded with respect to the practical applicability; the influence of the Internet of Things and virtual reality was manifested in the application for own business.

Enterprises often use requalification; however, many of them do not consider it to be an ideal solution. It is even considered to be very difficult in terms of critical soft skills. Enterprises believe that an appropriate procedure would be to provide employees with an option of targeted training; however, this approach is only consistent with the practice of micro enterprises. Enterprises also believe that key employees in particular should be involved in company-wide requalification.

For the use of requalification in enterprises according to size, see Figure 9.

Table 2 shows the results of Fisher’s test of the differences in Methodology evaluation according to the use of requalification.

Table 1:
Difference statistics of the use of technologies relating to the evaluation of Methodology

Technology	Structure and content		For practice		For business	
	V	p	V	p	V	p
Artificial intelligence	3.51	0.19	1.36	0.65	3.21	0.31
Virtual reality	5.26	0.09	2.33	0.45	7.03	0.02
Block chain	2.02	0.41	0.56	1.00	1.46	0.60
Drones	1.06	0.56	0.53	1.00	0.50	1.00
Internet of Things	9.05	0.01	3.93	0.21	5.85	0.04
Robotics	1.92	0.54	1.40	0.49	0.47	1.00
3D/additive manufacturing	4.28	0.14	2.07	0.42	0.62	0.84

Source: Calculated by the authors

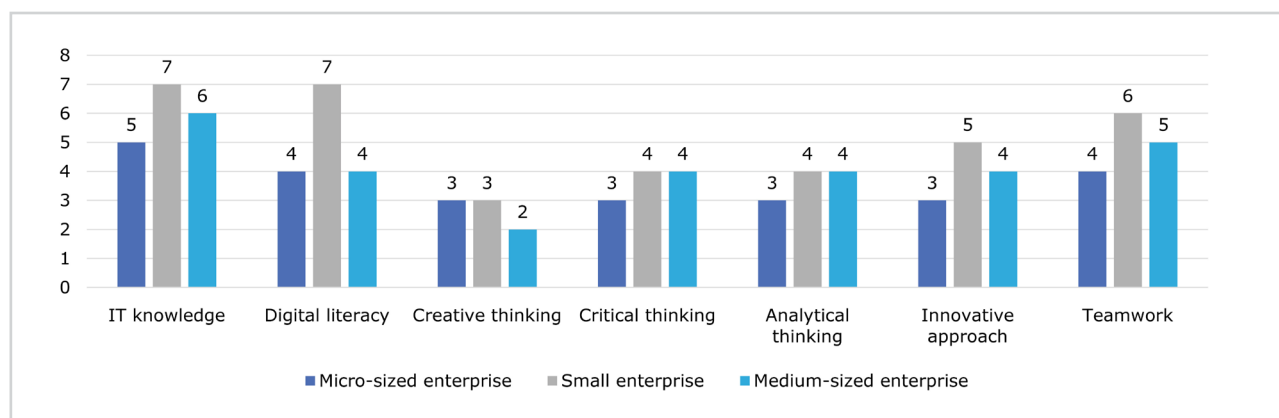


Figure 9:
Use of requalification in enterprises according to size

Source: Calculated by the authors

Table 2:
Difference statistics of the use of requalification relating to Methodology evaluation

Requalification area	Structure and content		For practice		For business	
	V	p	V	p	V	p
IT knowledge	1.73	0.63	3.40	0.26	1.30	0.69
Digital skills	5.80	0.06	6.26	0.04	4.16	0.09
Creative thinking	7.71	0.01	7.42	0.01	5.32	0.07
Critical thinking	4.27	0.09	5.37	0.05	3.27	0.19
Analytical thinking	7.71	0.01	7.42	0.01	5.32	0.07
Innovative approach	4.45	0.11	4.37	0.10	3.21	0.31
Teamwork	5.80	0.06	3.04	0.22	4.16	0.09

Source: Calculated by the authors

As you can see, a significant difference was identified in the evaluation of Methodology content in creative and analytical thinking; indications of a connection with the requalification of digital skills and teamwork both of which have a value of $p = .06$ were discovered. The requalification of analytical and creative thinking, digital skills and critical thinking are also significant for the evaluation of adequacy of the Methodology for practice. No differences for any kind of requalification were identified in the evaluation of the adequacy of the Methodology for an enterprise.

In cases where outsourcing is being used, the representation of outsourcing is high in many areas of evaluation. In additional comments in the qualitative part, enterprises listed the particular activities they outsource, including their connections to further procedures of business automation. Examples of particular activities outsourced by the enterprises are customer support for their own e-commerce projects, repeated marketing activities, accounting firm, the monitoring of trademarks by a patent office and the resolution of all disputes using a law office, including communication. Figure 10 shows the representation of outsourcing in enterprises according to size.

Figure 10 shows that enterprises of all sizes outsource mainly legal services. Micro enterprises also outsource the protection of intellectual property and accounting processes. Small enterprises use outsourcing for IT solutions or ERP. Medium-sized companies outsource in fact the same activities. Figure 11 shows the representation of automation.

In connection with the automation options, the enterprises often mentioned the introduction of austerity measures with respect to the operating costs. Automation was also frequently associated with investments and changes caused by the COVID-19 pandemic (working from home, increase of investments into IT or development of own new applications). Automation was most frequently mentioned in the context of the calculation of internal KPI (key performance indices).

The representation of innovation shown in Figure 12 plays a part no less important.

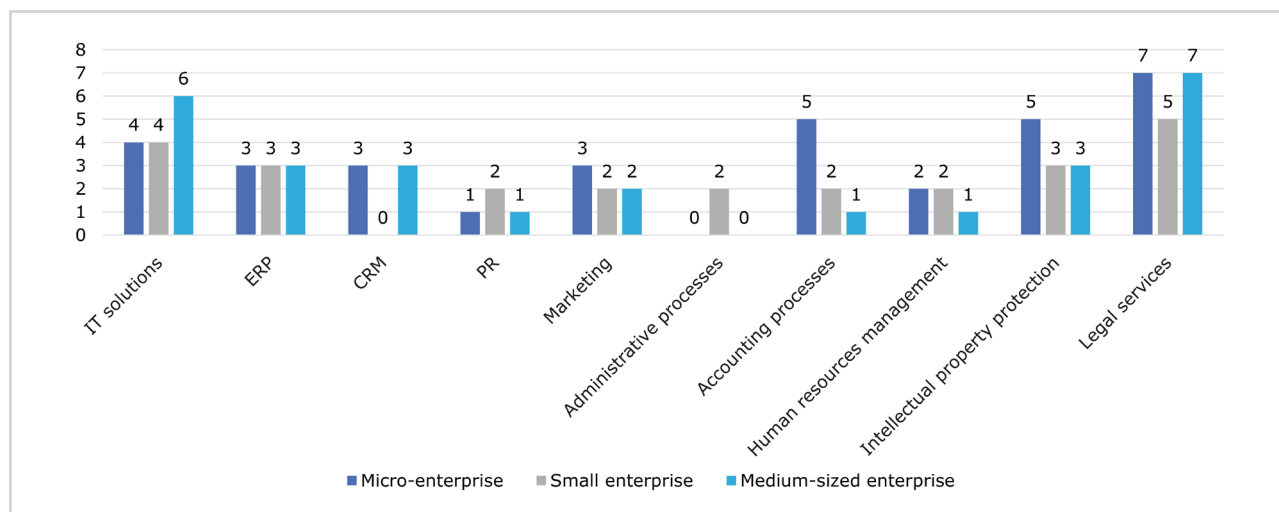


Figure 10:
Representation of outsourcing in enterprises according to size
Source: Calculated by the authors

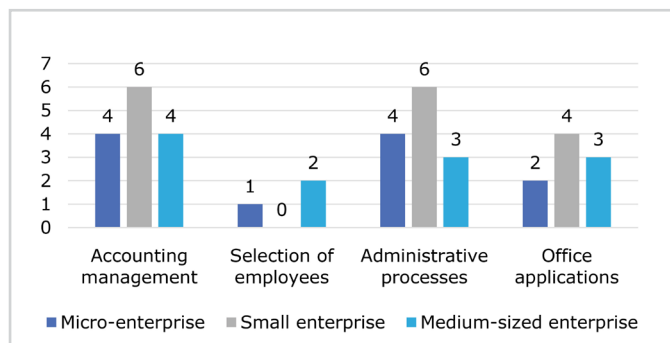


Figure 11:
Representation of automation of routine processes in enterprises according to size
Source: Calculated by the authors

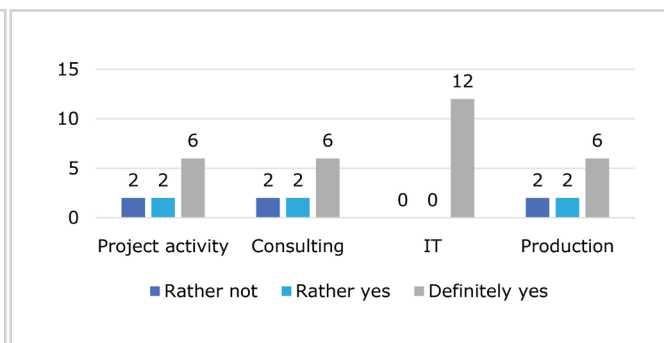


Figure 12:
Representation of innovation according to type of activities
Source: Calculated by the authors

Innovations are considered to be a matter of course by the selected sample of enterprises, emphasizing most of all the processes and technologies based on their long-term growth and expansion strategies. Currently, innovations are being connected mainly with the impacts of the COVID-19 pandemic on business. In this respect, a significant dependency of innovations on a target group was discovered, where certain segments currently show a lower likelihood of growth. Based on this fact, we can say that the segment of activity is the main drive for innovation.

As part of the field research, we established, by our research inquiry of the researched sample of knowledge intensive service enterprises, that even before the pandemic, about 25% of the enterprises standardly, to a certain extent, used work from home which was more than the average for the CR - 10% before the pandemic.

There was a boom of this form of work during the COVID-19 pandemic and all enterprises from the selected sample were using this form of work to a certain extent. In companies which standardly used work from home, their employees were ready for this alternative and the pandemic did not have a significant impact on them. However, the share of employees working from home was fluctuating from 10% to 100% with individual knowledge intensive companies and the number of days per week on which this form of work was applied varied as well.

The preferences for work from home of employees of the sample of companies quite differed. Some employees (about 10% to 20%) preferred working from home, approximately the same proportion did not and the rest preferred rather an alternating regime. Several employees perceived an insufficient background (facilities, technical equipment) and disturbances (e.g. presence of children) as disadvantages. Often, the enterprise itself was concerned about more difficult coordination and communication in its project teams. A certain part of companies saw specialized work as an obstacle to working from home; in their opinion, the virtualization of specialized work might have a negative impact on the rate of processes and might be demanding on new technologies. For some enterprises, working from home became an impulse for investments into IT technologies, own applications and increased robotization of human work, which may certainly be perceived as positive.

As far as the support for work from home is concerned, the enterprises mostly stated that their employees had sufficient equipment to work from home, meaning mostly company notebooks, software or a contribution for using the employees' own hardware and, in some cases, a financial contribution for using the Internet. The enterprises do not deal much with other aspects of working from home which is caused also by the lack of legislation that would regulate this form of work in the CR.

In the research inquiry, knowledge intensive enterprises also answered the question whether they planned on increasing the proportion of work from home in the future, after the pandemic goes away. In the selected sample, more than half of the enterprises are about to increase the share of work from home and approximately another 20% are rather inclined to do so. Only less than one tenth of the enterprises definitely have no intention to do so (see Figure 13).

If we take into account the size categories of enterprises (see Figure 14), the micro enterprises (71.4%) and medium-sized enterprises (57.1%) intend to «Definitely yes» increase the share of work from home, while only 28.6% small enterprises intend to do so.

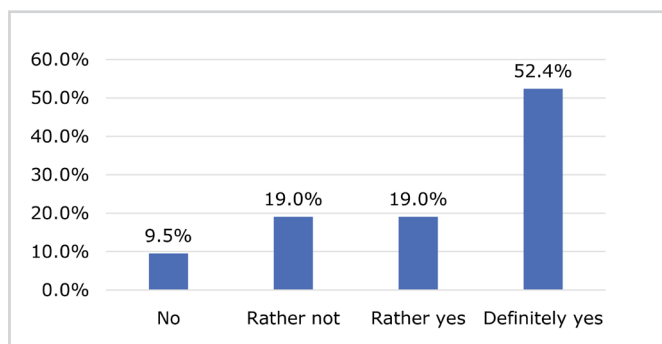


Figure 13:
Intention of enterprises to increase the share of work from home - entire sample of enterprises

Source: Calculated by the authors

If you look at the intention of enterprises to increase the share of work from home according to type of activity, all the examined IT companies want to increase - «Definitely yes» - the share of work from home, while all the examined production companies are rather not inclined to do so, which is logical considering the nature of business (for details, see Figure 15).

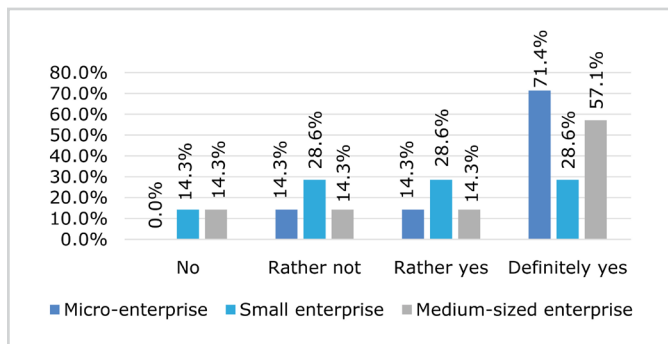


Figure 14:

Intention of enterprises to increase the share of work from home - enterprises according to size categories

Source: Calculated by the authors

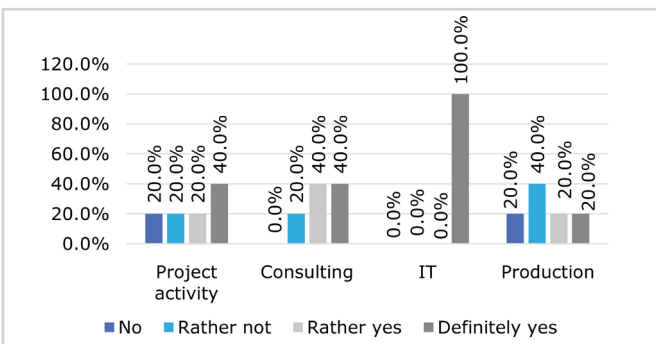


Figure 15:

Intention of enterprises to increase the share of work from home - enterprises according to type of activity

Source: Calculated by the authors

6. Discussion

Research focusing directly on the adaptation of SMEs in the sector of knowledge intensive services to the conditions of Society 4.0 has never been conducted before. Therefore, the results of this innovative article cannot be compared to others. However, results of the research of authors involved in similar issues or tackling similar topics might also be interesting. Research conducted by Choi et al. (2021) is worth mentioning; they researched the contribution of knowledge intensive business services (KIBS) in the stages of new product development (NPD) to the performance of companies with regard to correlations between the input variables. To explicitly quantify the contributions in the stages of NPD, the authors proposed a new methodology using the variable importance evaluation method. The proposed method mitigates correlation effects and facilitates a direct interpretation of the importance of input variables. The proposed methodology was evaluated in case of a public research organization in the South Korea using a data file of the research collected from Korean SMEs. Empirical results showed that KIBS with inter-stage correlations variously contribute to companies in the stages of NPD depending on performance measures. KIBS usually assist companies' management decision-making in both end stages of NPD and KIBS in all stages except for the product implementation and help the companies to save time and money. Campisi et al. (2019) researched the effectivity of companies in the sector of knowledge intensive services, using the data envelope analysis (DEA) to calculate Malmquist's productivity index for the period from 2012 to 2017. Malmquist's productivity analysis based on DEA was specifically applied at the corporate level in a sample of a total of 1,674 Italian companies in the KIBS sector associated with three different NACE codes (72 IT services, 73 research and development, 74 other professional business activities). The effectivity measuring was then applied to define the financial performance of a KIBS company by analyzing the formulas of average productivity grouped according to Italian geographic regions. Malmquist's productivity measures were divided into two parts: change of efficiency and technical change index. The results for the period from 2015 to 2017 showed that the average yearly growth of the total Malmquist's productivity index was positive in nine Italian regions which represented only 17% from the total number of selected KIBS companies. On the other hand, the drop of average performance measure was observed in five geographic areas that contributed to 75.7% of the entire sample. In general, the component of technological changes as a measure of innovations is strongly limiting on KIBS behavior in productivity growth in all geographic regions. The evidence of importance of the regional configuration of the heterogenous nature of the KIBS sector for economic and productive transformation in local branches of industry in the context of the Fourth Industrial Revolution was presented in their study by Vaillant et al. (2021). Based on evolution perspectives which are based on the sources claiming that industrial development of

a region mostly stems from the existing capabilities of the local capacities and creates a trajectory related to diversification and builds on the local servicification framework, the authors claim that the impact of KIBS enterprises on the production performance (HPH per employee) is conditional upon the specific nature of the locally present provision of knowledge intensive services by KIBS enterprises. Regions with T-KIBS (technology-based knowledge intensive business services) have, in their «knowledge space», a potential relationship of resources which makes it possible for their local production sectors to diversify production more easily towards Industry 4.0.

Based on the above-mentioned results, we can now answer the determined research questions.

1. Why was it necessary to formulate a methodology for the adaptation of SMEs in the sector of knowledge intensive services in the CR to the conditions of Society 4.0 and what was its formulation process including validation in practice?

The reason for the formulation of the Methodology was mainly that there is currently no methodology which would be able to provide the procedure to these companies containing individual steps for their adaptation to disruptive changes into business processes and into the entire company, brought about by Industry 4.0 and Society 4.0. The need to formulate the Methodology was also caused by the demand and requirements of business practices which had been mapped in advance.

The formulation of the Methodology was based on the research which included the analysis and evaluation of principles, procedures, methods and tools for the adaptation of the service sector to the technical, economic, social and environmental conditions of Society 4.0. It also contained an evaluation of the changes of knowledge and skills qualification requirements for the workforce in the environment of Society 4.0, a questionnaire inquiry, structured interviews, analysis and the evaluation of the results of project workshops and the analysis, evaluation and integration of motions and reminders of six external application guarantors of the project. Based on the above-mentioned materials, the synthetization of the information obtained and the conception of proposed measures for the adaptation of SMEs was then performed.

The proposed Methodology was consulted and formulated, and, immediately afterwards, it was validated and tested in business practice on a selected sample of enterprises (42 enterprises in the category of SMEs), in cooperation with six external application guarantors of the project who believe that the procedure and content of the proposed methodology corresponds with the requirements and needs of SMEs in the service sector.

2. How does the selected sample of enterprises appreciate the methodology for adaptation of SMEs in the sector of knowledge intensive services in the Czech Republic to the conditions of Society 4.0 (practicality, extent, potential)?

The selected sample of enterprises appreciates the practicality of the Methodology mostly positively, where in fact all types of enterprises in terms of size consider it practical. Consultancy companies find it most adequate in terms of practicality. Even in spite of these facts, some enterprises feel there is a certain lack of detailed practical procedures and instructions, namely with respect to internal processes, application of automation and use of best practice examples.

Opinions on the extent of the Methodology differ. Although the extent is appreciated mostly positively (mainly by small enterprises and consultancy firms and companies involved in project activities), criticism was also put forth that some parts were excessively detailed, while other parts had less detail or no detail at all. Based on the recommendation with respect to the extent, an abbreviated summary version of the Methodology for practical purposes (in the form of a workbook) will be made.

There were bigger differences in the evaluation with respect to the potential of the applicability of the Methodology for enterprises. For example, all small enterprises consider the Methodology suitable in terms of the potential of applicability for enterprises, like most of the micro enterprises, however, 43% of medium-sized companies consider the Methodology as rather not suitable. The potential of the Methodology is mostly appreciated by enterprises involved in project activities and IT. General appreciation and appreciation of the potential of the methodology are mostly positive. Many have mentioned the applicability of and the need for this methodology.

3. To what level is work from home supported in knowledge intensive service enterprises in the CR in regard to the current COVID-19 situation?

The factors determining the level of using work from home include: the Digital Economy and Society Index (DESI), organization culture, the structure of economy, legislation and organization

of work (Llave, 2021). The DESI index assesses five areas of digitization: connectivity, human capital, use of Internet, integration of digital technologies and digital public services. The Czech Republic has the third best coverage of 4G networks in Europe (99%) and is among the first five in the number of SMEs using Internet for sales (23%). Overall, the CR is right under the EU average and it lacks behind mainly in the field of digital services (European Commission, 2019). In terms of legislative tools in relation to work from home, there are significant differences among the EU countries. Some countries already have the legislation (such as France, Italy or Spain), others have submitted bills or are currently debating or passing the legislation (such as Germany, Sweden, Finland), while some countries, including the Czech Republic (Llave, 2021), are not even preparing it yet.

In 2019, before the global coronavirus outbreak, about 10% of employees in the Czech Republic worked from home on a daily basis or at least several days a week; compared to other countries, the use of work from home was below average in the CR (the EU average was 14%); in Sweden and The Netherlands, it was 37% of employees, in Finland, it was 32%, 25% in Belgium and 23% in France. The countries that used work from home even less than the Czech Republic included our neighbors Slovakia with 9% and others, such as France - 8%, Italy and Greece - 5%. In Bulgaria, the use of work from home was extremely low, a mere 1% (Llave, 2021).

The use of work from home significantly changed with the global coronavirus outbreak and the average level of use of work from home increased to 48% in the EU countries in 2020. The Czech Republic, with its 44.6%, was slightly below average. Countries with a rapid growth, compared to the period before the pandemic, included France with 57.8% and Italy with 56.8%.

We established that enterprises were using work from home, to a certain extent, even before the pandemic (about 25% of enterprises). During the COVID-19 pandemic, work from home experienced a significant growth. The enterprises stated that their employees were sufficiently equipped for working from home - company notebooks, software or contribution for the use of their own hardware and Internet. Unfortunately, there is no sufficient legislation regulation work from home and that is why SMEs do not deal much with other aspects of work from home. This will have to change, considering that more than one half of the selected sample of enterprises intends to intensify work from home and the other 20% are inclined to do so.

4. What limits do the enterprises in the field of knowledge intensive services encounter when adapting to the conditions of Society 4.0?

The limits that the knowledge intensive service enterprises may encounter in the CR include mainly the introduction of new technologies. Currently, many enterprises are using modern technologies, which opens the door to multiple possibilities and facilitates the business activities. However, a significant disadvantage of the modern technologies is high cost and great demands for trained employees. Other limits include no doubt the involvement of requalification, which the enterprises apply, however, many of them consider it not ideal, in particular requalification in the area of critical soft skills. Outsourcing is another limit which the knowledge intensive service enterprises in the CR may encounter when adapting to the conditions of Society 4.0. As the research results show, outsourcing is largely used. Particular examples of such use are customer support for own e-commerce project, repeated marketing activities, accounting firm, monitoring of trademarks by a patent office and resolution of disputes by a law office, including communication.

Other limits include automation which is perceived by the enterprises as necessary thanks to operating cost savings. Automation is often perceived in the context of investments and changes brought about by the COVID-19 pandemic (work from home, increased investments into IT or development of own new applications) and in the context of calculating internal key performance indices (KPI). Innovation is another limit, no less important; enterprises consider innovations as a matter of course, emphasizing the processes and technologies based on their long-term growth and expansion strategies. Currently, innovations are being connected to the impacts of Covid-19 on business activities. In this respect, a significant dependency of innovations on the target group was discovered, where certain segments currently have a lower likelihood of growth.

7. Conclusion

There is no doubt that the current phenomenon of the last ten years is the effective and in-time implementation of the concepts of Industry 4.0 and Society 4.0 in SMEs in the service sector, connected, on the one hand, with the fast and dynamic advent of robotization, automation, computerization and digitization in production and non-production industries of large companies, and,

on the other hand, with the obstacles of financial, human, time and knowledge resources given by the specifics and nature of SMEs in the service sector. And this was the reason for formulation of the Methodology which is to serve mainly as instructions for the procedure of adaptation of micro, small and medium-sized enterprises to the conditions of Society 4.0 and as a tool and instructions for SMEs for the identification and assessment of opportunities and threats relating to the development of technical, economic, social and environmental conditions in the environment of Industry 4.0 and Society 4.0. The main objective of this article was to validate the applicability of this Methodology and to answer the research questions.

The data sample used for the validation of the Methodology included a total of 42 enterprises (14 micro enterprises, 14 small enterprises and 14 medium-sized enterprises). For the purposes of statistics, typology based on the size of an enterprise and its subject of business was applied, where groups of approximately the same sizes were formed based on the categorization. The methodology validation was split into two parts - the qualitative part and the quantitative part. The «Results» chapter contained graphical expressions and descriptions of how the selected sample of enterprises assesses the Methodology for adaptation in terms of practicality, extent and potential. It also included the limits encountered by these companies. They were in particular representation of technologies, representation of requalification, outsourcing, representation of automation, innovations. The issues of COVID-19 pandemic impacts on enterprises, being both negative and positive, were tackled as well. An example of a positive impact of COVID-19 is its impact on the introduction of new technologies allowing for the streamlining and automation of certain processes. In the performance of work, COVID-19 brought about the emphasis on work from home or the adoption of specific hygienic measures.

Work from home was yet another limit discussed in this article. Because of the pandemic, work from home is now more strongly represented in companies. Specialized work was seen as a major obstacle to work from home; its virtualization may have a negative impact on the rate of processes and demands for new technologies.

In the «Discussion» chapter, all research questions posed have been answered. Based on the above-mentioned, the determined objective of this article has been met.

Based on the above-mentioned, the following potential research can go into several directions. By way of example, the future research may be focused on more detailed practical procedures and instructions for the particular areas of internal processes of SMEs relating to automation, for instance. The research can be focused also on the formulation of a brief summary version of the methodology for practical purposes (workbook) for the needs of particular enterprises or the particular field of business.

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