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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[1]

Abstract. The contribution presents results of the research focused on the adaptation of small and medium-sized enterprises (SMEs) in the service sector to technological, economic, social and environmental conditions of Industry and Society 4.0. The main goals of the research were the analysis and evaluation of the current state, preparedness, motivation and needs of SMEs in the sector of knowledge-intensive services for the timely, purposeful and effective implementation of Industry 4.0 methods and tools in the South-West region of the Czech Republic. The methodological approach is based on a mixed research strategy. Qualitative and quantitative methods such as desk research, explanatory and interpretation methods, questionnaire survey, semi-structured interview and evaluation of data and information were used to achieve the research goals. The results document the high current and future need to increase the knowledge and innovation potential of SMEs, the need for changes in the organisation and content of work, the need for changes in the competencies of employees in the context of robotisation, automation and digitisation of business processes. The results demonstrate barriers to access to sufficient internal and external financial resources, as well as a strong interest of SMEs in cooperation with the academic sector and regional authorities in the development of methodological tools for adaptation to new societal conditions and in the interest of the sustainable existence of these enterprises. The direction of future research is oriented towards the creation of a methodology for the adaptation of SMEs to the conditions of Industry and Society 4.0.

Keywords: business services, Industry 4.0, knowledge-intensive services, small and medium-sized enterprise (SME), Society 4.0, South-West region of the Czech Republic, information and communication activities, professional, scientific and technical activities

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[1]

ИССЛЕДОВАТЕЛЬСКАЯ СТАТЬЯ

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Малые и средние предприятия сферы услуг в условиях Индустрии 4.0 и Общества 4.0: опыт Юго-Западной Чехии

Аннотация. В статье представлены результаты изучения адаптации малых и средних предприятий (МСП) сферы услуг к технологическим, экономическим, социальным и экологическим условиям Индустрии 4.0 и Общества 4.0. Цель исследования — анализ текущего состояния, мотивации и потребностей предприятий в сфере наукоемких услуг, а также оценка возможности своевременного и эффективного внедрения методов и инструментов Индустрии 4.0 на Юго-Западе Чехии. Совмещение методов позволило сочетать различные качественные и количественные подходы, такие как кабинетное исследование, методы объяснения и интерпретации, анкетный опрос, полуструктурированное интервью и оценка данных. Полученные результаты демонстрируют высокую потребность в повышении знаний и инновационного потенциала МСП, изменении организации и содержания труда, формировании новых компетенций сотрудников в условиях роботизации, автоматизации и цифровизации деловых процессов. Выявлены препятствия для доступа к необходимым внутренним и внешним финансовым ресурсам. Показано, что МСП заинтересованы в сотрудничестве как с академическим сектором, так и с региональными органами власти для разработки методологических инструментов адаптации к новым социальным условиям в интересах устойчивого развития этих предприятий. Цель дальнейших исследований –создание методологии адаптации малых и средних предприятий к условиям Индустрии 4.0 и Общества 4.0.

Ключевые слова: бизнес-услуги, Индустрия 4.0, наукоемкие услуги, малые и средние предприятия, Общество 4.0, Юго-Западная Чехия, информационно-коммуникационная деятельность, профессиональная и научно-техническая деятельность

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1. Introduction

Business services in Central and Eastern European (CEE) region has been dynamically developing during the past three decades. Incoming wave of digitisation, automation, artificial intelligence, and other components of the fourth industrial revolution puts additional emphasis on the knowledge-intensive services (KIS). This contribution surveys the specific characteristics of this segment of services and summarises the results of the questionnaire research focused on the micro, small and medium size knowledge-intensive services in the Czech Republic's South-West cohesion region according to Eurostat statistical area of Nomenclature of territorial units for statistics (NUTS) level 2. The territory of the region consists of the South Bohemian Region and Pilsen Region. The region has an area of 17,706 km^2 and approximately 1.22 million inhabitants live on its territory. The research described here is one of the introductory activities of the project aiming for the development of the methodology for this sector's adaption to the forthcoming era of Society 4.0.

The Faculty of Economics of the University of West Bohemia in Pilsen in cooperation with the Institute of Technology and Economy in České Budějovice prepared the project "Adaptation of the knowledge-intensive services to the conditions of Society 4.0", which gained support of the ÉTA programme of the Technology Agency of the Czech Republic[1]. Field research was carried out in the South-West cohesion region.

This introductory section briefly summarises reasons for this project and specifically the motivation and goal of the questionnaire survey. The following section 2 gives an account of insights gained from the review of literature related to the background and socio-economic consequences of current technological trends and emphasises the

[1] TAČR. (2019). ÉTA Programme. Retrieved from: https://www.tacr.cz/en/eta-programme (Date of access: 14.09.2019).

Table 1

Employment in the knowledge-intensive services in the Czech Republic (thousands of employees)

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Total employees	4764	4828	4922	5002	4934	4885	4872	4890	4937	4974	5041	5138	5221
J	106,5	109,3	115,0	117,9	129,2	137,1	145,4	125,3	139,8	148,7	141,5	147,6	149,3
M	153,1	172,0	189,1	195,1	201,7	202,1	198,7	212,4	220,8	222,4	237,5	251,5	266,6

Note: *J* — information and communication activities, *M* — professional, scientific and technical activities according to NACE classification

Source: CZSO (2018) (CZSO. (2018). Employed by CZ-NACE sector. Retrieved from: https://vdb.czso.cz/vdbvo2/faces/en/index.jsf (Date of access: 14.09.2019)).

increasing importance of knowledge-intensive services in the context of the forthcoming era of Society 4.0. It is concluded by the classification of knowledge-intensive services and activities with their specific characteristics.

The main part of the article is devoted to the results questionnaire research. First are introduced the method of questionnaire design and sample selection in the Data and Methods section 3. The goal of the questionnaire survey was twofold: first, to establish links between the project team and the companies identified, and second, to gain a deeper insight into the issues faced by those companies in the transition period of adaptation to Society 4.0 conditions. In the following sections 4 and 5, the research results are presented and discussed. The Conclusion briefly puts the findings of the questionnaire research into broader context of the whole project targeted on the adaptation of the knowledge-intensive companies to the conditions of the Society 4.0 initiative. The discussion of the findings results in some hints that can help to formulate proposals for the follow-up studies.

What was the motivation for this project: as many other countries, the Czech Republic enters the era of the fourth industrial revolution. The special attention is currently paid to changes expected in manufacturing industries. However, we can expect that, similarly to other developed economies, the focus will shift to service sector and its role in the economy and employment will be increasing. Incoming wave of digitisation, automation, artificial intelligence, and other components of the fourth industrial revolution will put additional emphasis on the knowledge-intensive services (KIS). Table 1 supports this assertion by the trend of employment in KIS in the Czech Republic.

The role of small and medium-sized enterprises (SMEs) in the economy of EU, including the Czech Republic, in the last three decades is ever increasing, as SMEs play a significant role at the market from the point of view of their number, employment, turnover, etc. (Chládková, 2010). As noted by Vojík (2010), their main advantages are their flexibility (including their creation, reorganisation, and closure), relative high labour force absorption capacity and ability to fill in the gaps in the market, creation of business alliances and fast response to changing conditions. The disadvantages are more difficult access to capital and new knowledge, as well as weaker capability to accommodate external influences, especially in initial development stages. Their limited resources (human, time, finance) can become limiting factors in access to new technologies, methods and tools of Industry 4.0 or introduction of innovations (Ingaldi, Ulewicz, 2020; Müller, 2019).

The pace of growth of technologies is more rapid than the absorption capacity of the society. To fully exploit the potential of technological advances they must be followed by profound changes in the chain Industry & Services –> Work –> Education –> Society, therefore, the project attempts to cover the road throughout this complete chain leading to Society 4.0 (Vacek, 2017). New technologies of Industry 4.0 as digitisation, robotisation, automation, artificial intelligence, and others, leading to increased efficiency, productivity, quality, more precise, reliable, user-friendly and easily available products and services, supporting environmentally friendly processes in all branches of national economy, will require significant changes in structure of jobs (Work 4.0), requirements to competencies and educational systems (Education 4.0), all of them embedded within the concept of the Society 4.0 as a society where the various needs of society are met by providing the necessary products and services in the required amounts and time to the people who need them and in which all the people can receive high-quality services and live a comfortable life overcoming differences such as age, gender, region, or language[1].

[1] CSTI (2015). Outline of the Fifth Science and Technology Basic Plan. Retrieved from: http://dst.tokyo/docs/5th-STBP.pdf (Date of access: 10.10.2019).

The main goals of the research project are to identify, analyse and evaluate the present state, preparedness, motivation, and needs of the service sector for the effective and efficient use of Industry and Society 4.0 methods and tools with specific focus on the knowledge-intensive small and medium-sized enterprises in the South-West region of the Czech Republic. Achieving this goal will contribute to the sustainability of micro, small and medium-sized enterprises and the significant economic and social progress of the South West region, as the service sector brings higher added value than the manufacturing industry.

To attain these goals, the following research questions were formulated and tested:

— Do the specific features of SMEs (related to knowledge, personnel, organisational, time and financial aspects) in the service sector in the South-West region represent a barrier to the implementation and development of principles, procedures, methods and tools of Industry 4.0 in their business processes?

— Do SMEs in service sector in the South-West region understand the necessity of their business processes transformation to eliminate threats and risks resulting from the transition to a new environment in the context of Industry 4.0 and Society 4.0?

— What are the current and future needs of SMEs in the service sector in the South-West region in order to timely and successfully adapt to the conditions of Industry and Society 4.0?

2. Theory. Literature Background

Socio-economic and Technological Aspects

Small and medium-sized businesses are supposed to innovate in cooperation with other firms, as this enables to optimally use their own knowledge resources and to combine them with specific competencies of their partners (Muller, Zenker, 2001).

The technological competence is the minimum required for companies and other service organisations to operate efficiently and effectively. In the last years, the digitisation based on the new technologies became applied in different organisation areas and streamlined their processes. In some cases, even small improvement of service or technology could have a significant impact (Marciniak, 2019).

Among the most significant global business technologies in the enterprise are cloud computing, Internet of Things (IoT), Big data (Brem, Voigt, 2009) and Artificial Intelligence (AI). Cloud computing is currently a rapidly emerging, worldwide platform which connects all services to the virtual world through hardware and software and accelerates existing processes (Skřivan, Sova Martinovský, 2019). The IoT helps to create and distribute new products and services at the unprecedented rate and scale and will lead to the creation of new jobs, which are directly connected with KIS. It has a wide range of applications like healthcare, utilities, transport, public sector, etc. (Sundmaeker et al., 2010). Big data is associated with increased volume of data in the business, which leads to the development of new management techniques and analysis of large data sets supported by the AI (Sousa, Rocha, 2019).

The increasing role of the service sector is expected also in job creation. According to Eurofound[1], "the service sector accounted for nearly all net new employment in 2011–2015. The greatest growth of jobs in the public sector is mainly in health and education jobs and in private sector in knowledge-intensive services, such as media, ICT, consulting, advertising, financial, legal services and accounting."

Moreover, jobs in services, and especially in knowledge-intensive services, are among least susceptible to automation (Frey, Osborne, 2017; Manyika et al., 2017c). Similar conclusions for the Czech Republic were confirmed by Chmelař et al. (2015) and Kohout and Palíšková (2017). Another look at the structure of work and jobs was presented by Harris et al. (2018). Manyika et al. (2017a, 2017b) analyse the impact of technologies on employment, loss of old jobs and creation of new ones.

Knowledge-Intensive Services and Activities

Services are commonly defined as activities providing intangible products consumed at the place of their origin. Vargo and Lusch (2004) suggest the following definition: "Service is an application of competencies to the use by others."

In developed economies, the importance of services is increasing both in gross domestic product (GDP) and added value creation and creation of new jobs. The traditional economy oriented on production is being transformed to service-oriented structures. This transformation is supported by advancements in information and communication technologies, platforms, applications and services facilitating offer and consumption of services of many kinds.

[1] Eurofound. (2016). Highest-paying and lowest-paying jobs grow most. Retrieved from: https://www.eurofound.europa.eu/news/spotlight-on/employment/highest-paying-and-lowest-paying-jobs-grow-most (Date of access: 14.09.2019).

The share of small and medium-sized companies in service sector is higher than in manufacturing. On the other hand, it is much more difficult (if not impossible) to increase productivity in services as significantly and rapidly as in manufacture (Baumol, 2013). Particularly significant become the two following kinds of Knowledge-Intensive Services (KIS) with the big intensity of knowledge use:

— Knowledge providers: the companies in which the prevailing form of activities is creation of new knowledge that is included in the company's intellectual property to increase its intellectual capital. This knowledge is then commercialised by providing licenses, know-how, consulting, etc., to their users. For these companies, intellectual property rights and protection are of utmost importance.

— Knowledge users: companies using the knowledge created by knowledge providers to innovations of their products, processes, marketing and organisation, as categorised in Oslo manual (OECD/Eurostat, 2018). As an example of this type of knowledge transfer, Merino and Rodríguez (2007) analyse the outsourcing of business services by manufacturing firms.

In many cases, companies combine both approaches — they are both knowledge providers and users (e.g. a research and development (R&D) company can use services of patent attorney). Such approach is typical for open innovations.

Knowledge-Intensive Services include those more extensively using R&D and employing highly qualified workers (doctors, nurses, engineers, researchers and scientists, teachers, IT specialists, etc.). Driving force of these services is their high added value. Their R&D develops products, platforms and knowledge critical for success of the knowledge economy. This role of R&D in Knowledge-Intensive Services is often underestimated and not always properly understood.

For companies and other organisations are important Knowledge-Intensive Service Activities (KISA) of both internal and external character. They are defined in OECD (2006) as follows:

"KISA are related to production or integration of service activities provided by private and public sectors either independently or in combination with products."

KISA are provided by various types of organisations, such as companies, public sector, formal and informal networks, etc. Among typical examples of KISA are R&D, management consulting, information and communication services, human resources management, job agencies, legal services (including intellectual property protection), accounting, auditing, and marketing services. These services are used by majority of organisations in their everyday practice.

The use of KISA is changing during innovation lifetime: while R&D is important in the initial phase, in later phases, the importance of services related to intellectual property rights, commercialisation, marketing and post-production processes increases. For example, many software companies perform SW specification, design, and implementation internally, while they employ external services in strategy, finance, and law.

KISA play an increasingly important role in innovation and the number of their external suppliers rises, integration of internal and external competencies is ever more important.

The study by OECD (2006) confirms the important role of KISA in innovation processes. They are resources of innovation, if they act in initialisation and development of clients' innovation activities. They are innovation facilitators, if they support client's innovation processes. And they are innovation intermediaries, if they transfer existing knowledge within or among organisations, industries, and networks so that it can be applied in a new context. Specific aspects of innovation and entrepreneurship in KIS are treated by Cainell, De Marchi and Grandinetti (2020), as well as by Malerba and McKelvey (2018).

Knowledge-Intensive Business Services (KIBS) include companies helping others to deal with problems the solution of which requires external knowledge. Their clients are not only business, but also public sector.

Extensive reviews of academic articles performed by Snyder et al. (2016) and Figueiredo et al. (2017) find that service innovation acts as society's engine of renewal and provides the necessary catalyst for the service sector's economic growth and identify categories of service innovation and their reflection in the academic literature and find four unique traits: (1) degree of change, (2) type of change, (3) newness, and (4) means of provision.

Based on the extensive literature search, von Nordenflycht (2010) formulates the concept of professional service firms (PSF) as a subset of KIS characterised by three characteristics — knowledge intensity, low capital intensity, and a professionalised workforce, where knowledge intensity refers to tacit knowledge of an intellectually skilled workforce.

Knowledge intensive services are commonly classified according to NACE sections[1] (Hinke et

[1] European Communities. (2008). NACE Rev. 2 — Statistical classification of economic activities, Luxembourg: Office

al., 2019). Lau and Lo (2015) study the links between the regional innovation system and KIBS and conclude that KIBS positively affect the firms' absorptive capacity, what leads to better innovation performance. Brunow, Hammer and McCann (2019) investigate how the innovation performance of KIBS firms is influenced by their location.

3. Data and Methods

Sample Selection

Among the first steps of the project was mapping of the situation in relevant services using the questionnaire survey. The preparation of the questionnaire was based on the structure of questionnaires used in 5-years joint research of MIT and Deloitte summarised in the book "Technology Fallacy" (Kane et al., 2019) and the study of the same team "Coming of age digitally" (Kane et al., 2018). They provided the inspiration for the selection of limited subset of their questionnaires adapted to local conditions. The questionnaire prepared using the application Google Forms was distributed to the companies identified in the selection process.

Due to the location of two project partners, the survey focused on the situation in the NUTS 2 region South-west joining two regions — Pilsen and South Bohemia. Potential respondents were identified by filtering the database Albertina — Bisnode[1]. This database synchronises data from broad variety of resources and its partnership with Dun and Bradstreet agency provides access to global databases. Bisnode processes big data to smart data available to its customers. The data can be filtered according to many selection criteria.

The following selection criteria were used in our search:

— Company location — Pilsen and South Bohemian regions.

— Company size — small and medium-sized enterprises according to the EU definition of the SME (EU, 2015).

— Industry sector — prevailing NACE sections: J — information and communication activities, M — professional, scientific, and technical activities.

The results of the search were summarised in the summary report and Excel table containing basic information about the companies including contact e-mail addresses, phone numbers and www pages. These data were used to create the list, including 622 companies identified in Pilsen region and 853 in South Bohemian region. 296 companies were identified in NACE section J and 1179 companies in section M. Prevailing were micro-companies with up to 5 employees (1048), only 18 had more than 50 employees. Turnover of the majority of selected companies was less than 60 mil. CZK (approx. 2,5 mil. €).

Data Collection

By November 16, 2019, the online questionnaire was completed by total of 141 respondents. Data were collected from June 5, 2019, to November 15, 2019.

The rather low response rate can be explained by overload of companies with questionnaire surveys. As the project team does not have any tools to motivate the companies to respond, it was necessary to use personal contacts. At the very beginning, the reaction of some companies was a bit controversial, and it appeared important to explain that the contact information used in our request for information was gained from publicly available resources and the General Data Protection Regulation (GDPR) provisions had not been violated.

The questionnaire survey was followed by semi-structured interviews with selected companies and their completion contributed to getting a better picture of the knowledge-intensive services in two regions of project interest.

4. Results

This section presents the results of the questionnaire survey in Tables and Figures[2].

The prevailing organisational form of responding companies was a limited liability company (64 %), the rest were self-employed (22 %), public limited company (7 %), and partnership (4 %).

Table 2 summarises respondent organisations characteristics — the average number of employees and types of their customers (B2B or B2C).

Majority of respondents work in micro and small enterprises (111; 26 enterprises are medium-sized and 4 are self-employed without any employees; types of their business are mostly business-to business (B2B) and business-to-customer (B2C)). Six respondents do not know prevailing types of their customers. The slightly surprising fact is that all these respondents are in top management of their companies.

for Official Publications of the European Communities. Retrieved from: https://ec.europa.eu/eurostat/web/products-manuals-and-guidelines/-/KS-RA-07-015 (Date of access: 10.10.2019).

[1] Bisnode. (2019). Contacts for business and marketing. Retrieved from: https://www.bisnode.cz/produkty/albertina/ (Date of access: 09.01.2020).

[2] Percentages in some tables and figures does not sum to 100 %, as corresponding questions allowed multiple choice.

Table 2

Organisation characteristics

Average number of employees	Number of respondents	Companies' share (%)
0	4	3
1-9 (micro)	60	43
10-49 (small)	51	36
50-249 (medium)	26	18
Customers type (B2B, B2C)		
Mostly B2B	67	48
Approx. equally B2B and B2C	20	14
Mostly B2C	48	34
I Do Not Know	6	4

Source: authors' calculations.

Table 3

Organisation activities according to NACE Rev. 2

	Number of respondents	Companies' share (%)
58 — Publishing activities	2	1
59 — Motion picture, video and television program production, sound recording and music publishing activities	4	3
60 — Programming and broadcasting activities	3	2
61 — Telecommunications	3	2
62 — Computer programming, consultancy and related activities	14	10
63 — Information service activities	7	5
69 — Legal and accounting activities	14	10
70 — Activities of head offices; management consultancy activities	9	6
71 — Architectural and engineering activities; technical testing and analysis	7	5
72 — Scientific research and development	14	10
73 — Advertising and market research	14	10
74 — Other professional, scientific and technical activities	18	13
75 — Veterinary activities	8	6
95 — Repairing and service	23	16

Source: authors' calculations.

Top management is the most frequent organisation function (33 %) of respondents. Other respondents work in Customer Service (23 %), IS/IT Operations and Development (11 %), Sale (7 %) and Product Research and Development (3 %), under 5 % work in Human Resources, Finance, Administration, Project management, Ecology and Risk management.

Over 60 % of respondents work in the organisation for more than 5 years; only five respondents work there less than for 1 year. About two thirds of respondents (65.25 %) said they are working in managerial positions, other respondents (34.75 %) are lower-level employees of organisations.

Table 3 shows the main organisation activities according to NACE Rev.2.

All these SMEs work with new knowledge and information. Most respondents (54 %) receive new knowledge from outside the organisation and the rest of them create their own knowledge. For those knowledge-creating companies, the intellectual property protection is of great importance. Figure 1 shows how organisations protect their new knowledge against competitors.

Respondents most frequently use business secrets (54 %) followed by copyright. More formal standards (Certified methods, Industrial property) still are used less often. Twelve organisations do not use any protection and 1 organisation uses protection by commercial contracts.

The time horizon of added value creation is an important feature of KIS. The following Figure 2 shows when new knowledge is expected to bring the highest added value to the organisation.

Most of current knowledge is used or will be used in the forthcoming 1–5 years. Four respondents do not use any specific knowledge. This information about respondents is not surprising and the trend is optimistic.

Figure 3 shows which organisation units bring the highest value added.

Respondents stated that the highest value is added in Customer Service, while Risk Management surprisingly brings the lowest one (only 3 respondents). The experience of several last years shows that the importance of risk management is highly undervalued.

Figure 4 shows how respondents use new knowledge in their organisation.

The use of existing competences prevails over seeking new ways of doing business

The type of working with new knowledge is slightly connected with preferred modes of job development.

Respondents could choose from several options:

— Rotation of working positions;
— No job development in the organisation;
— Identification of talents;
— Training;

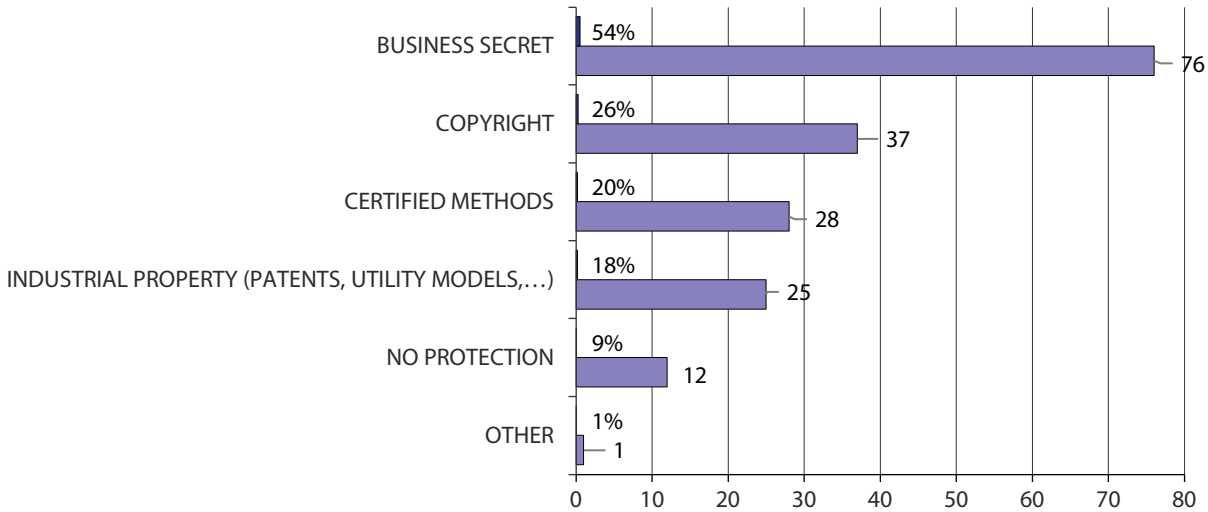

Fig. 1. *Protection of knowledge against competitors (source: authors' calculations)*

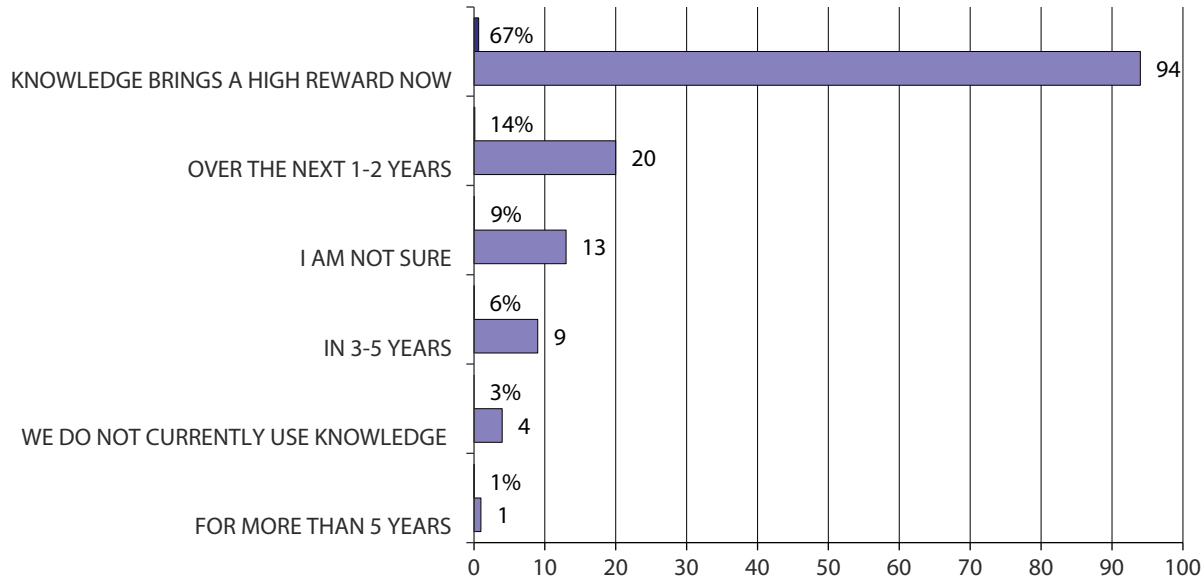

Fig. 2. *Expectation when knowledge will bring the highest added value (source: authors' calculations)*

— Lifelong learning;
— Learning through work.

Surprisingly, no respondent chose rotation of working positions. 90, i.e. over 60 % of respondents, learn on the job while working in an organisation. Lifelong learning is used by 53 (38 %), identifying talents by 23 (16 %) and training by 14 (10 %) respondents. Only three respondents (who are self-employed) are not concerned with job development.

The following Table 4 compares the attitude of management and employees to changes in business processes.

Responses are ordered from change prevention to active change support. It is positive that more than half of respondents from management (73 %) and 50 % of employees declared that management supports change; only 2 managers declared that management prevents change. Only 23 % of managers declared that changes are either equally supported and prevented or mostly prevented; however, this share among employees is higher (34 %). It can be concluded that management sees itself more open to changes than this position is perceived by employees. It should be taken into account that 92 respondents work in managerial positions and 49 are lower-level employees.

Since management should be open to change, it must also respond to the specific requirements. Figure 5 shows requirements to management competencies (multiple answer option).

According to respondents, determining direction and vision creation are the most important competencies. More than 50 % of respondents emphasised the following competencies:

— talent development: supporting the self-development of employees' competencies,
— collaboration: encouraging people to cooperate across departments and disciplines,

Table 4

Attitude to change

Attitude to change	Management		Employees	
	Number of Respondents	%	Number of Respondents	%
Usually prevent changes	2	1	9	6
More prevent changes than support them	7	5	15	11
Equally prevent and support change	22	16	33	23
More support changes than prevent them	50	35	33	23
Usually support changes	53	38	38	27
I do not know / I am not sure	7	5	13	9

Source: authors' calculations.

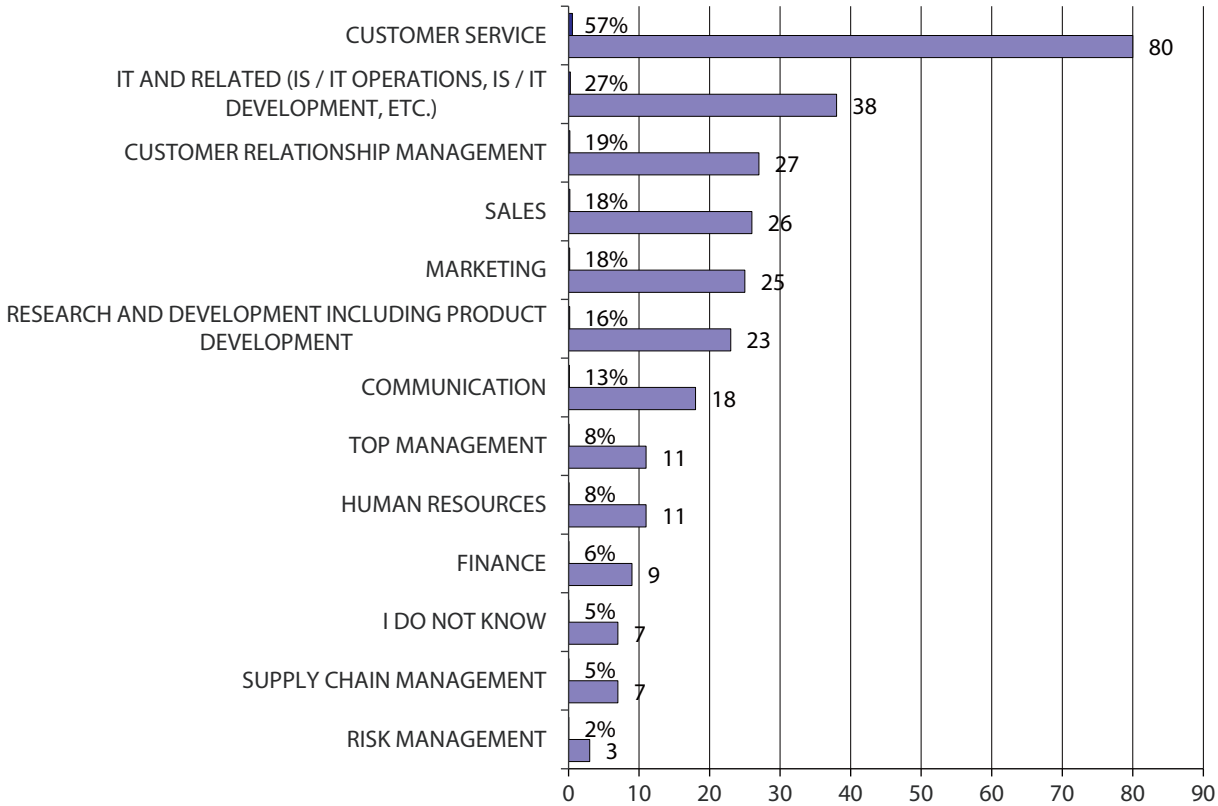

Fig. 3. *Where knowledge brings the highest added value (source: authors' calculations)*

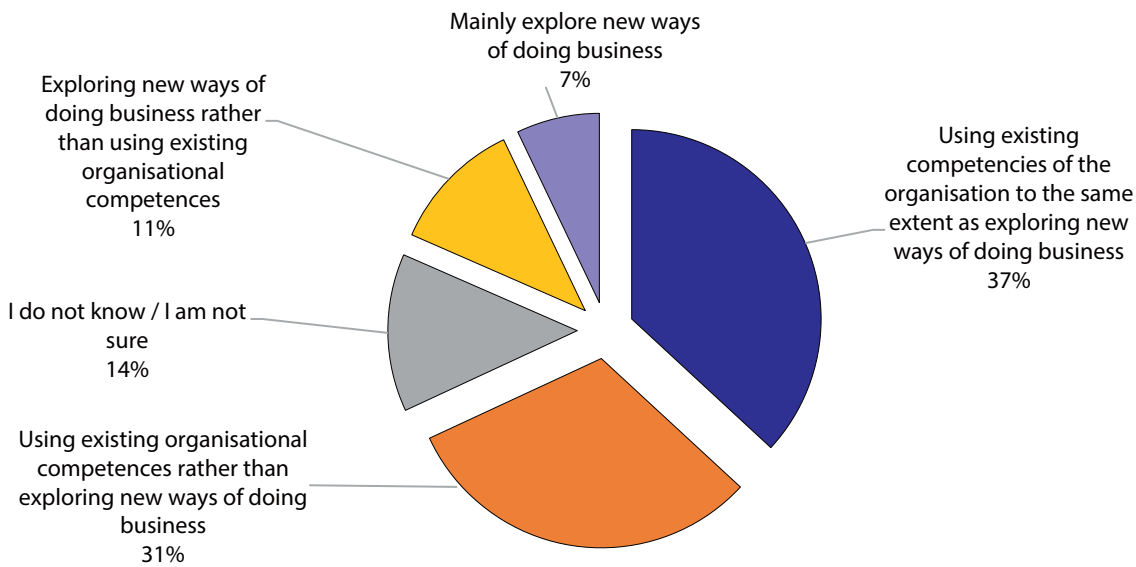

Fig. 4. *Purpose of working with knowledge in the organisation (source: authors' calculations)*

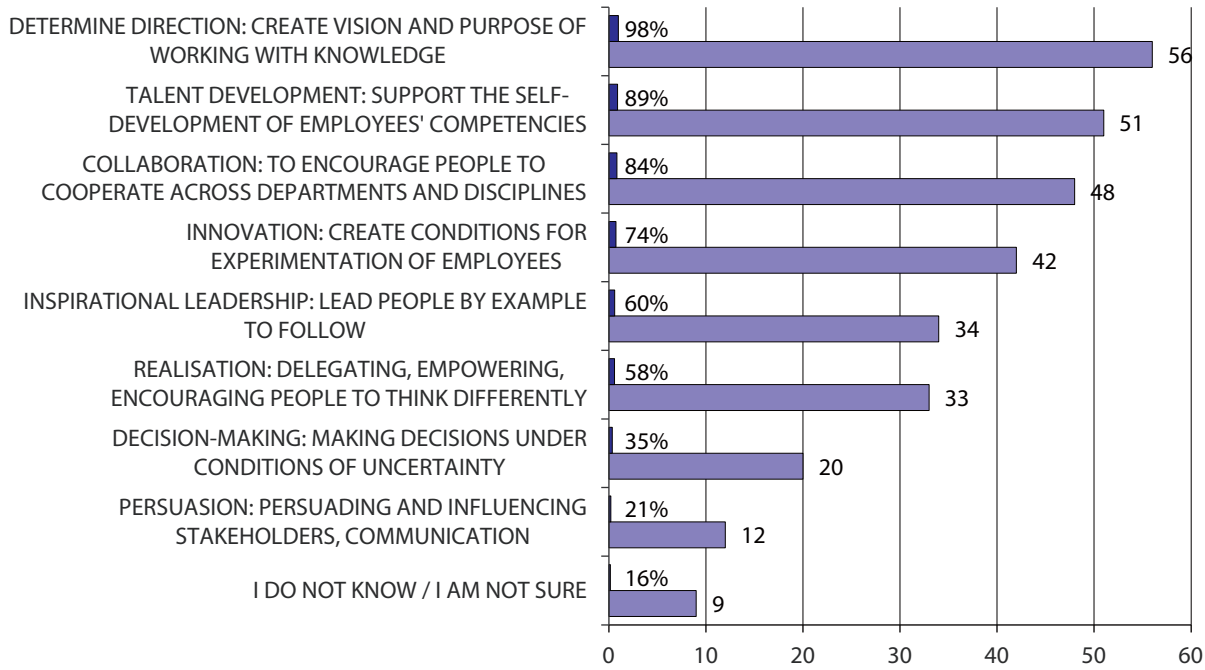

Fig. 5. *Requirements to management competencies (source: authors' calculations)*

Table 5

Extent of company support for new tools and technologies

Extent of support for new tools and technologies	Number of respondents	Companies' share (%)
Significant	57	40
Slight	49	35
Little	17	12
None	6	4
I do not know / I am not sure	1	1

Source: authors' calculations.

— innovation: creating conditions for experimentation by employees,

— inspirational leadership: leading people by example to be followed,

— realisation: delegating, empowering, encouraging people to think differently.

According to respondents, decision-making and persuasion are not critical; nine respondents said they do not know / are not sure.

As important as the competencies is the frequency of introducing new knowledge and skills needed to work. According to respondents, more than half of organisations (59 %) upgrade and develop new knowledge and skills in the workflow. Only 2 respondents do not need to improve their knowledge and skills at work.

As for the opportunities, most frequently offered by an organisation for improving new knowledge and skills are learning through work and lifelong learning (79 % in total), what suggests they are considered the most important. The frequency of opportunities is in good agreement with ways of job development (see Figure 5).

Table 5 shows the extent to which organisations support new tools and technologies (for cooperation among people, departments, etc.).

40 % of respondents declared strong, 35 % moderate, 12 % little support, and 6 respondents stated that the organisation does not support new tools and technologies.

Figure 6 shows what respondents consider to be the biggest challenge facing organisation in relation to effective collaboration.

The significant limitation to the new knowledge development in organisations are resources (in particular, time, finance and technology), followed by an understanding of need. The share of the following items, i.e. structure (barriers between departments, regulations), organisational culture, and insufficient motivation, is less than 15 %.

Four respondents declared human resources and bureaucracy as other challenges.

The last question focused on respondents' opinion on the difference between working within a knowledge-based or traditional organisation. The results are shown in Figure 7.

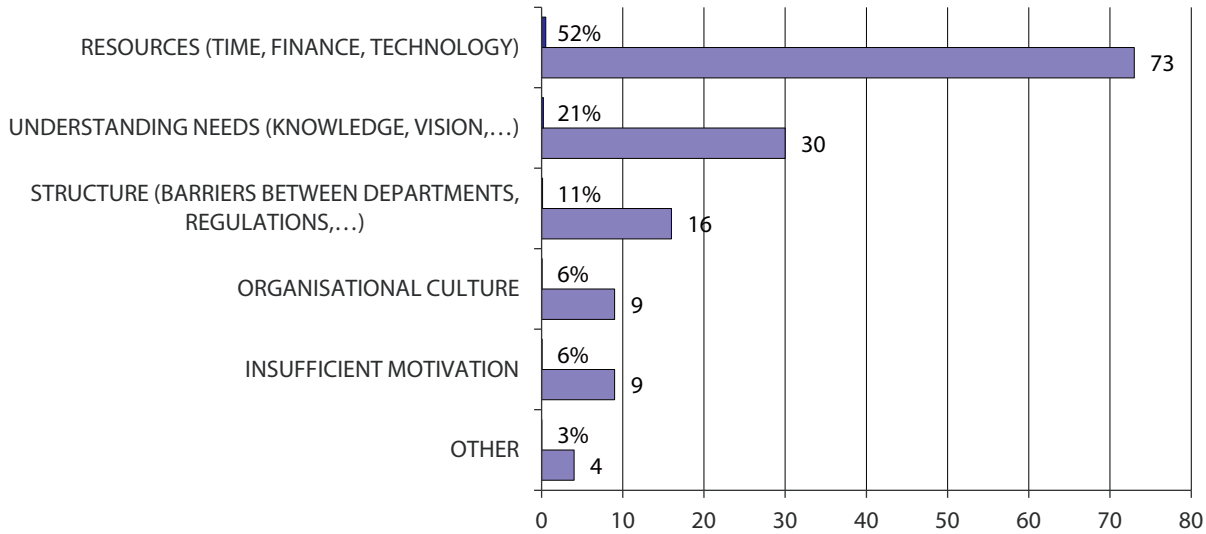

Fig. 6. *The challenge facing organisations for effective collaboration (source: authors' calculations)*

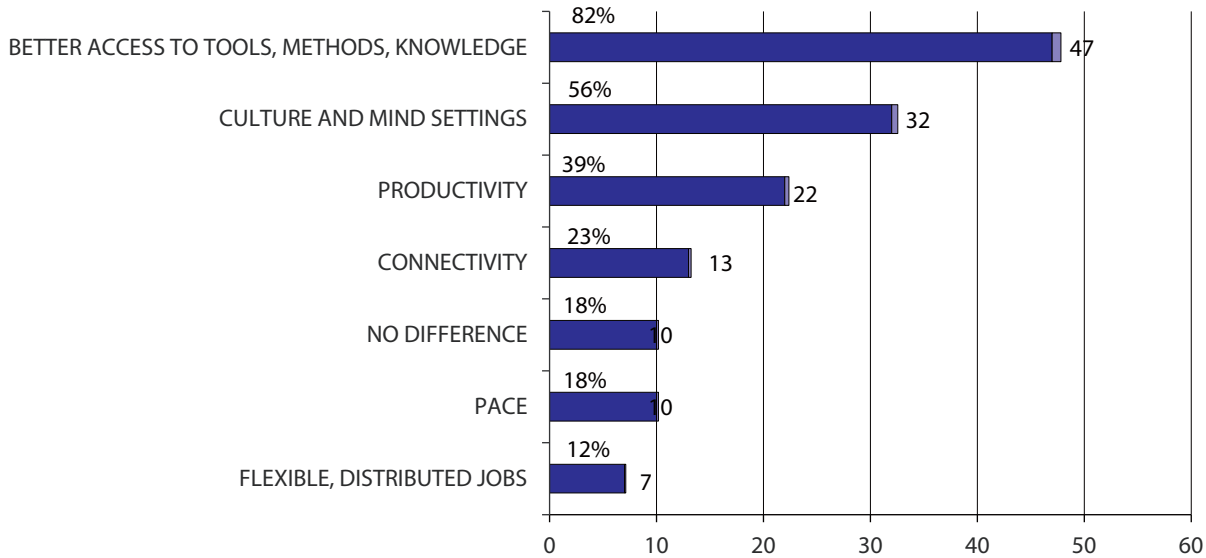

Fig. 7. *The biggest difference between working within a knowledge-based and traditional organisation (source: authors' calculations)*

Only 18 % of respondents do not see any difference. Over 80 % of respondents emphasise better access to tools and methods, followed by culture and mindset, and productivity; the other opinions (connectivity, pace and flexible, distributed jobs) are below 15 %.

5. Discussion: Summary of Questionnaire Survey Results

Based on the processed and summarised results of the research focused on small and medium-sized knowledge-intensive services in the selected region, it is possible to present basic findings supporting the tested hypothesis:

— Majority of knowledge-intensive service SMEs are micro and small enterprises.

— Over 60 % of respondents have been working in the organisation for more than 5 years; rather few are the newcomers.

— About two thirds of respondents work in managerial positions. This can be explained by the questionnaire distribution — the mails asking for response were directed mainly to company owners or managers.

— The highest share of respondents from our sample can be found in repairing and service activities, followed by other professional and scientific activities, advertising and marketing, legal and accounting services and IT.

— Most respondents receive new knowledge from external resources, i.e. they are more knowledge users than providers. It means they operate in the open innovation mode, but mostly in one direction only (knowledge import).

— The intellectual property protection is mostly informal (business secrets) or automatic (copyright) for about three fourths of companies. The formal industrial property pro-

tection such as patents, etc., is not broadly used.

— The majority of companies already use their current new knowledge or expect to use it within 1–5 years.

— The highest added value is created in customer service, while the lowest one in risk management. The approach to risk should be researched more deeply — it can negatively influence the company operation.

— The use of existing competencies significantly prevails over seeking new ways of doing business. Such an approach can negatively influence the company competitiveness.

— Enforcement of new knowledge creation and seeking new ways of doing business can be supported by job development. The majority of companies use and support learning through work followed by lifelong learning. A bit surprising is the lack of job rotation; the possible reason may be the prevailing share of small companies with frequent face-to-face communication. More than half of respondents prefer continuous upgrading of knowledge and skills.

— In the rapidly developing environment the companies are — and will be — ever more forced to change. In our sample, the managers declare themselves as supporting the change (75 %), a bit less optimistic are respondents at lower levels (50 % says their management is supporting the change).

— Concerning management competencies, as the most important were evaluated those related to soft skills. It can be concluded that in the future should prevail leadership (doing right things) over management (doing things right). What is surprising is the low rating of decision making under uncertainty — it may become, together with rather low importance of risk management prevailing in Czech companies, the weakness of many companies.

— Prevailing number of companies (about 75 %) answer that their company sufficiently supports introduction of new tools and technologies.

— Main difference between knowledge-intensive and traditional companies is better access to tools, methods and new knowledge, culture and mindset of KIS.

Research findings support the conclusion that knowledge-intensive SMEs managed as knowledge-oriented enterprises create and use open, more sophisticated approach to innovation, new knowledge, methods and tools, and are better prepared to implement concepts on Industry 4.0 as a starting point to Society 4.0. The barriers of usage and development of new knowledge, methods and tools consist primarily in limited time and finance resources, in incomplete understanding of necessity of timely business processes transformation and related risk management. The level of company preparedness on the implementation of methods and tools related to automation, robotisation and digitisation of company processes was evaluated using the assessment of attitudes of company managers and employees towards changes in company processes. More than half of respondents confirmed positive approach to process changes and job competencies, continuous updating and development of new knowledge and skills.

The research results and outcomes can be used in theory and practice of not only small and medium-sized enterprises, but in the whole service sector (including the public one) in preparation, development, and realisation of their transition to Industry 4.0 and Society 4.0 conditions.

6. Conclusions

The rather low response rate can be considered one of the limiting factors of this phase of our research. Nevertheless, it brought interesting findings to be used in the following research, the ultimate goal of it being the development of the methodology of knowledge intensive small and medium-sized enterprises adaptation to conditions and requirements of the forthcoming challenges brought by the transition to the Society 4.0.

This initial survey helped us 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, among them Regional chambers of commerce.

The questionnaire research was followed by semi-structured interviews with 20 selected companies, the purpose of which is to gain deeper insight into their functioning.

The results of the research analysed in this contribution lead to the conclusion that the approach of companies participating in the research to most issues investigated in the questionnaire survey is mostly positive, but still there is a lot of space for improvement. The findings of initial project activities described in this article together with two studies elaborated by the project team (Vacek et al., 2019; Hejduková et al., 2019), the feedback from companies and other project stakeholders combined with continued desk and field research form a sound basis for achievement of the project goal stated above.

The research goals and research questions posed in Section 1 — Introduction lead to the formulation of the following conclusion. Small and medium-sized enterprises in knowledge-intensive sectors in the South-West region of the Czech Republic use in their business processes new knowledge, technologies, and personal and organisational management techniques to achieve higher level of preparedness for implementation of methods and tools of Industry 4.0 and Society 4.0.

Acquired information proved the necessity of access to sufficient internal and external financial resources and strong interest in cooperation among various stakeholders — businesses, academic sector, regional and professional associations supporting timely adaptation to new conditions using development and implementation of relevant methods and tools. This demanding process should be complemented by development of the regional innovation system, strengthening of the knowledge and innovation potential of the concerned companies and public sector, including development of new competencies of employees applicable in newly created jobs.

The economic and social impacts of the COVID-19 pandemic in 2020 further reinforced and accelerated the necessity of fast, effective, and efficient adaptation of SMEs to technological, economic and environmental conditions of Society 4.0 predetermining their sustainable operation. Among other, it becomes clear that more attention should be paid to rather neglected risk management.

The results and outcomes of this phase of research created data and information base for follow up research in 2020 and 2021 focused on development of methodology of small and medium sized knowledge intensive services adaptation to Industry 4.0 and Society 4.0 conditions.

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