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Richard Novák et al.

Data Ethics Lab, Prague University of Economics and Business

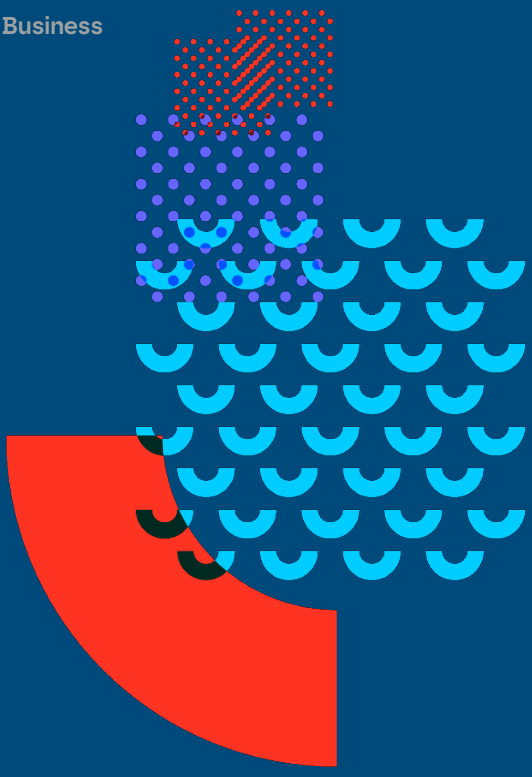

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Table of Contents

LIST OF IMAGES

LIST OF TABLES

LIST OF IMPORTANT SHORTCUTS

AI – Artificial Intelligence

DEL – Data Ethics Lab

DII – Digital Intensity Index

DESI – Digital Economy and Society Index

MSE – Micro and Small Enterprises

LLM – Large Language Model

SaaS – Software as a Service

NIS_2 – Network and Information Security 2

MES – Manufacturing Execution System

Introduction and Summary

The research is based on the quantitative GARI study (KOŘAN, 2023), which provided the first indicative results. These results highlighted key areas and data that the quantitative method could not fully clarify. We consequently proposed a qualitative study focused on key actors in various regions and interpreted the sourced quantitative data (Eurostat, OECD...) with the assistance of the key digitalization stakeholders present in the regions. We selected institutions such as regional offices, chambers of commerce, universities, innovation centers, CzechInvest, and representatives of small entrepreneurs from the Moravian-Silesian Region, Hradec Králové Region, and Vysočina Region. The aim was to determine the state of digitalization of small and micro enterprises in the regions, uncover problems, and identify possible solutions.

We sought to gain specific insights from the actors regarding existing best practices and recurring problems that form the root causes of successes or failures in digitalization.

We conducted a total of 24 relevant interviews, resulting in 30 hours of anonymized recordings and 91 root causes (codes),[1] which we validated through 4 roundtable discussions with the individual actors in the regions. This study includes a total of 84 quotes from the individual actors, which are presented in the text as representative of the root causes and listed in Appendix 1. We see the unique contribution of this study in bringing various stakeholders together at one table, delving deeply into the root causes through a qualitative study approach, and finding inspiring examples of best practices that can be shared across regions.

Micro and small enterprises (MSEs) play a key role in the economy of both the EU and the Czech Republic, despite the fact that their contribution is not always given priority. Due to their high number and small size, they represent a segment that is difficult for both institutions and large technology companies to serve.

Young people are more attracted to large corporations and their benefits, which is a trend with an increasing impact for the future. Institutional actors often perceive supporting one large corporation as a more efficient way to achieve quick results, although the comprehensive ecosystem of MSEs and local patriots offers stability and long-term loyalty in the regions where these enterprises operate.

Business within MSEs (Micro and Small Enterprises) has specific characteristics that make standardizing processes challenging. The owner-entrepreneur in an MSE is often the only one managing the supporting agenda, including digitalization. Given the priority of achieving quick results in MSEs, digitalization support here requires a greater initial push than in large companies. The MSE entrepreneur does not have any support apparatus and can only allocate their resources (funds, people, etc.) to a limited extent to gain support.

[1] Thematic analysis, such as by Braun and Clarke (2006), offers an accessible approach to analyzing qualitative data applicable in many fields, especially in the social sciences. The main steps include familiarizing oneself with the data, coding key points, searching for and reviewing themes, defining and naming them, and finally presenting the results of the analysis with examples from the data.

Digitalization is not suitable for every business. The degree and suitability of digitalization depend on the nature of the main processes in the particular industry. For instance, in automated engineering, digitalization can be beneficial, whereas it might not be suitable for a small bakery. On the other hand, support processes like invoicing, accounting, or marketing communication are universally applicable, although they often do not bring a significant competitive advantage. Each MSE is unique, and its competitive advantage stems from this uniqueness. Assessing which processes are economically worthwhile to digitalize requires a specialist who understands the uniqueness of a particular MSE, rather than the general advice available on the Internet.

In our study, we identified three key areas for successful digitalization in MSEs, which will be further detailed:

- Motivation and needs of MSEs (see Figures 7 and 8).
- Discovered obstacles and barriers to implementing digitalization (see Figure 8).
- Support options with examples of best practices (summarized further).

Examples of Best Practices:

- The location and history of a region, along with the geographical, economic, and human arrangement of relationships in the area, is a decisive factor for successful projects in digitalization and can surprisingly survive political changes (see Subchapter 4.3).
- The first successes in digitalization for MSEs, regardless of their field of business, come from implementing various SaaS solutions in the area of automation, and their supporting activities such as finance, accounting and marketing communication (see Subchapter 3.1, e.g., Quote-4).
- It is important to start with small digitalization projects in MSEs to ensure that any failures are not discouraging or devastating, such as entrepreneurs saving time by implementing 'boxed' SaaS solutions (see Quote-21).
- We need to attract more young people with a positive attitude towards digital technologies to MSEs. Available quality housing and the prestige associated with publicity are appealing factors for them (see Quote-42).
- The presence of a good university in a region is essential for digitalization (see Subchapters 4.1 and 4.3), and where it is absent, it appears to be a significant handicap (see Subchapter 4.2).
- Upon reaching a critical size, MSEs can offer the opportunity to hire a specialized IT/grant specialist, opening up a wide range of support programs that can propel entrepreneurs forward significantly (see Subchapter 3.3, e.g., Quote-61, Quote-80).
- Most institutions believe that the level of digitalization will improve with more intensive communication and special portals, but this often leads to information overload. MSEs call for fewer resources that are more targeted, specialized, and supported by personal interaction, which can be obtained at regional innovation centers (see Subchapter 3.3.3).
- Networking and educational events are crucial for MSEs, especially when they provide personal and credible recommendations on best practices from similar businesses, often serving as inspiration and a push for innovation (see Subchapter 3.3.1).
- Smaller MSE entities such as sole proprietors and micro-enterprises prefer simple and affordable solutions with a limited complexity, but as they grow and become part of supply chains, they soon face integration requirements (ERP) (see Subchapter 3.1.2, e.g., Quote-3).
- Key IT areas for the future, that will influence the development of digital technologies in MSEs in the regions, are seen as: 1. GenAI (LLMs) adapted to solve specific MSE situations; 2. Cybersecurity to minimize the risks and benefits associated with the implementation of IT best practices and governance methods (e.g., NIS 2).

1. Context and Definition of Terms

In the data analysis of the situational context, we primarily turned to available sources from the EU and the Czech Republic. We quickly found that while there are many sources, they are fragmented, inconsistent, and of limited relevance to the specific situation of comparing the state of digitalization among different regions of the Czech Republic.

1.1 DEFINITION OF MSE ENTERPRISES

Micro and small enterprises (MSEs) are defined based on the maximum number of employees and annual turnover. According to the National Development Bank (2024), they are specified in Table 1 as follows:

Table 1: Distribution of Enterprises by Size (NATIONAL DEVELOPMENT BANK, 2024)

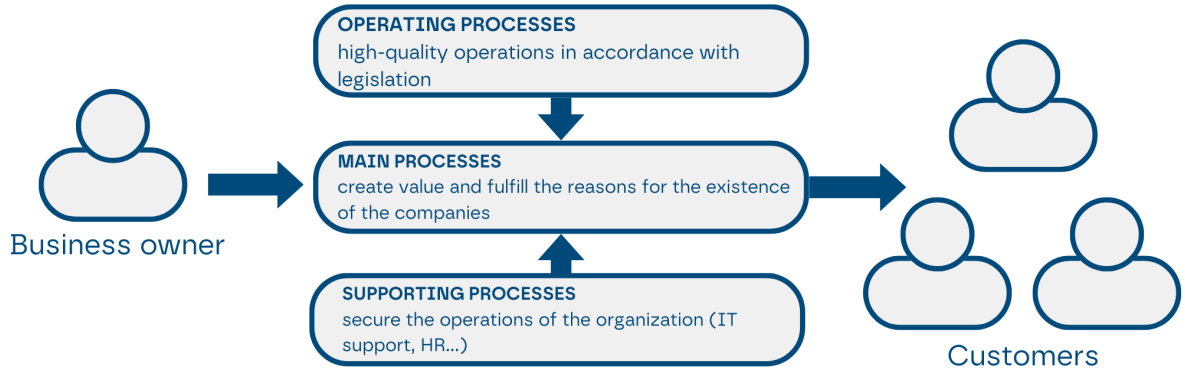
	MICRO COMPANIES	SMALL COMPANIES	MEDIUM-SIZED COMPANIES	LARGE COMPANIES
Maximum number of employees	0-9	10-49	50-249	250 and above
Maximum annual revenue (€)	2 million	10 million	50 million	unlimited

1.2 DEFINITION OF DIGITALIZATION

Digitalization is the process of integrating digital technologies into all areas of a business, fundamentally changing how organizations operate and deliver value to customers. It involves the use of digital tools and technologies to optimize and automate processes, increase efficiency and improve communication. It can be defined as follows: "Digitalization is the support of a company's main, managerial, and supporting processes through the transformation of manual processes into software & data-driven ones" (NOVÁK, 2024, see Figure 1).

For the needs of small and medium enterprises, it makes sense to distinguish the degrees of digitalization as follows: 1 – Automation (elimination of manual processes), 2 – Robotization (involvement of physical machines in the process as hardware with software elements), and 3 – Digitalization as a comprehensive solution to MSE business problems.

Figure 1: Diagram of Digitalization (NOVÁK, 2024)



In greater detail, digitalization encompasses the following key aspects:

1. Process Transformation: digitalization enables the transformation of traditional manual and paper-based processes into a digital form, which increases the speed and accuracy of operations.
2. Improved Communication: the use of digital technologies, such as emails, video conferences, chat applications, and social networks, facilitates both internal and external communication. This enhances the efficiency of team collaboration and interactions with customers and partners.
3. Customer Satisfaction: digitalization contributes to improved customer satisfaction through personalized services and quick access to information and products. Online platforms, e-commerce, and digital marketing enable businesses to reach a broader audience and better respond to customer needs.
4. Innovation and Growth: implementing digital technologies supports innovation and opens up new opportunities for business growth. Companies can leverage data and analytics to gain a better understanding of the market and customers, allowing them to develop new products and services, optimize offerings and improve strategic decision-making (NOVÁK, 2024).

1.3 BROADER ECONOMIC CONTEXT

Digitalization is becoming a key factor for the development and increased competitiveness of MSEs, not only in the Czech Republic but also in the broader European context. The European Commission has long emphasized the importance of digitalization as a means to strengthen economic growth, increase efficiency and foster innovation in the business sector. It has therefore introduced a way to measure progress in this area through the Digital Economy and Society Index (DESI) and the Digital Intensity Index (DII). Both serve as tools to measure the progress of digitalization among EU member states and identify areas needing improvement (EUROPEAN COMMISSION, 2022A).

Table 2: Number of MSEs in the Czech Republic and Their Share of Employment Compared to the EU in 2022 (EUROSTAT, c2024A; CZSO, c2024C)

Category	Number of companies			Number of employees		
	CZ		EU	CZ		EU
	Count	Share in %	Share in %	Count	Share in %	Share in %
Micro (0-9)	1 233 046	96.4	94.1	1 362 522	32.7	30.3
Small (10-49)	36 981	2.9	4.9	727 855	17.5	18.9
Micro and small total	1 270 027	99.3	99.1	2 090 377	50.2	49.3
Medium-sized (50-249)	7 407	0.6	0.8	758 575	18.2	15.4
Large (250+)	1 748	0.1	0.2	1 312 893	31.5	35.3
Total	1 279 182	100	100	4 161 845	100	100

Table 3: Number of MSEs in the Czech Republic and Their Share of GDP Compared to the EU in 2021 (OECD, 2021, EUROSTAT, c2024B)

Category	Share of GDP		
	CZ		EU
	Billion (€)	Share in %	Share in %
Micro (0-9)	73	29.8	31.8
Small (10-49)	26	10.6	18.2
Micro and small total	99	40.4	50.0
Medium-sized (50-249)	83	33.7	17.8
Large (250+)	64	25.9	32.2
Total	246	100.0	100.0

In the Czech Republic, MSEs are a key element of the economy, constituting a significant share of employment, as seen in Table 2. They also represent a substantial portion of the gross domestic product (GDP), as shown in Table 3. This underscores their role as key players in the economic environment. It is important to note that the data from the OECD found in Table 3 are indicative, as some data are missing. For instance, in the data concerning the Czech Republic, approximately 40% of the total value is not allocated to individual business groups. This implies that there can be up to a 10% variation in each item.

1.4 DATA AND INDICATORS OF TECHNOLOGY USE IN THE EU AND THE CZECH REPUBLIC

As mentioned earlier, the Digital Economy and Society Index (DESI) and the Digital Intensity Index (DII) are key indicators used to measure the digitalization progress among EU member states. The individual indicators are developed as follows:

- DESI (Digital Economy and Society Index) relates to specific EU states and assesses overall digital performance and progress. It evaluates the level of digitalization across various dimensions. Policymakers use it as a guide when making decisions about digital transformation and to identify areas needing improvement. It includes a wide range of indicators that cover infrastructure (e.g., broadband coverage), digital skills, individuals' online activities, business digitalization and electronic public services (EUROPEAN COMMISSION, 2022A).
- DII (Digital Intensity Index), on the other hand, relates to the small and medium enterprises (SMEs) of a given member state. It specifically focuses on the adoption of digital technologies, assessing how "digitally intensive" businesses are based on their use of certain digital technologies. It helps understand how businesses integrate digital technologies into their operations and identify areas where they may be lagging. It is based on survey questions regarding the use of social media, cloud computing, big data, e-commerce and others. Companies are rated and categorized according to their level of digital intensity (very low, low, high, and very high) (EUROPEAN COMMISSION, 2022A).

As can be seen in Figure 3, the use of digital technologies in Czech MSEs compared to other EU countries shows that Czech MSEs are below the EU average. The main gaps are in areas such as big data, invoicing, social media, artificial intelligence, and sustainability, as shown in Figure 4. Strengths lie, in contrast, in online commerce (a large number of e-shops...), including beyond the borders of the Czech Republic, and the use of cloud services (EUROPEAN COMMISSION, 2022B).

According to the strategic plan "Path to the European Digital Decade: Strategic Digitalization Plan of the Czech Republic until 2030," businesses are recommended to utilize funds for digital transformation, such as the OP TAK digital and virtual enterprise, or European financial programs like the National Recovery Plan or the Digital Europe Programme (OFFICE OF THE GOVERNMENT OF THE CZECH REPUBLIC, 2022).

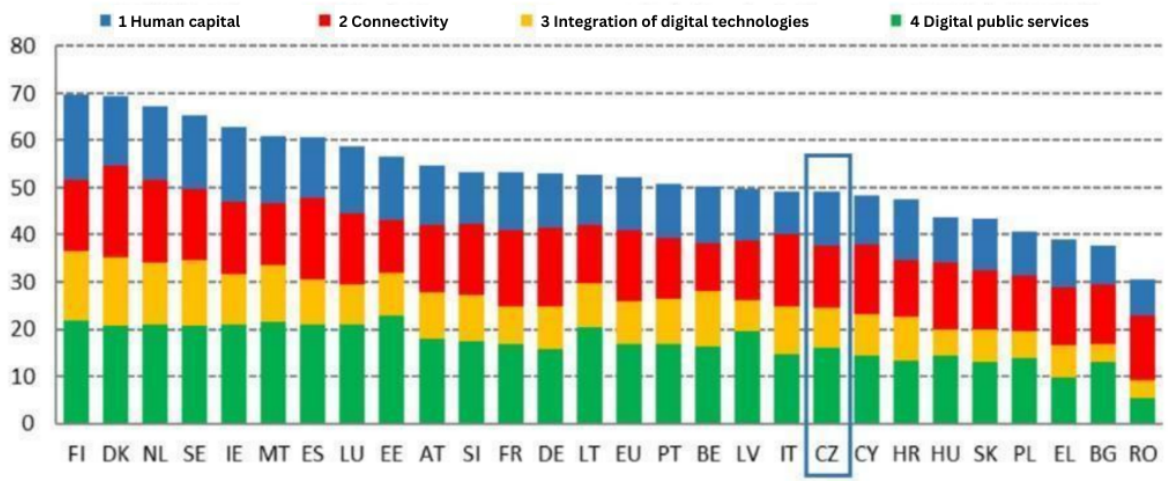


Figure 2: The Czech Republic in the Digital Economy and Society Index (DESI) in 2022 (EUROPEAN COMMISSION, 2022B)

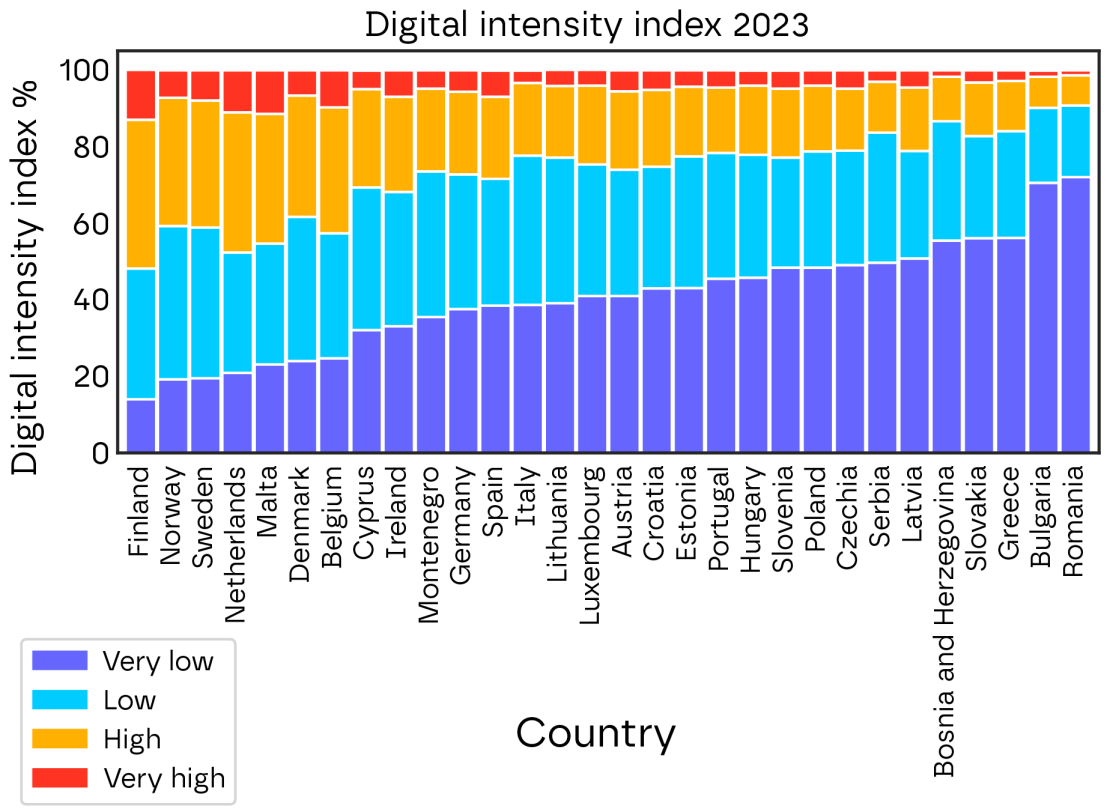


Figure 3: Digital Intensity Index (DII) in 2023 (EUROSTAT, 2023)

	Czechia			EU
	DESI 2020	DESI 2021	DESI 2022	DESI 2022
3a1 Small and medium-sized enterprises with at least a basic level digitalization rate % of small and medium enterprises	–	–	53 % 2021	55 % 2021
3b1 Electronic sharing of information % of enterprises	38 % 2019	38 % 2019	38 % 2021	38 % 2021
3b2 Social media % of enterprises	20 % 2019	20 % 2019	24 % 2021	29 % 2021
3b3 Big data % of enterprises	8 % 2018	9 % 2020	9 % 2020	14 % 2020
3b4 Cloud % of enterprises	–	–	40 % 2021	34 % 2021
3b5 Artificial intelligence % of enterprises	–	–	4 % 2021	8 % 2021
3b6 ICT for environmental sustainability % of enterprises with medium/high intensity of environmental measures through ICT	–	56 % 2021	56 % 2021	66 % 2021
3b7 Electronic invoices % of enterprises	14 % 2018	12 % 2020	12 % 2020	32 % 2020
3c1 Small and medium-sized enterprises selling online % of small and medium-sized enterprises	28 % 2019	29 % 2020	23 % 2021	18 % 2021
3c2 Turnover from e-commerce % of turnover of small and medium-sized enterprises	21 % 2019	18 % 2020	17 % 2021	12 % 2021
3c3 Cross-border online sales % of small and medium-sized enterprises	15 % 2019	15 % 2019	11 % 2021	9 % 2021

Figure 4: Use of Digital Technologies Compared to the EU Average in 2022 (EUROPEAN COMMISSION, 2022B)

1.4.1 LIMITATION OF DATA AND INFORMATION SOURCES

In exploring the literature and data on the digitalization of small and micro enterprises, we primarily encountered a lack of information. Most available data pertain to small and medium enterprises (SMEs) rather than specifically to micro and small enterprises (MSEs). Nevertheless, for completeness, we decided to compile a list of the sources we found, although we often did not use them; these are listed in Appendix 2.

In addition to the absence of sources, we also faced several challenges related to the availability of current and accurate data on small and micro enterprises (MSEs), especially in the Czech Republic. On a practical level, there is a lack of specific data on MSEs at both the regional and national levels, as data are often combined into the broader category of small and medium enterprises (SMEs). This deficiency complicates the accurate assessment of the state of digitalization for MSEs and makes it difficult to easily compare regions.

We use here the most up-to-date available data, sources, and reports from relevant entities such as the European Commission, Eurostat, the National Development Bank and the Czech Statistical Office (CZSO). Our aim is to provide the most accurate picture of the state of digitalization of MSEs, despite being constrained by a lack of specific data.

Tables concerning the number of MSEs in the Czech Republic and their share of employment contain data that pertain only, for example, to registered entities. The Czech Statistical Office warns that these figures may be inaccurate, particularly regarding employment, as many businesses do not report

the exact number of employees. This discrepancy between reported and actual values can thus affect the interpretation of results. It is therefore important to bear in mind that the quantitative data provided, processed through secondary analysis, may be indicative only, and the actual situation might show certain deviations.

1.5 ACTORS OF DIGITALIZATION IN THE CZECH REPUBLIC

The various actors jointly responsible for the area of digitalization in the Czech Republic can be divided into three categories: 1. Central State Administration and the EU, 2. Regional Institutions, 3. MSEs. A brief description of how we will address them in this study is summarized in Table 4.

Table 4: List of Relevant Actors in Czech Digitalization (Source: Own)

CATEGORY	DESCRIPTION OF ROLE	REPRESENTATION IN THIS STUDY
1. Central State Government and EU	Defines the economic and legislative framework and integrates it into the context of EU activities. Involves itself in the digitalization directly (through regional representation) and indirectly (central projects and budgets).	Only secondary analysis of data, see sources, i.e. (European Union and European Commission, Eurostat, CZSO, Strategic plan for the digitalization of the Czech Republic by 2030, state offices, etc.)
2. Regional institutions	Represented directly either in individual regions, whether organized by the state or MSE associations. In each region we met with the representatives of the organizations we identified as decisive for digitalization.	1. Regional offices, 2. Chambers of commerce, 3. Universities, 4. Innovation centers, 5. CzechInvest.
3. MSE companies	The main subject of the research in this study, in this context, which sets up for digitalization particularly the subjects of categories 1 and 2.	In each region, according to the recommendation of the Chamber of Commerce or the regional government office, we chose three MSE firms that were representative of the region based on their field of work.

1.6 SPECIFICTS OF THE HRADEC KRÁLOVÉ REGION

The Hradec Králové Region has more than 550,000 inhabitants and benefits from a strategic location and good transport accessibility (CZSO, c2024J). The GDP per capita is 543,106 CZK (CZSO, c2024E), which is the fifth highest value in the Czech Republic. The region is known for its agricultural-industrial character and rich tourism. Significant industrial sectors include the manufacture of transport equipment and components, engineering, textile industry, electronics and information technology (IT) (CZSO, c2024I). The Hradec Králové Region is also a region with developed research, development, and innovation, supported by the active use of information and

communication technologies (ICT) in households and businesses. The strong presence of enterprises of all sizes and active collaboration with institutions such as CzechInvest, the Center of Investments, Development, and Innovation (CIRI), European Digital Innovation Hubs (EDIH), the University of Hradec Králové (UHK), and the Regional Chamber of Commerce (KHK) make this region suitable for analyzing the digitalization of MSEs.

According to data from the Czech Statistical Office (c2024H), small and micro enterprises (MSEs) account for 99.8% of all businesses in the Hradec Králové Region and employ more than 60% of workers. These figures highlight the significant contribution of MSEs to the region's economy. The dominant sectors are manufacturing, construction, trade, services and IT.

- Internet Penetration: 99% of businesses have Internet access.
- Online Communication and Websites: 97% of businesses use online communication and websites.
- Social Networks for Marketing: 65% of businesses utilize social networks for marketing purposes.
- E-commerce: 24% of businesses engage in e-commerce.

These data illustrate that the Hradec Králové Region is not only a dynamic and innovative region, but also a place where MSEs are key players in employment and economic growth. The high rate of ICT and online tool usage among MSEs in the region underscores their readiness for digitalization and their potential for further development.

The Hradec Králové Region boasts an advanced infrastructure supporting digitalization, including technology incubators and innovation centers. Grant programs and initiatives, such as digitalization grants from CzechInvest and other financial supports from the EU, play a key role in facilitating the transition of MSEs to digital technologies. The University of Hradec Králové (UHK) and other educational institutions in the region provide the necessary educational foundation for developing digital skills. These institutions collaborate with local businesses on research projects focused on innovation and digitalization, thereby contributing to economic growth and improving the region's competitiveness.

The Hradec Králové Region exemplifies effective collaboration between local businesses, the public sector and research institutions. These partnerships are crucial for the implementation of digital technologies and innovations, which are vital for maintaining and enhancing the region's competitiveness.

Despite its strengths, the Hradec Králové Region faces certain economic challenges, such as a shortage of skilled labor and the need for infrastructure modernization. Digitalization offers opportunities to enhance competitiveness, streamline operations, and access new markets, which can help overcome these challenges.

These data and information demonstrate that the Hradec Králové Region is a dynamic and innovative area where MSEs play a crucial role in the economy. The high rate of ICT and online tool usage among MSEs highlights their readiness for digitalization and their potential for further development (CZSO, c2024J; CZECHINVEST, 2024A).

1.7 SPECIFICS OF THE VYSOČINA REGION

The Vysočina Region, with its more than 517,960 inhabitants, making it the third least populous in the Czech Republic, is characterized by its industrial and agricultural focus. The GDP per capita is 474,282 CZK as per the latest calculations (CZSO, c2024E.) The region is known for its strong orientation on traditional industrial sectors and a relatively low unemployment rate. The main sectors are engineering, metalworking and wood processing industries, food production linked to agriculture and energy. The Vysočina Region has a lower level of research and technological innovations, attributable to the absence of a university-type higher education institution with a PhD program. The active use of information and communication technologies (ICT) in businesses and households contributes, however, to the development of this region and makes it suitable for analyzing the digitalization of small and medium enterprises (MSEs).

According to CZSO data (2023), small and micro enterprises (MSEs) make up 99.1% (CZSO, c2024H) of all businesses in the Vysočina Region, employing a significant portion of the local workforce. These enterprises are most commonly found in sectors such as trade, construction, technical activities and tourism. Internet penetration in the region stands at 82.4%, and 74.5% of households have access to a computer, indicating considerable digital readiness among the population.

Businesses in the Vysočina Region also actively use online communication and websites. Approximately 68% of businesses utilize social networks for marketing purposes. This data illustrates that the Vysočina Region is an area with high potential for digitalization, particularly in the MSE sector, which is a key player in economic growth and employment.

Currently, the Vysočina Region does not have an innovation center to support digitalization. Thus, grant programs and initiatives, such as state grants supported by the region, digitalization grants from CzechInvest, and other financial supports from the Chamber of Commerce, play a crucial role in facilitating the transition of MSEs to digital technologies.

Despite its strengths, the Vysočina Region faces economic challenges, such as the need for infrastructure modernization and increasing digital literacy among employees. Digitalization offers opportunities to enhance competitiveness, streamline operations, and access new markets, which can help overcome these challenges.

These data and information demonstrate that the Vysočina Region is a dynamic area where MSEs play a crucial role in the economy. The high rate of ICT and online tool usage among MSEs and their readiness for digitalization in the region indicate significant potential for further development (CZSO, c2024L; CZECHINVEST, 2024B).

1.8 SPECIFICS OF THE MORAVIAN-SILESIAN REGION

The Moravian-Silesian Region is the third most populous region in the Czech Republic, following Prague and the Central Bohemian Region, with a population of over 1,189,000 (CZSO, 2024A). The GDP per capita, according to the latest calculations, stands at 499,813 CZK (CZSO, 2024E). This region is characterized by great diversity – encompassing mountainous and lowland areas, industrial cities, as well as tourist attractions. It has a long-standing tradition of heavy industry, particularly coal mining, metallurgy, and engineering, which has significantly shaped its character. Although coal mines have largely been closed, and the steel industry has gone through substantial

restructuring, these sectors continue to play a significant role in the regional economy. Apart from steelworks and metal production, engineering firms and companies from the automotive industry operate here. The presence of the food industry, IT sector, and services is also notable (CZSO, c2024B). The region benefits from its strategic location near the borders with Poland and Slovakia, making it an important logistics and transportation hub (CZSO, c2024D). However, the region faces challenges associated with transitioning to more modern knowledge-based industries, ranking fourth in science and research investments in 2023 (CZSO, c2024F). The support for innovation, technological parks, and business development is significant in the region.

The labor market is heavily influenced by the ongoing economic transformation. The region has been struggling with a higher unemployment rate compared to the national average, manifesting the second-highest unemployment in the country in 2022 (CZSO, c2024G). Thanks to the industrial heritage, there is a pool of skilled labor, especially in technical and engineering fields. The region attempts to address labor market issues through retraining programs, educational initiatives and efforts to attract new industrial sectors. The gradual development of the service sector, particularly in information technology and business services, is providing new employment opportunities. In 2023, the region ranked fourth among regions in the number of small and medium-sized enterprises (MSEs) (CZSO, c2024H).

Small and medium-sized enterprises (MSEs) constitute 98.9% of all companies in the region (CZSO, c2024H) and primarily focus on trade, technical activities, construction, real estate, and tourism. (CZSO, c2024I). In addition to the region itself, key players in the digitalization of services include economic chambers, universities and colleges, the Moravian-Silesian Innovation Center, CzechInvest, and others. The regional leadership is fully aware of the importance of digitalization in connection with restructuring and has included this area in four out of six strategic priorities. Interestingly, the region has been consistently moving towards digitalization across several election cycles (MSR, 2019).

2. Description of Research Methods

To determine the state of digitalization among MSEs in the Czech Republic, an extensive review of the quantitative data mentioned in the sources of this study was initially conducted. This review served as the foundation for our own research, which was carried out qualitatively using thematic analysis methodology (Braun & Clarke, 2006). This approach allows for an in-depth examination of the issues and the exploration of connections based on the experiences and opinions of the involved groups. Its goal is to discover and describe themes relevant to the research questions. The results of such a study cannot be generalized, however, in our case, they can be used to identify important facts and examples that may serve as best practices. The qualitative part of the study is based on the GARI study (Kořan, 2023) for ASPEN in 2023, in the field of digitalization research of small and micro enterprises.

2.1 DESCRIPTION OF QUALITATIVE RESEARCH METHODS

The aim was to explore the issue in depth, drawing on the experiences and knowledge of respondents, who were primarily stakeholders and representatives of MSEs from selected regions– namely, the Moravian-Silesian Region, Hradec Králové Region and the Vysočina Region. The data

collection method chosen was semi-structured interviews, and their analysis was conducted using the principles of thematic analysis.

To achieve this aim, three research questions were formulated based on the conclusions drawn by Kořan (2023):

1. What is the situation of micro and small enterprises concerning new technologies and digitalization in the selected regions?
2. What are the obstacles in acquiring projects related to the digital transformation of MSEs?
3. What is the level of digital literacy on the labor market in the selected regions?

The research questions were further developed into a semi-structured interview guide.

The research was conducted in accordance with the principles of ethical research implementation, such as the Universal Declaration of Human Rights, Regulation (EU) 2016/679 of the European Parliament and the Council on the protection of natural persons with regard to the processing of personal data and on the free movement of such data, and repealing Directive 95/46/EC (General Data Protection Regulation), as well as other generally binding legal regulations.

2.1.1 DATA COLLECTION AND RESPONDENTS

Semi-structured or semi-standardized interviews are a guided form of interaction with respondents. They involve a verbal dialogue between two people, where the researcher has prepared a set of questions (a script or guide) that need to be addressed during the interview. It is possible to change the order of questions, modify them, or add or remove questions based on the current situation. In preparing such a script, general themes, sub-themes and sets of questions are first proposed, which are then arranged in a logical order and based on importance. It is also important to consider the attention span of the respondent, as the interview should typically last between 30 and 90 minutes. In-depth and probing questions should also be considered and applied when a topic has not been fully explored, or if the respondent's answers are very general (Hendl, 2023).

Within the semi-structured interview script, the following topics were developed to reflect the research questions:

1. What is the overall situation regarding digitalization and new technologies in the region?
2. What is the information support for micro and small enterprises in the area of digitalization and new technologies in the region?
3. What priority does this issue have for the region?
4. What barriers exist for micro and small enterprises in this issue?
5. What support exists for micro and small enterprises in this issue?
6. What is the level of digital literacy in the labor market in the region?
7. What are the possibilities for supporting digital literacy in the region?

For each region, the survey was conducted with respondents from stakeholders involved in innovation, technologies and digitalization, as well as representatives of MSEs. These were representatives responsible for digitalization and new technologies, representatives from economic chambers, innovation centers and universities within the regions. For the purpose of the research, each interview was recorded, which the respondents were informed about. The recordings were transcribed and anonymized.

The interviews were conducted during the period from March to April 2024. Following these, preliminary results were presented at roundtable discussions, which took place in June. The roundtable discussions were also recorded and transcribed, and the data contained within them were used in the evaluation of the qualitative part. Respondents were also informed about the recordings in these sessions and the transcripts were anonymized. The research data obtained from the qualitative interviews can be described using the following schema, see Figure No. 5.

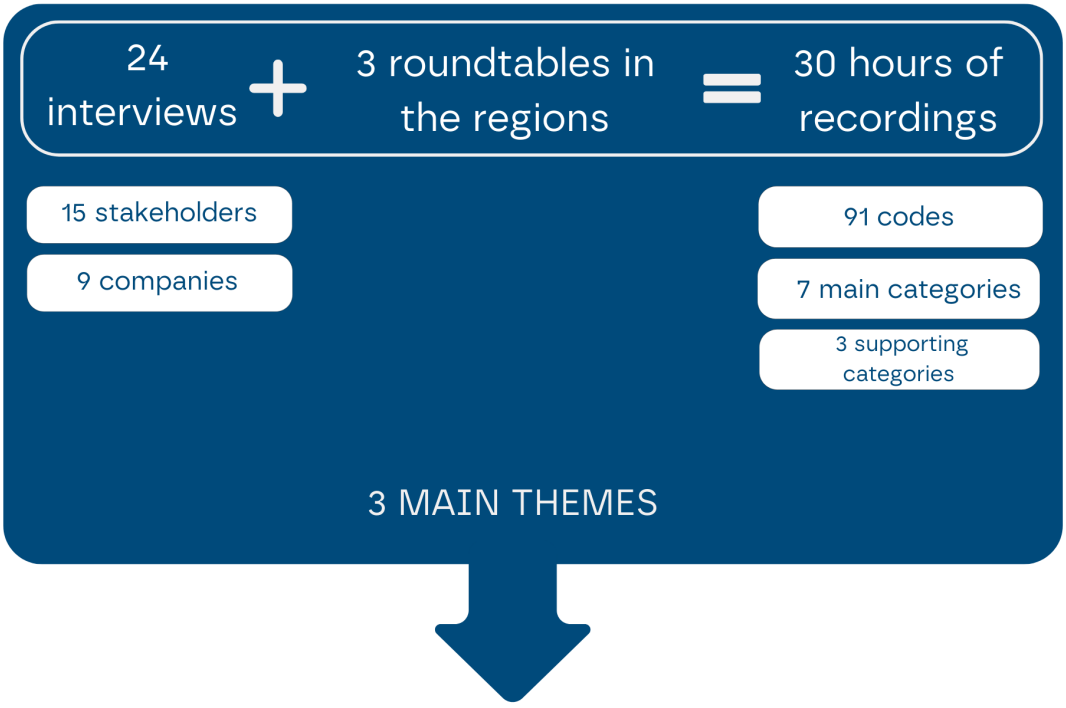


Figure No. 5: Description of Data Obtained from Qualitative Interviews (Source: Own)

2.1.2 DATA PROCESSING

The collected data were processed using the principles of thematic analysis, which is used to find meaning based on common themes. This approach aims to gain a deeper understanding of the information obtained during the research. The analysis focuses primarily on observing the subjective experiences, attitudes and opinions of the respondents. A theme is a set of patterns or common ideas that recur within the data set (GUEST, c2012). This method systematically identifies, examines and interprets the patterns (themes) in the data. Its task is to clarify underlying ideas, assumptions and concepts.

In practice, this means that transcripts of interviews and roundtable discussions are subject to analysis, where relevant parts related to the studied issue are identified within sections of the text (words, sentences, paragraphs), and are assigned clear and comprehensible codes. A code is the smallest descriptive unit of analysis, which can take the form of a word, phrase or sentence. The codes are then divided into appropriate categories according to the contexts across all obtained transcripts, but are first cleaned of duplicate, similar and irrelevant codes. Categories form the basis for the themes, which are named and described based on the obtained data and information.

It is important to realize that the results of the thematic analysis are examples, concepts and interpreted situations. The results cannot be easily converted into graphs, tables, ratios or predictions. The focus is on answering questions of why and how, not on the question of how many.

The data were processed using the software MAXQDA Analytics Pro version 24.4.1. (VERBI GmbH, c1995–2024).

3. Results of the Qualitative Analysis

The analysis of the transcripts from all the interviews and roundtable discussions identified three main themes related to the digitalization of MSEs in the Czech Republic, which are further elaborated in Figure No. 6. These themes are detailed below in the context of related sub-themes. The most significant themes are the obstacles and barriers that MSEs and stakeholders attempt to address. This is followed by the associated motivations and needs of businesses, and lastly, the possibilities for support, including examples of best practices.

Figure No. 6: Wordcloud of Represented Codes (Source: Own). Legend – Needs and Motivations (blue), Possible Solutions (light green), Obstacles and Barriers (red), Entities (purple), Types of Companies by Approach (dark green), Evaluation of Solutions (yellow).

In general, it can be said that the approach to the digitalization of MSEs in the regions is a very important issue being addressed. Each region approaches this issue slightly differently, influenced by its location, socioeconomic factors, history and the focus of its industry and services. It appears that regional offices themselves, in collaboration with innovation centers and economic chambers or agencies such as CzechInvest or the Business and Innovation Agency (API), play a significant role in

support and in seeking financial opportunities. There is also substantial support from universities, whether through programs aimed at lifelong learning and supplementary education or specifically at entrepreneurship. Startups are frequently created by students or graduates of these universities, focusing on one of the spheres of digitalization and the general needs of businesses. Well-structured and targeted collaboration among stakeholders leads to improvements in the digitalization of MSEs.

"Collaboration with universities is crucial for us. [...] We invite experts from higher education institutions to our events. [...] Thanks to student projects, companies can access affordable options that might otherwise be unattainable for them."

3.1 MOTIVATION AND NEEDS OF MSES

It appears that MSEs can be categorized into several basic groups based on their motivation for digitalization according to their needs:

- They do not feel the need.
- They feel the need but are unaware of the possibilities and do not know how to start.
- They feel the need and even know what they need, but they do not know how to proceed.

Businesses that do not feel the need to digitalize are most often sole proprietors, or individuals who have business as a side activity. Their primary need is to perform their work well, typically without expecting further business growth. A typical example is an older craftsman who does not have a close relationship with information technology. Their usual need is accounting, which they either handle themselves or outsource. Another example might be mothers on maternity leave who earn extra income; they generally only feel the need for advertising and presenting their products or services, or perhaps assistance with accounting.

Businesses that do not feel the need to digitalize are most often sole proprietors, or individuals who have business as a side activity. In contrast, businesses that feel the need for digitalization but are unaware of the possibilities and do not know how to start typically require a significant amount of support.

Businesses that feel the need for digitalization but are unaware of the possibilities and do not know how to start typically require a significant amount of support. These are most often sole proprietors and small enterprises focused on manufacturing or services. Their most common needs include digital accounting, online marketing, and for manufacturing businesses, the automation of production processes, purchasing advanced equipment and integrating it into operations. They are unaware of the available tools and support programs, however, and often have concerns about making large investments and choosing inappropriate solutions. Their business objective is usually to achieve profit while efficiently utilizing limited resources. They tend to prioritize solving acute problems and do not give digitalization as much importance. When they perceive the potential for business growth, they realize that at least partial digitalization might assist them. A typical example would be a construction company that needs to automate logistics and material storage but whose representatives are not familiar with or aware of market options.

MSEs that feel the need for digitalization, know what they need but do not know how, typically require assistance with selecting and implementing appropriate solutions for activities such as digital accounting, online marketing, process automation, and digital document communication, among others. They are often compelled to digitalize due to external pressures, such as the demands of various supply chains into which they wish to deliver their products or services. These chains usually require them to use a specific program for the electronic communication that the chain itself utilizes. A typical example is a small production facility in the food industry striving to supply its products to larger chains, which require the operation and installation of a specific system.

The main goal of MSEs is to provide their services with quality and remain competitive on the market. They often lack the resources (finances, personnel, time) to invest in information technologies and digitalization. Micro-enterprises and companies with up to ten employees feel particularly restricted by their size. They reinvest all earnings back into the business and handle immediate problems not related to digitalization. If the business grows, the management usually recognizes the importance of digital transformation; however, the number of such businesses is relatively small. This behavior is most frequently observed in small enterprises whose size or turnover approaches that of medium-sized businesses.

MSEs that feel the need, know what they need but do not know how, typically require assistance with selecting the right tool and its implementation.

Another reason why businesses pursue digitalization is the anticipated financial savings. Here too, the size of micro and small enterprises becomes evident, as they typically produce on a much smaller scale compared to medium or large enterprises, for whom substantial investments in expensive technologies are more justifiable. The focus of the business also plays a significant role. It is very challenging to find a suitable solution because a large investment poses a much greater risk for a small business than for a medium or large enterprise.

The reason businesses pursue digitalization is the anticipated financial savings.

"The company makes sandwiches, and out of curiosity, the manager implements some automation. The potential for savings is significant, but not as large as it would be for a big manufacturing company producing tens of thousands of identical components annually."

A common need and motivation for implementing information technologies and systems is business growth. As the number of employees, orders, turnover, and products increases, the need for MSEs to manage work processes and procedures efficiently, as well as their automation and improved administration, grows. The needs of businesses vary according to their focus, the problems currently being addressed and the tasks. Figure No. 7 demonstrates the varying needs of businesses to digitalize in the context of their growth.

The need and motivation for implementing information technologies and systems is business growth.

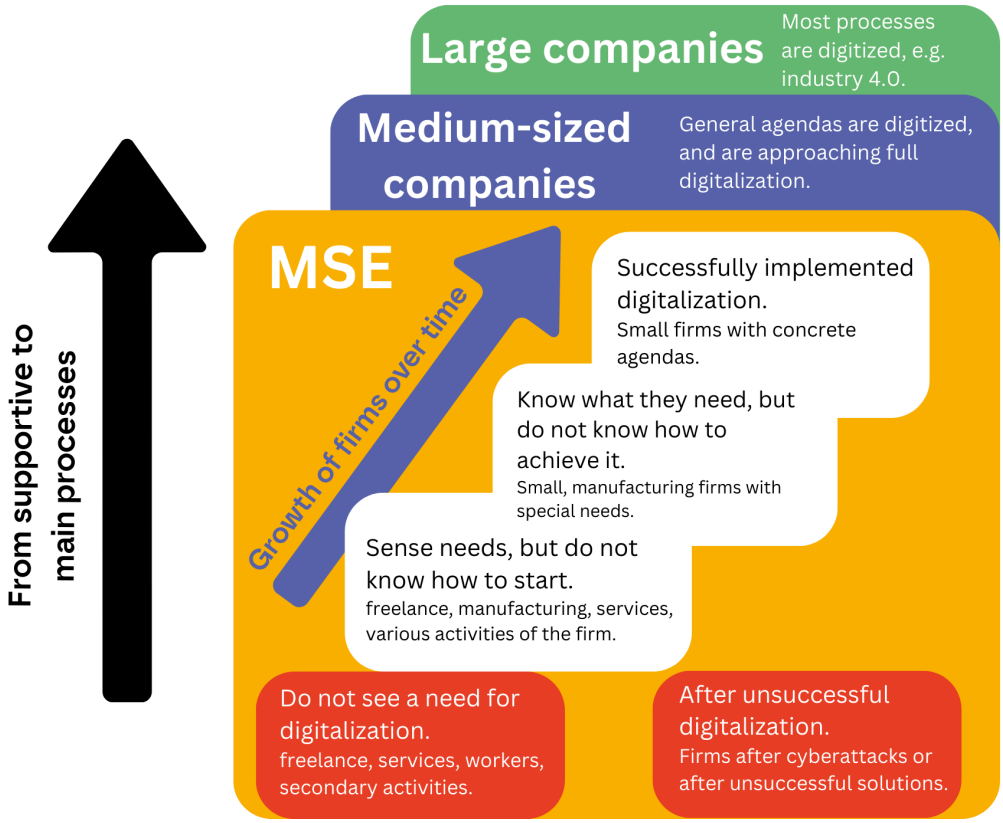


Figure No. 7: Phases of Digitalization of MSEs According to the Needs and Level of Development (Source: Own)

"As soon as a company grows, it undergoes process changes and innovations where it needs to elevate its information system to a higher level. [...] Small companies might start with something like Excel as their system, but with growth, they encounter various limitations. [...] They then need to address their own information system, ERP, a database, or something that they can use to store and retrieve data. The more people there are and the more complex the tasks become, the more sophisticated the information system they need..."

"Some find the need in marketing, others in legal affairs, some in process setup, application development, or in the design of data architecture, perhaps during process redesign..."

Significant differences in motivation are evident among businesses based on the age category of the leadership. Younger leaders often show enthusiasm for information technologies, particularly hardware solutions and information systems that can help streamline processes within the company. Their enthusiasm is sometimes so strong that they experiment with various tools or their combinations, which can be counterproductive. In contrast, older leaders tend to have a more conservative approach to digitalization and information technologies. Even when presented with an opportunity to make company processes more efficient, they usually reject it. A specific case is family businesses, where the younger generation is set to succeed the older one.

Younger leaders are often enthusiastic about information technologies, while older leaders tend to exhibit a more conservative approach.

"Companies with older leadership need a stronger impetus. Younger leaders are often enthusiastic about information technologies, while older leaders tend to exhibit a more conservative approach.They often do not need a vision because they were established back in the 1990s and just continue doing what they have always done."

"An example could be a family business where some innovations might succeed if, as the leader, I discuss them with the younger members. In that respect, it is better, but it progresses slowly."

Experiences from respondents indicate that men in leadership positions of MSEs tend to focus more on technical and technological solutions—such as hardware and information systems—when it comes to digitalization. Women usually focus on marketing and administration. It also emerges from experience that interest in digitalization is predominantly shown by men, likely because more men are in business. Additionally, it appears that when women are in leadership positions of micro or small enterprises, they are typically very strong and competent, eager to innovate, and actively seek assistance.

"Most of the entities we assist have men in leadership positions, typically under the age of fifty."

"I would say not many women use our services, but it might be because there are not many of them. And when they are there, they are very competent and strong, often a level above male leaders. They usually know what they want; they just need help getting there."

Businesses located near regional or district cities, where the majority of programs and opportunities are concentrated, generally have significantly higher motivation to at least get educated or proceed with digitalization. In contrast, companies based in the outskirts of the region, outside of major cities, tend to show much less interest. It appears that one reason for the lack of interest is the distance, which reduces the willingness to participate in various meetings, events and consultations. Additionally, some entrepreneurs from peripheral areas do not feel threatened by competition, and therefore are not motivated to engage more with the issue at hand. The situation is different for MSEs that see potential in collaborating with foreign partners. In such cases, the need and motivation to digitalize is usually stronger, in order to align with foreign partners or meet the conditions required for such collaboration, whether it be for effective communication or to monitor and streamline transport.

"We try to serve the entire region, but it is true that the greatest impact is on the Ostrava area. Even though we attempt to reach beyond Ostrava and the larger cities in the region, we have not been very successful. More than half of the cases involve companies in and around the city of Ostrava, which is disproportionate compared to the rest of the region."

"Someone who really operates in real time and collaborates extensively with foreign partners tends to adopt these trends quite quickly."

The needs and motivations of MSEs often depend on the focus of the company. Extensive digitalization in this sector is not suitable for everyone. Automation and robotization of workshops are appropriate for manufacturing or engineering companies with growth prospects, but they make little sense for small enterprises and craftsmen. Supportive processes like accounting, invoicing, and marketing are relevant for everyone, but there is often no perceived necessity to implement them. Each such business is unique, so it is important to have an expert who can competently assess which

processes make sense to digitalize, both economically and functionally, from a short-term and long-term perspective. A good practice in this context is recruiting or recommending IT and grant experts, even from within micro and small enterprises, who can assist with the selection and implementation of solutions for companies.

Every business needs an expert who can competently assess which processes to digitalize.

"Yes, when you properly set up machine sensors and a complex MES[2] system in engineering, it is very costly, but in the long run, you have the potential to save a lot."

3.1.1 STREAMLINING ADMINISTRATION

One of the significant areas where MSEs feel the need for improvement through digitalization is the streamlining of administrative activities, specifically at the levels of:

- Internal business processes.
- Communication with public authorities.

Regarding internal business processes, this primarily involves inventory management and logistics for manufacturing businesses. For companies of any focus, it concerns areas such as accounting, streamlining administrative procedures or internal communication. Examples include electronic leave requests or travel orders, mass dissemination of critical messages to employees, and human resource management (e.g., shift scheduling). In terms of customer communication, it includes options for digital invoicing and order communication. The main goal is to streamline administrative work enough to allow MSEs to focus on their core business activities.

"I tracked everything in Excel for a long time because an external accountant handled all the invoices. [...] Basically, I am still looking for a suitable solution that I can afford."

"The right choice of accounting software can advance a company because some accounting programs can also handle inventory, and they can connect to an e-shop. I think the right software can be the core of the business."

MSEs often struggle with problematic communication with public authorities. One of the issues is unsystematic and uncoordinated inspections, despite the fact that information could be shared digitally between these authorities. The need for MSEs in this area is to streamline information flows, which they cannot control themselves. Another problem is the use of existing digital communication tools and platforms, such as the data mailbox. Although businesses utilize it, frequent transmission problems occur, necessitating the resolution of issues through traditional paper-based or in-person methods. This often reduces trust in digital solutions among businesses.

[2] MES – Manufacturing Execution System

"When we talk about digitalization for micro-entrepreneurs, we often hear that they still have to go to offices and sign documents multiple times. This is unnecessary. If we have a data mailbox, we should be able to handle everything electronically, but the reality is often different. We have to regularly change passwords, which is impractical, and many offices still require a personal visit."

Communication with public authorities occurs unsystematically and uncoordinatedly.

Last but not least, it is particularly time-consuming for MSEs to search for information about administrative or financial assistance in the areas of business, innovation and digitalization. Therefore, MSEs are calling for a unified, centralized and clear information channel.

"The information is on the Internet, but to say it is easily accessible would be an overstatement. I mean, I do not have the desire or time for such browsing."

3.1.2 INFORMATION SYSTEMS

A frequent need for MSEs is the implementation of specific information systems, whether for previously mentioned administrative activities or to support the production process, storage and logistics, customer information, etc. For the entrepreneurs themselves, it is usually very challenging to navigate both their specific needs and the solutions available. At the same time, they feel a lack of solutions targeted specifically at them – most major providers focus on solutions for medium and large enterprises because solutions for MSEs would not be profitable for them.

"There are so many options and of course, everyone sells it as if these systems work beautifully, with enthusiasm, smiles, telling you how much it will cost, how everything will function. But the reality is often different."

The need for trained personnel or services to assist with the implementation and management of such systems is closely related to information systems. It turns out that there are relatively few such experts, and some are themselves in the position of micro or small enterprises offering specific IT services. They do not develop their own systems but help with installation, implementation and management. Notably, micro and small enterprises with fewer employees and turnover typically lack the financial means to employ their own IT specialists. It has been observed that freeing up an administrative position, through the introduction of an appropriate system, could provide the resources for hiring an IT expert.

"As an example, one can describe the replacement of an administrative worker with an IT specialist. Such specialists are often missing in the job market. [...] There are some, but they are few."

"No one can expect me to learn to program or write web scripts overnight. [...] I need help with that."

There is a need for trained personnel or services to assist with the implementation and management of the information system.

MSEs often tend to purchase custom systems, which are extremely costly and difficult to develop. Additionally, the sustainability during business growth is often overlooked during their development. It can then happen that the investment in an expensive solution (not only tailored to the enterprise) does not pay off and can even lead to bankruptcy. Entrepreneurs expect and must be certain that the software solutions will be sustainable, functional and secure. One potential solution for micro and small enterprises could be SaaS (Software as a Service) solutions, where payments are typically made on a monthly, quarterly, or annual fee basis, or according to the number of licenses purchased. This service can be more advantageous for entrepreneurs than a single large investment. Furthermore, it is possible to test and select more suitable solutions through this service.

"In certain cases, it can be counterproductive. [...] In this supposedly small stage, a person designs a system, but how expandable is it for the future, so it does not have to be redesigned?"

"The transition to a higher information system has harmed many companies. The solution cost millions, but it did not work, which led to a loss of trust for many of them, sometimes even to bankruptcy..."

"Most small businesses do all their administration in Excel. They are not concerned with security at all, and they do not see the possibility that they save on employees, on processes [...]. The successful ones we work with use various smaller and cheaper applications, and only move to more complex solutions when necessary."

Entrepreneurs often struggle with system incompatibility, or they are forced to use multiple systems to perform various tasks. Therefore, when solutions are provided, ideally comprehensive systems are expected, or solutions that allow interoperability and compatibility.

The various evolutionary phases of the digitalization of MSEs, according to their needs and stage of development, are summarized in Figure 7.

They often struggle with system incompatibility and are forced to use multiple systems to perform various tasks.

"We have a number of applications from different vendors, each working independently, which means that each employee must be individually trained for each application." (Citation-22)

3.1.3 HOT TOPICS OF INTEREST TO MSES

In the context of Industry 4.0, manufacturing and engineering companies are specifically dealing with the topics of robotics and advanced process automation. These are typically very expensive solutions, which is why only a small number of MSEs are active in this regard, and mainly large or medium-sized enterprises are undertaking major changes. Nevertheless, there is a prevailing interest in learning more about this area and exploring possible involvement.

"Robotics is a completely different topic. From what I know from a survey three years ago, only 3% of small companies in the region addressed robotics in any way. Among medium-sized enterprises, it is around 14 to 15%."

"We collaborate with various external instructors. [...] We are currently preparing a course on the implementation of Industry 4.0 elements in enterprises, which will focus more on discovering new target groups. [...] We perceive it as an important part of developing the environment and companies in the region."

Another frequent topic inherently linked with digitalization is cybersecurity, where there is a need to focus on understanding legislation as well as securing one's own data and processes. Among MSEs, there are concerns about storing data in cloud services, particularly the fear of data misuse and the subsequent legal implications. It has been shown that many systems are not always properly secured and encrypted, which ultimately must be addressed by the entrepreneur themselves. Here too, MSEs resort to seeking experts and advisors to help them either understand applicable legislation or secure their own data within the systems they use.

In cybersecurity, it is important to understand both the legislation and the security of one's own data and processes.

"I often encounter situations where outdated technologies, which are long obsolete and insecure, are implemented. I always insist that everything should be transferred in an encrypted manner, and some of the suppliers are quite taken aback by this."

"It will work if it goes hand in hand with the state. This is if the state digitalizes well and prepares conditions for cybersecurity. This is a huge task, because if we all become digital, even small companies will find it necessary, and naturally, these companies will have to pay for it. It can pose extreme risks because it can bring a company down the moment they undergo digital transformation."

One of the priorities for MSEs in their competitive environment is online marketing. Entrepreneurs do not always realize the full scope of this area. They usually need assistance because they aim to increase their reach and sales through this method. They frequently seek experts but often struggle with the vast array of options available. Marketing agencies offer comprehensive but often very expensive solutions, which businesses find difficult to understand in terms of real impact. Student and graduate projects and startups focusing on marketing communication are increasingly coming to the forefront. Businesses particularly mention the need for creating and maintaining a corporate presence, e-shops, social media, and targeting customers, advertising, newsletters, etc.

"It is one of the issues that trouble companies. [...] Marketing evolves extremely quickly, and there are significant demands on the business because what was relevant five years ago is no longer modern, and approaches have changed."

They usually need help with online marketing to increase their reach and sales.

"When we conducted a survey, we found that only about 45% of small businesses engage in marketing. [...] Therefore, I highly appreciate the path of collaboration between universities, specifically students, and companies that help them with it."

Artificial intelligence and its use in business is another hot topic that naturally interests MSEs. They are very often curious about how AI models can assist them in data analysis, marketing, or what possibilities exist for improving production and internal processes. They are also informed about the risks and potential for misuse, among other things. From the experiences gathered, it is evident that companies currently show great interest in various courses and training, seeking ways that AI models or tools based on them can assist them.

"I even heard somewhere that programmers will not be in such high demand anymore because that is something artificial intelligence can handle."

Artificial intelligence naturally interests MSEs.

"I am not saying that artificial intelligence is brilliant, because, as experts say, it could kill us [hyperbole]. I think that things like taking minutes, automatic notifications—people can work with that, they can respond to it. I believe it can lead to the streamlining of many processes."

"Artificial intelligence creates quite an interesting wow effect among entrepreneurs. Of course, they realize that digital transformation within the company is necessary to begin using it."

3.2 OBSTACLES AND BARRIERS

Based on the experiences of respondents, particularly from innovation centers, agencies, chambers of commerce, and regional authorities, it emerges that interest in digitalization among MSEs is relatively low, even when their current needs focus on specific areas. The answer to why this is the case relates, on the one hand, to a group of businesses that feel they do not need to digitalize, whether this is true or not, and on the other hand, to the reluctance to engage for various reasons. Along with this reluctance, businesses face a number of obstacles and barriers. It is essential to respond appropriately to these barriers and obstacles, attempt to remove them, assist, and create suitable conditions where it makes sense to do so. Poorly managed change management among both leadership and employees leads to resistance to adopting or changing anything new. Such businesses usually have established procedures that work for them to varying degrees. Although these could be improved with the introduction of appropriate solutions, there is a lack of willingness to accept them.

Poorly managed change management leads to a reluctance to introduce or change anything new.

Among employees, fear of job loss often plays a role, causing them to resist changes. Such businesses are very difficult to reach and activate because they simply are not looking for any solutions.

"Many craftsmen will not digitalize or automate and will still rewrite receipts by hand..."

This may also relate to a lack of awareness of possibilities, at least in businesses that show no interest in them. There are, however, MSEs that try to find solutions, but even for them, it is very challenging. It is not just a matter of lacking knowledge of technologies, information systems, or digitalization in

general, but also about the awareness of supportive and grant programs, or the organizations and agencies that back them. There is often a misconception that these solutions are not intended for micro or small businesses, but only for larger ones. It would be appropriate to increase the awareness of MSEs using well-chosen tools and channels.

This may also relate to a lack of awareness of possibilities...

"There seems to be an outdated stigma that grants and subsidies are primarily intended for larger companies."

"We are talking about perhaps a thousand companies in the region, where only a tenth are aware of us, request consultations, or use our services. Of course, they are not obliged to know about us, but we should strive to support them in this regard."

"They often think that digitalization is not possible or crucial for their business. [...] They do not fully comprehend all the benefits they could gain. It is more about getting the right information about the range of possibilities, which could suddenly open their eyes and free up entrepreneurs to focus on many other things where there currently is not time, energy, or money."

This also ties into decision paralysis, where a business shows uncertainty about which solution to choose. The choice of what to invest in gradually plays a significant role. It is crucial to consider which processes need support and in what way at a given moment. This includes, for example, whether it is necessary to purchase new technologies, like an automated line that requires specialized software, or to streamline administration, such as implementing an information system for electronic communication with a chain to which it supplies goods. Then there is the selection of the program or service itself. This decision-making should not be based solely on numerous Internet articles and advertisements but on qualified assistance.

The business shows uncertainty about which solution it should choose.

"The biggest problem is the speed of change. It is important to choose a suitable solution that I can work with for the next 15 years, as I will not have the resources to renew and change technology every year."

A previous negative experience often plays a role, where a business loses trust in digital services. There were examples mentioned where a company acquired a very expensive solution that exceeded its needs, but the investment did not pay off, which could have had fatal consequences for the business. Alternatively, there was a security issue. Such negative experiences then hinder the leadership of the company from making further attempts at innovation, often because they are still recovering from the problem.

"The first requests came from companies that chose an information system poorly, perhaps two levels higher than they needed. It cost millions and did not work, which harmed them significantly or, in the worst case, completely ruined them."

A negative experience can have fatal consequences for a business.

The absence of a strategy or vision, whether overall or specifically related to digitalization, plays a key role in decision-making. Experience shows that businesses often lack a coherent strategy, leading to unawareness of possibilities, purchasing unsuitable solutions, decision paralysis, or reluctance to engage. Every business should define its goal, decide which processes it will digitalize, what technologies it needs to purchase, where it is heading, and with whom it wants to collaborate, or whom it will supply with its products or services. This also makes it much easier to apply for financial support through various programs. Despite the fact that it is a micro or small business, defining a strategy is essential.

"Even digitalization should start by determining what my business model is, where I want to go, where I want to be in five years, what I should invest in, and what I should simplify. For example, if I want to be able to supply to the automotive sector in five years, what do I need to do, or what do I need to invest in?"

A significant obstacle MSEs face is the lack of experts within the company and often a general shortage of employees. Micro and small enterprises typically do not have sufficient resources or funds to hire one or more experts in IT, digitalization or other activities. A small manufacturing company involved in sales may lack, for example, the employees needed for fulfilling production orders and cannot afford to hire a new employee or to train an existing one for tasks like creating an e-shop or managing social media. Businesses often require qualified advice or need to establish their own expertise for strategic planning and future development. A solution could be finding and providing quality and vetted experts for assistance, consultations, or specific tasks such as programming, administration, management or troubleshooting. Regions also face an outflow of competent employees to larger cities or abroad, while larger enterprises and corporations attract young people and graduates. One possible reason is young people's desire for job security, with a greater trust in large companies than in MSEs. The outflow also relates, however, to economic, social, and cultural issues in the regions, such as a lack of housing or the perception of poorer living conditions.

"People often do not know how to find programmers and cannot afford it. Even if they had a universal application that they could customize, it would cost money. It could be a month's earnings, which many micro-entrepreneurs cannot afford."

Micro and small enterprises typically do not have sufficient resources to hire an expert.

"[...] I currently have a girl who comes twice a week due to her kids, but she has worked in other companies, so she has a good focus. But of course, it is clear that I cannot utilize her as much as I need. [...] If I could have someone who was here at least four hours every day, everything would progress to where I need it much faster."

"My main problem is the lack of guys in the workshop. Few are graduating from schools. [...] Well, or they are leaving for elsewhere, like Brno, Prague, or somewhere else."

Entrepreneurs often suffer from a lack of time. They are so focused on the operations and addressing the immediate issues of their business that they do not have the time or energy to delve deeper into further development. This impacts the planning of digitalization processes, finding suitable grant programs, and self-education in the field, among other things.

"Sole proprietors and smaller firms have enough problems of their own and hardly have time to solve these problems in-depth. [...] It is more of a retrospective resolution later when the business is settled."

"For example, even my time. [...] Not everything is within my possibilities to manage in a reasonable time frame. So if I could clone myself, it would certainly be better for those customers."

"First, I need to grow the company, then I can think about automation and digitalization."

Entrepreneurs focus on operations and solving immediate problems, leaving them no time to dedicate to development.

The lack of time is also connected to the administrative burden that entrepreneurs face when applying for grants or subsidies for digitalization. Experiences indicate that the process of locating grant opportunities and handling the associated administrative tasks is demanding. It has been noted, however, that national and regional calls are straightforward and require a relatively short application of just two A4 pages, followed by the submission of accounts and documents proving that the planned activities were carried out. The more complex procedures relate mainly to calls for programs from European funds, where much more demanding documentation is needed both at the beginning and during activity reporting. Additionally, it often happens that funding from the grants arrives later, necessitating the initial use of one's financial resources to implement the project. Businesses lack the resources (finance, people, time) to execute large and demanding projects, and they usually require simple, one-off solutions.

"We have already encountered many companies that did not even attempt to apply for grants because they lack the time and energy when they calculated the associated costs, obligations and conditions they would have to meet."

"The primary problem is finding out what grants exist and then the time-consuming nature of all the administration involved."

"When it comes to these calls, proving how the money was spent usually involves a series of steps that must be completed correctly for it to succeed. [...] All the work needed to be done before the money even arrives."

"I have experience with grants, like the European ones that are not adopted by the Czech Republic—they are otherwise complicated, actually much simpler. What the Czech Republic rewrites is, with all due respect, a zoo."

MSEs are calling for a clearer overview of grant opportunities and a simplification of administrative processes.

A significant barrier for MSEs in implementing digitalization is the lack of financial resources and their acquisition through grants. Micro and small enterprises generally do not have sufficient funds to digitalize their processes. Some businesses try to save part of their earnings and subsequently invest in innovations, but it turns out there are many businesses that have to reinvest all their profits back into the business immediately, leaving nothing for additional pursuits. Consequently, they have

to seek funding elsewhere, such as through grants. Experience shows, however, that there is a lack of interest in various grant programs, whether in simpler innovation vouchers or complex programs from European funds, which can be argued is due to the immense administrative burden. Overall, businesses are calling for both a clearer overview of grant opportunities and a simplification of administrative processes to save time. The lack of finances and time also affects entrepreneurs' self-education activities, as courses from specialized companies are often very costly.

"When I pay employees, operational costs, outsourced services [...], there is hardly anything left for implementing additional systems."

"I do not want grants; as soon as you change anything, the project has to be changed and approved, so it is quite cumbersome."

"Most courses are very financially and time-demanding, especially if conducted by companies offering those solutions."

"We do a lot of grants– we even manage them for companies and write projects for them. Basically, it is simple, and the offers are great. The EU ones are now interesting even for small businesses, typically well-subsidized, often around 50%."

Low digital literacy among employees is also perceived as an obstacle to the digitalization of MSEs. It emerges from interviews that managers view their employees' digital literacy levels very critically, considering them insufficiently literate. Due to shortages of staff, time, and finances, there is no room for employee education and training in this area. Although a variety of courses are offered on favorable terms through initiatives by employment offices, innovation and business programs, or universities, businesses often rely on the transfer of knowledge and experience among employees.

"I am concerned we will encounter a problem with mental capacity. For example, our chimney sweep knows what is on the form, but anything additional is extra work for him. It is stressful for him, so he will not do it..."

"[The level of digital literacy] among my employees is nothing much. [...] There is actually a person coming here twice a week for digital services, setting things up and explaining them to colleagues."

Respondents among stakeholders estimate that the digital literacy level is sufficient among employees and entrepreneurs up to about 45 years old. The larger issue seems to be the criteria for determining the level of digital literacy–how much they use digital technologies, what tasks they can perform with them, or how aware they are of market possibilities. The question of digital literacy often relates to courses and education. Between 2005 and 2010, there was high demand for ECDL courses, which certify digital literacy based on ten modules of digital competencies. Today, these competencies are taken for granted, with a focus now on new technologies like AR/VR, artificial intelligence and secure technology usage. There is a consensus that a basic good level of digital literacy means being able to understand and use new technologies while ideally being aware of potential risks and issues. The problem of digital literacy is viewed as a global issue that needs to be addressed at the basic and secondary education levels.

Figure 8 summarizes the individual obstacles and changes in motivation for digitalization.

Leaders critically view the digital literacy of their employees and consider them insufficiently literate.

"I think digital literacy is good among employees up to forty-five years old."

"I would say it is good, that there is not a fundamental problem. The people we work with use computers, online tools, and electronically sign documents for us..."

"Honestly, I do not know what to imagine by the term digital literacy. Does it mean I can operate a smartphone, turn on a computer? What does it actually mean, and are there different levels of digital literacy?"

"If you ask me what the faculty does to enhance the digital literacy of micro and small businesses, I would say we educate their future employees."

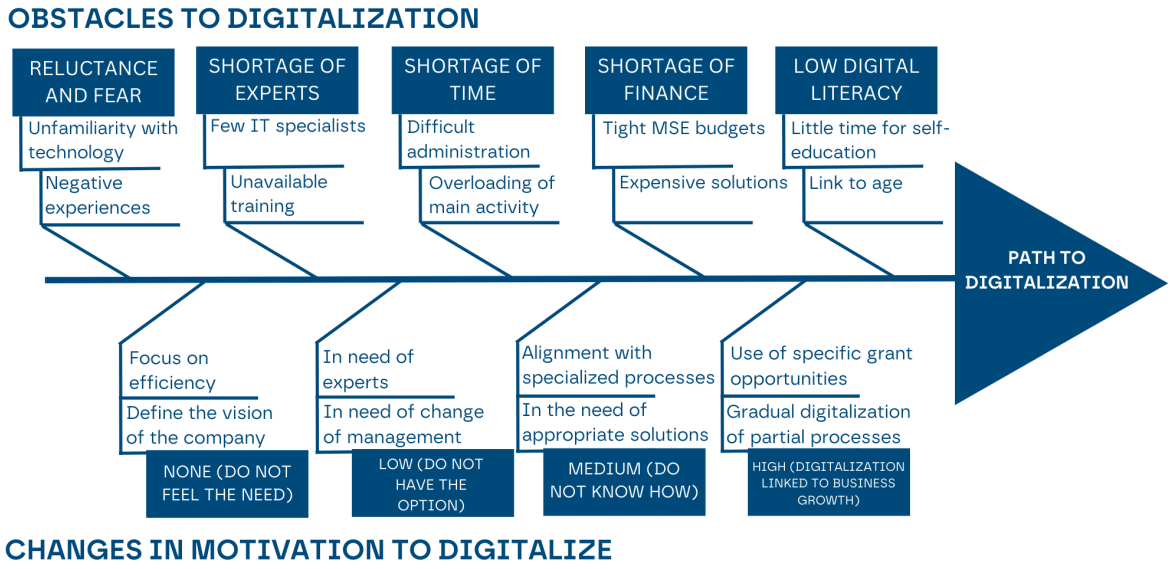


Figure No. 8: The Path to Digitalization of SMEs with Obstacles and Necessary Changes (Source: Own)

3.3 SUPPORTING THE DIGITALIZATION OF MSES AND EXAMPLES OF BEST PRACTICES

The elimination or at least mitigation of obstacles and barriers for MSEs in the digitalization realm naturally also aligns with the needs of individual stakeholders, who recognize the importance of supporting this segment. One of the fundamental needs, particularly highlighted during roundtable discussions, is awareness of how specific regions, organizations and agencies are performing in this area. In each of the observed regions, they build on their history, opportunities and the specific impacts of demographic, socioeconomic factors, industrial sectors, as well as their position and location. Supporting the digitalization and innovation of MSEs is their mission. They are often dependent, however, on the willingness of businesses to engage. Although they strive for their

activation, it is generally a challenging process. Many examples can be demonstrated that function with the support of MSE innovation.

One important aspect of the work is identifying the needs of MSEs, which leads to decisions on which areas and topics need to be covered, what resources (human, financial, time) are required for the upcoming period, and in what form these supportive services should be carried out. A good practice involves conducting regular annual analyses based either on data from previous periods or through direct surveys among companies, not only in digitalization but also in terms of innovation and general support. It is therefore appropriate to monitor the broader context, especially considering that businesses often do not understand or cannot envision all the specific opportunities digitalization can bring them. It is essential to approach them with appropriate insight, asking clear and easily understandable questions and suggesting possibilities.

It is essential to identify the needs of MSEs.

"For me, the results of such an analysis are very interesting. We have always pushed support towards the realm of educating entrepreneurs, but the response was not that strong. [...] So, if it turns out that everyone tells us to establish an innovation center and provide such services, we are ready to offer them."

Implementing a service like Digi Sken and related activities can be beneficial from the perspective of both companies and agencies. The service is based on consultations with a digitalization expert who determines which innovations and measures make sense. Subsequently, activities can progress toward developing a project, applying for a grant, or further collaboration in the form of supervising solution implementation.

"We run such programs, we call it Digi Sken, where an expert who has gone through 10 or 15 companies and understands how things work [...] is capable of saying, based on their experience, what might work. [...] And in this way, the potential for digitalization is mapped."

"In the Digi Sken, deficiencies were revealed, some of which we were aware of, but this brought them to our attention. Now we mainly have a plan for how to proceed when we begin to expand."

The DigiScan-type service has proven effective.

A key advantage for regional support in the digitalization of MSEs is the systematic, coordinated collaboration of actors involved at the regional level. This collaboration should manifest in the coordination of support processes and the targeted distribution of activities and competencies. Innovation centers and agencies, often associated with universities and regions, generally have an understanding of how to approach digitalization, create a suitable environment, develop support programs and provide experts. An undeniable advantage is the presence of a university in the region. It can assist with educational programs for entrepreneurs and employees, generate future employees, and facilitate student and graduate projects and startups whose services can be utilized by MSEs.

Chambers of commerce build business communities, share information and organize networking events. The region typically has a coordinating and supervisory role, and its strategic decisions greatly influence the area of innovation and entrepreneurship. When stakeholders are familiar with each

other, communicate, solve issues, plan, or initiate development strategies, it creates a synergistic effect that can help eliminate some barriers and obstacles.

"We are aware of each other, and when we see an opportunity outside our agency, we recommend it to clients, we refer them."

"The ideal is for everyone to be involved so that the activities are interconnected. This is the challenge for small companies; we cannot do everything best, no one can, so we focus on one specific thing and do it the best we can. Then we collaborate with others who are the best at something else."

"There is collaboration with other significant regional entities. Colleagues recently organized an event with the Chamber of Commerce, and I organized an event with the Confederation of Industry and Transport..."

Systematic and coordinated collaboration among actors (regions, chambers of commerce, innovation centers and agencies, universities...) is key.

Another level is collaboration beyond the region with agencies and institutions from other areas. This can include sharing experiences, discussing directions, arranging cooperation on important events like conferences, or coordinated educational activities. There is an opportunity to merge agendas and connect across regions, leading to savings for individual regions.

"[In terms of digitalization consulting], we touch on it, but according to our job description, we are not supposed to be such a specialized digitalization organization that provides consulting. That role should be fulfilled by the Hradec-Pardubice-Liberec EDIH."

3.3.1 NETWORKING

A key tool for activating companies and increasing their awareness in the area of digitalization is the organization of events where they can share experiences and insights from their own practices. These events also provide an ideal opportunity to collect feedback and further explore areas currently being addressed by companies. Respondents' experiences indicate that personal recommendations, from someone the entrepreneur knows well, have a significant impact on technological innovations.

"[...] One point from the survey showed that the influence of personal recommendations, especially concerning technologies, is indeed crucial. More than half of entrepreneurs rely on friends or family when implementing technologies."

"In my opinion, there should be at least an option to turn to someone who understands the issue, so they can easily and simply ask for advice."

One way to support networking is by organizing conferences and workshops with specific themes. It is important to make use of the potential brought by gathering a large number of MSE representatives and the opportunity to acquaint them with theory, suppliers, experts, and examples of best practices, including successful implementations, methods and experiences with operations. The goal is to reach

as many companies as possible at once, introduce existing possibilities, and enable networking both among businesses and between experts specializing in digitalization.

"We collaborate with the platform Czechinno and organize a conference together once a year on the topic of digitalization."

"Up to ten companies use our consultations annually, but we need to reach out and intervene with about 50 companies. [...] Conferences prove effective for us, with over a hundred businesses registered."

Personal recommendations from someone the entrepreneur knows well have a ignificant influence on technological innovations.

Another approach is organizing conferences and workshops with specific themes.

"At larger conferences, we have around 70 attendees, while workshops attract up to ten people, although we organize several of them."

Motivational elements and successful networking activities can include events like corporate balls or gala evenings that feature award announcements, such as Innovator of the Year. These are demanding events, however, requiring proper preparation and organization. It is important to emphasize a common theme, such as digitalization. Networking can also benefit from informal events like Christmas gatherings, summer barbecues and more.

"We strive to support networking and always thematically focus an event. In the region, we are the only ones organizing a Business Ball, and we host various Christmas gatherings for members within the Chamber of Commerce. [...] These events are ideal for meeting and sharing."

At the events mentioned above, building communities and finding ambassadors can also play a crucial role. By providing space at thematic events, communities of entrepreneurs who frequently meet and share information can be formed. Including new businesses in such a community has a very positive impact. Moreover, ambassadors can emerge from these groups–representatives from MSEs who have undergone or are undergoing successful digital transformation. They can share their experiences more broadly with people of similar or related fields. Searching for suitable ambassadors can begin with consulting services, educational events, etc. They can, however, run into issues with the willingness and availability of these representatives.

"We have been building a community for six years. I think the ambassador route is the right one. For example, we have a carpenter who successfully digitalized his work. He could be the one to tell other carpenters how he does it, how it helps him, how much time it saves, and the added value it brings. If IT specialists and developers speak directly with regular people, they often misunderstand each other. That is why personal recommendations and ambassadorship are key."

Building communities and finding ambassadors can also play a key role.

In the realm of networking, company tours that have undergone digital transformation serve as examples of best practices. The aim is to familiarize businesses of a similar size and focus on how such digitalization can take place, emphasizing the sharing of experiences and insights among the

entrepreneurs themselves. There is a concern, however, about whether there would be an interest in such events, given that MSE leaders often lack the time to attend these activities. Is is therefore important to carefully assess whether this form of networking would be beneficial at this time or in this area.

Company tours that have undergone digital transformation are an example of best practice.

"I think company tours are one of the key elements we are missing. [...] We did it before COVID, but over time, we forgot about it. Business owners get inspired by other owners directly in their operations."

3.3.2 EDUCATIONAL EVENTS AND CONSULTATIONS

MSEs show interest in various areas concerning digitalization, new technologies, and innovations, despite the fact that they struggle with time constraints. Well-targeted courses, educational events, and consultations in these areas can help increase the engagement and motivation of businesses that have not yet shown interest, especially in popular topics (e.g., artificial intelligence, etc.). From topics on process digitalization, marketing, law, cybersecurity, to courses focused on deploying highly specialized technologies and tools (digital twins, production automation), businesses are also interested in the use and risks of artificial intelligence or Industry 4.0. The focus of the business plays a significant role here as well.

Within regions, the Ministry of Labor and Social Affairs, the Ministry of Industry and Trade, agencies, innovation centers, universities, and other institutions, numerous courses and trainings focused on innovation, digitalization, digital literacy, and business competencies are organized. Given the fact that one of the barriers to attending such events is the lack of time for entrepreneurs, suitable formats are being sought. These include the previously mentioned conferences, workshops and thematic events. The organizer usually sets the main topics. MSEs are also calling for courses and consultations that focus on specific areas, problems and finding solutions.

"If someone offered the opportunity to attend a company tour today, I would decline, even though I find it interesting. [...] I simply would not have the time and energy for it."

"The courses we organize are tailored to ensure that everyone takes away what they need. We ask people in advance why they are attending, what they expect, and we try to prepare the instructor or consultant for it. It is just limited by time."

MSEs show interest in various areas concerning digitalization, new technologies, and innovations, even though they struggle with time constraints.

One option is organizing webinars. This reduces the costs associated with the personal attendance of both instructors and entrepreneurs. The constantly busy leaders of MSEs have the opportunity to participate in courses that interest them, join remotely, or access recordings if they cannot attend the live sessions. The goal is to reach and impart knowledge to as many people as possible. In

collaboration with other stakeholders, it is possible to divide topics and focus on the quality of educational content rather than quantity.

One solution option is organizing webinars, which reduce the costs of personal attendance for both instructors and entrepreneurs and can be replayed later.

"Each region has its innovation center or a similar agency, and each of these organizations conducts awareness activities as part of their functions. [...] A webinar is a wonderful platform that can be broadcast from anywhere and anyone can join. For instance, we are now in discussions with other regions, including Zlín, Central Bohemia, South Moravia, and Žilina, and we are doing these webinars together. A year ago, we had ten topics and organized ten physical seminars. The costs for these ten events were huge when considering marketing, speaker fees, travel expenses, and maybe only twenty attendees would show up. So now we have agreed that each region will provide certain webinar topics and we will proceed together. Not only do we save costs, but we also have better, higher-quality output and a large number of viewers."

"In terms of activating companies, we conduct training sessions, seminars and conferences. This works in some way, but it is not so effective. I think webinars are probably one of the most effective things because they cost so little."

Various consultations are sought-after services. There is a particular interest in trend monitoring and advising on finding and submitting grant applications, implementing solutions, or finding suppliers and services. Consultations typically take place with an expert in the issue the MSE wants to address. It turns out that a suitable strategy is to have several topics ready and pre-arranged consultants who can offer advice to companies.

"We have various consultation days on different topics. Initially, it is a one-on-one meeting lasting about an hour, where the company representative and consultant discuss their ideas. If they find common ground, they continue and if not, I try to find someone else. [...] This can lead to analysis, project development, etc. [...] We just supply the consultants."

Sought-after services include consultations with experts in the issues MSEs want to address.

Choosing an inappropriate solution can be prevented by expert recommendations or advice on proven solutions.

While large companies can afford and have access to large and sophisticated solutions, smaller businesses often lack the resources to acquire and operate them. They also typically lack an overview of market options, which often leads to choosing inappropriate solutions. Recommendations from experts near the business's location and advice on proven solutions can help. In both cases, this can take the form of a consulting service or a public database accessible on a website. Companies would thus be able to easily find a solution provider or an expert to assist with digitalization for their specific issue. This involves finding such experts and verified suppliers, creating their profiles, and describing the services they offer. This approach addresses the obstacle where companies are unable to select an appropriate solution, choose unsuitable ones, or face a lack of expertise within their organization.

"You actually need that person who will bring the Digi Sken output to life, who will implement it in practice. At the moment, I do not have such a person; I need to delegate these tasks to get my hands free for the work I want to do..."

"For example, in marketing. We started working with a student marketing agency. We were satisfied with them and mentioned it at four or five meetings, and everyone eventually jumped on it."

3.3.3 INFORMATION CHANNELS FOR MSES

It turns out that the motivation of MSEs is negatively influenced by information channels, specifically the volume and complexity of information related to innovations and digitalization. Some businesses are not interested in opportunities and do not actively seek them out, while those that are interested struggle to find information. The most common source is websites because they are quick to access and can be viewed whenever time permits. MSEs call for more user-friendly websites and portals to provide information on support programs and services. Fragmented information sources should be integrated or linked through directories.

"We are planning new websites that should include a chatbot, a new file service, a resolution registry, which should communicate and share data with the accounting program."

"The region actually operates several portals, including a website for innovations that consolidates all information for the Smart Accelerator. [...] There is also a grant portal that provides information on opportunities to obtain financial support, and a council for science, research and innovation is operational. [...] And then there are the special conferences."

The multitude of information channels and the complexity of information negatively impact MSEs, prompting them to call for more user-friendly websites and portals.

Agencies believe that information is easily findable, but targeted advertising on appropriate channels would help.

Based on the experiences of businesses, agencies, organizations, suppliers, and other stakeholders in the digitalization area believe their services and solutions are easily accessible. Businesses often struggle, however, to even identify who provides such services and where to find this information. Better engagement could be facilitated by well-targeted advertising of programs, services and organizations on suitable channels. Apart from websites, entrepreneurs are also active on social media, particularly Facebook and LinkedIn. Advertising space can also be utilized during organized events.

"I search the Internet, but the sheer number of options and sites often discourages me because I lack the energy and time to explore and read through them all."

One of the desired outcomes is to streamline and unify information channels to support MSE digitalization and increase the visibility of organizations, activities and services. Such solutions must

be approached cautiously, however, to avoid information overload and fragmentation, which can lead to even greater demotivation for businesses to seek out information.

It is important to approach solutions cautiously, however, to avoid information overload and fragmentation, which can lead to demotivation to search.

3.3.4 TIPS ON EXAMPLES OF BEST PRACTICES FROM INTERVIEWS

We have summarized and interpreted the tips on examples of best practices from the interviews. Although most of the interviews highlighted issues within MSEs, we identified several proven practices that form a strong compendium for sharing among regions and MSEs. These tips are presented in Chapter 3.3, Supporting the Digitalization of MSEs and Examples of Best Practices, and summarized in the Introduction and Summary chapter.

4. Experiences from Specific Regions

4.1 HRADEC KRÁLOVÉ REGION

There is potential to increase the level of digitalization and automation in small and medium-sized enterprises in the Hradec Králové Region, particularly in administrative and support processes (marketing, order management, customer communication, records, financial management, inventory management, accounting, etc.). These technologies should simplify administrative work for entrepreneurs, allowing them to focus more on their core business activities. This is done by using simple and user-friendly tools (e.g., iDoklad). Complex robust systems are not suitable for most micro and small enterprises.

The research also identified several barriers in the digitalization process for MSEs, such as resistance to change, lack of finances and time and low digital literacy. These factors often hinder entrepreneurs from implementing digital solutions. Generational differences also play a role, with older entrepreneurs being potentially more skeptical, while younger generations are more willing to integrate digital tools into their businesses.

Personal recommendations and the sharing of experiences among entrepreneurs have been identified as key motivators for digitalization. Successful digitalization examples can significantly increase others' willingness to implement digital solutions. A carpenter who has successfully digitalized his work can serve, for example, as an ambassador and share his experiences with others.

An important point mentioned in the region is ensuring long-term sustainability and trust in digital systems. Entrepreneurs need to be assured that their data will be secure and that the software provider will ensure longevity.

This means that software solutions have to be accessible, functional, secure and sustainable in the long term. Introducing suppliers of such solutions to entrepreneurs would be beneficial, and there is potential for certifying suitable suppliers and systems by government authorities, or providing guarantees for the continuity of solutions.

Regarding support for digitalization, the main need is to have easy access to information and administrative support in designing and implementing projects that promote digitalization. Entrepreneurs should not have to go through complex documentation searches but should be able to focus on their core business activities. In this context, the need for better coordination of regulatory bodies was discussed, so that entrepreneurs do not face unnecessarily frequent inspections from various authorities. Inspections should occur at legislatively set intervals, and information should be shared internally among agencies.

A roundtable discussion revealed issues with the current websites' lack of clarity, the integration of information sources and linking through directories. There is a demand for support not only in the form of financial grants but also through educational programs, workshops and tailored consultations. The current situation indicates an effort by public institutions to support MSE digitalization and adapt to their needs. Challenges include a lack of financial resources and a changing technological and political environment.

Thanks to the organization of roundtables, various stakeholders have concluded that it is beneficial that they met and exchanged experiences, as this will lead to further and better integration and alignment of activities.

4.2 VYSOČINA REGION

Discussions held at roundtables in the Vysočina Region revealed significant potential for increasing the level of digitalization, especially in administrative and support processes such as order management, accounting, customer communication and marketing. Similar to the Hradec Králové Region, entrepreneurs view digitalization as a tool that could streamline operations and allow them to focus on their core business, although they encounter limited implementation. Significant barriers to digitalization include a lack of finances, time and low digital literacy. Generational differences also play an important role here, with older entrepreneurs often being more skeptical, while younger generations are more open to integration. This trend is also evident in their approach to more advanced automation technologies. Entrepreneurs often fear the complexity and costs associated with transitioning to digital solutions.

Entrepreneurs in the region require simple, user-friendly tools, and there is a demand for applications that encompass only essential features while streamlining processes, such as simple accounting programs or CRM systems.

Sharing experiences among entrepreneurs and personal recommendations also play a key role in this region. Examples of successful digitalization can significantly increase the motivation of other entrepreneurs to implement digital solutions.

In terms of supporting digitalization, entrepreneurs would welcome easier access to information and support for implementing digital projects. They often encounter difficulties navigating available resources and grants. There is a need for better coordination in publishing information, for example, by creating centralized information platforms.

As in the Hradec Králové Region, regional innovation agencies, universities, and the Chamber of Commerce are seen as important organizations for the successful digitalization of small businesses in the Vysočina Region. They play a crucial role in education, professional consulting and networking.

4.3 MORAVIAN-SILESIAN REGION

In the region, there is effective coordination and distribution of responsibilities among several actors, including the regional office, which defines and oversees strategic goals; the innovation center, which is intensely involved in education and collaboration with experts and companies; the chamber of commerce, which networks and supports the business community; universities, which focus on educating students and connecting the startup world with the application sphere; and other agencies focused on business innovations and digitalization. The key element is collaboration, communication and mutual referrals based on synergy. This expands opportunities for MSEs and decentralizes support services, enhancing their quality. In practice, this means that individual activities support each other. When an entrepreneur completes the GreenLight startup and acceleration program, for example, they are referred to the services of the Innovation Center (MSIC), where there are follow-up programs. As the business develops and grows, it integrates into the business community and becomes a member of the Chamber of Commerce, sharing experiences in networking events. Agencies communicate among themselves, and the region coordinates and funds these activities.

The notably low interest from small businesses (medium-sized companies generally seek out information) is a frequently discussed issue. Activity is higher in larger cities than in the peripheral parts of the region. There has been a question as to whether greater intervention and awareness from the involved institutions and agencies would improve the situation. The low interest often relates to a lack of awareness of possibilities or decision paralysis due to an abundance of options. In many cases, they struggle with the absence of strategy and vision. Many small businesses also address digitalization themselves, and often choose inappropriate solutions. Such investments frequently result in existential problems for the business. What they earn, they typically reinvest in operations. Similar to other regions, the time entrepreneurs have is consumed by their core activities. Therefore, the goal should be greater and more targeted awareness of consulting and advisory services available in digitalization, innovation and business.

The Moravian-Silesian Region (MSR) contains three public universities—University of Ostrava, Silesian University (in Opava and Karviná), and Technical University of Ostrava. The universities or experts from them are often invited to participate in significant activities. These universities generate student projects, startups, programs and activities that assist regional development. Collaboration between innovation agencies and educational institutions creates additional opportunities for MSEs, such as educational courses, leveraging student projects and employing well-prepared graduates. There is a high demand from MSEs for skilled experts to assist with digital transformation and an increasing need for a system that recommends quality suppliers of digital solutions and verified experts to aid in selection, methodology, implementation and system management.

MSEs show interest in specific courses and training in technologies, digitalization, marketing, innovation and business, although low attendance is a concern. One solution is to include such topics in significant events like conferences, and another is organizing webinars with recordings, which seem viable for time-pressed entrepreneurs. Effective collaboration is functioning in MSR in this area, coordinating major events and promoting cooperation with similar institutions from other regions, thereby increasing quality and reducing costs.

Networking events are highly successful in MSR, allowing entrepreneurs to share recommendations and experiences, whether through already mentioned conferences or other events such as balls or

holiday gatherings organized by the Regional Chamber of Commerce. Examples of successful solutions by colleagues or acquaintances increase motivation for digitalization and innovation.

5. Discussion and Topics for Further Research

According to the Office of the Government of the Czech Republic, interest in digital transformation among Czech companies is growing, with "55% planning to increase investment in digitalization and 98% enhancing their cyber resilience in 2021, although the main obstacle remains the shortage of qualified ICT specialists in the labor market" (OFFICE OF THE GOVERNMENT OF THE CZECH REPUBLIC, 2022). These findings are also significantly reflected in our results. The positive data mentioned above often have a declarative nature. We therefore consulted with our partner Strive Mastercard in Q1/2024 to verify MSEs' plans to invest in digitalization. Out of the 615 MSE entrepreneurs surveyed, 20% intend to allocate less than 6% of their business budget to digitalization in the upcoming year 2025. We view this positively, despite the fact that it is lower than the figures mentioned above. This opens an interesting discussion on why it is crucial, not only in this study, to more closely monitor the situation in regions for small MSEs and compare it with the intentions of the central government.

The central government genuinely supports the digital transformation of its economy and society, especially by leveraging various EU funds and participating in most key European technology alliances and networks. This is expected to support the global goal of the European Digital Decade, which aims for at least a basic level of digitalization in more than 90% of small and medium enterprises. According to the European Commission (2022B), "in the area of research and excellence, artificial intelligence and high-performance computing are the country's priority areas. A shortage of digital technology experts prevents businesses, especially small and medium ones, from developing more dynamically." There is a significant overlap between the lack of digital transformation specialists and the needs of businesses in the regions we are monitoring.

One of the issues is that micro enterprises are often left out of regional, state and EU strategies. While there is a great deal of talk about small and medium enterprises (SMEs), it is actually the micro enterprises (MSEs) that lag behind the most, according to DII (EUROSTAT, 2023). This may be due to the fact that micro enterprises include many self-employed individuals who manifest the lowest willingness and motivation to digitalize.

Transcripts from interviews also reveal concerns about cyberattacks. While cybersecurity is a matter of competitiveness, stability, and geopolitical relations for the EU (EUROPEAN COMMISSION, 2023), for MSEs, it is existential. There are known cases where a small company could not recover after a cyberattack and completely shifted to a purely physical agenda.

In addition to the recommendations for individual regional actors identified in the Conclusions chapter, the authors of this study suggest that the following areas be examined as separate topics:

1. Opportunities for utilizing AI technology, particularly generative and conversational AI, in MSE business operations.
2. The essential role of cybersecurity in MSE businesses.
3. The role of trust between central and regional actors in addressing the complex administration associated with drawing from EU funds.
4. Inspiration from countries with successful digitalization, such as Scandinavia and Benelux.
5. Research and design of successful digitalization strategies (scenarios and their validation).

6. The level of digitalization across various sectors and industries (sectoral segmentation according to NACE[3]).

Further exploration of the topics listed above represents potential subjects for future research but is beyond the scope of this study and discussion.

6. Conclusion

In this chapter, we will generalize the specific findings of the study and attempt to formulate recommendations for individual digitalization actors within MSEs present in the regions. These recommendations are built upon the arguments summarized in both the Introduction and Summary chapters, as well as in Chapters 2 to 5.

The Central Government and the EU

These entities are the most distant from the specific situation in the regions and the business environment of MSEs. They have, however, the most significant indirect influence due to their authority over budgetary, tax and legislative matters. In our view, the size of the EU budgets, which is transformed into individual programs administered by various state entities for the purpose of digitalization, is sufficient for achieving the strategic goals of the EU and national governments. The problem lies in inefficient utilization, where the requirements to obtain grants are more easily met by large companies and SMEs than by MSEs, for whom the programs are often declared. We consider this area difficult to influence from the MSE level and also as a macro and political issue. We therefore did not address it further, except for the initial analysis of data and strategic documents that define the context.

Regional Institutions

The implementation strategy truly occurs here, having a direct and relatively quick impact on the state of digitalization of MSEs in the regions. In our opinion, the most significant influence on decision-making in the region does not come from the regional office itself, but from an ecosystem composed of multiple entities (the region, the chamber of commerce, the innovation center, universities, CzechInvest, and other players and associations). The regional office can either actively support the emergence of such an ecosystem (as seen in the Moravian-Silesian Region) or hinder it through its passivity. It is essential that a principle of cooperation exists within the region, which should not only be declared but also easily recognized. A good manifestation of cooperation is when entities do not compete with each other but instead assist one another, both through overlapping agendas and by organizing joint events (such as educational courses) without excluding anyone a priori, as we have also observed. The true driver or magnet can be a different entity in each region,

[3] NACE is a French acronym that stands for "nomenclature statistique des activités économiques dans la communauté européenne," which translates to the Statistical Classification of Economic Activities in the European Community. It is issued by the European Commission and is used for categorizing economic activities.

although from our experience, the best candidate for this role is often the combination of a university with existing Ph.D. research and an innovation center.

Micro and Small Enterprises

Digitalization, much like entrepreneurship, is not suitable for everyone. What determines the appropriateness of initiating such a transformational project is the industry, the size of the company, and the entrepreneur's realistic ambition for business growth beyond the regional level. Industries such as agriculture or manual trades, whose scalability is limited by the number of newly hired craftsmen, have only limited potential to significantly expand or become more efficient through digitalization. Conversely, for a company to outgrow its regional size, digital transformation will be necessary. The size of the enterprise also influences the potential savings from automating, robotizing, and digitalizing core processes, which can create a competitive advantage. Supporting processes such as marketing, taxes, and accounting are always good candidates for efficiency improvements using available SaaS solutions.

Every entrepreneur should ask themselves where they want their business to be in 5–10 years and whether they have the potential to multiply their turnover by 2–5 times. If the answer is ‘yes’ or if they feel threatened by the global environment due to competitors' economies of scale, they cannot avoid launching digital projects for survival. A good starting point is to involve someone from their immediate vicinity for initial help—typically a younger family member, a student in a technical field nearby, a more progressive colleague from the chamber of commerce, or to contact the regional innovation center for an initial consultation. Once an entrepreneur engages with the digital ecosystem as a user, there is a high probability they will receive the support they need. Motivation and its various evolutionary phases, during which typical digitalization problems are overcome, are therefore crucial. For a quick understanding of what we mean, we recommend viewing Figure 7: Phases of MSE Digitalization Based on Needs and Development Level and Figure 8: The Path to MSE Digitalization with Obstacles and Necessary Changes.

Startups can be considered a special category of MSEs. These businesses have the ambition and potential to grow and scale significantly faster than standard MSEs due to their innovative technology. For most entities in the region, it is appealing to associate their support and communication with these few successful startups, which are often visible at the national and global level. It is essential to remember that the investment risk associated with these projects is enormous. This study primarily focuses on the large number of MSEs that already contribute to GDP and regional employment. We did not aim to address the issue of supporting startups in regions and their different needs from other MSEs, being conscious that for many entities (CzechInvest, universities...), this is a pivotal theme of their entrepreneurial support.

The selection of three regions (out of 14) was not random, as they are, in a way, representative of the entire country, unlike Prague, which typical studies describe most often and which stands apart from other regions. The Moravian-Silesian Region is particularly interesting due to the presence of quality universities, the MSIC innovation center, and especially the cooperative atmosphere of regional institutions stemming from the patriotism of the actors and the natural center, Ostrava.

The Vysočina Region faces the greatest challenges of the selected regions, impacting digitalization projects primarily due to geographic and investment fragmentation arising from the absence of a natural metropolis. Jihlava competes for this status with other potential centers such as Žďár nad Sázavou, Třebíč, Pelhřimov or Humpolec. The Vysočina Region only has a Polytechnical College in

Jihlava without Ph.D. research, although there is a strong effort towards industrial investments and laboratories.

The Hradec Králové Region represents a sort of middle ground among the regions studied, as it has a natural metropolis concentrating resources, the presence of a university with Ph.D. research, an innovation center and a reasonable spirit of cooperation among all the actors.

In Appendix 3, we have provided this data about all 14 regions (GDP, population, presence of a Ph.D.-granting university in the region, percentage of residents with Internet access), which allows for the generalization of selected regions to others with similar profiles. The Karlovy Vary Region, like Vysočina, does not have, for example, a university with Ph.D. research within its territory, which allows us to infer similar systemic issues. Such a generalization is only indicative and cannot be applied solely based on the data in Table 5; it always requires interpretation formed with prudence by an experienced researcher.

We see the contribution of this study in its deep insight into qualitative data with the help of comprehensive data and the interpretation of involved stakeholders present in individual regions. We would like to express our gratitude to them in the conclusion. We extend our sincere thanks to all the participants for their time, which they devoted to us beyond their regular duties without expecting any compensation. They in all likelihood saw a benefit in the work concerning the segment they represented both individually and collectively through regional round tables.

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Annex 2 – Table of Regions

Region	Population (CZSO, c2024K)	GDP/capita (CZSO, c2022L)	University with PhD research (MEYS, 2024)	Internet connectivity in % (CZSO, c2021M)
Hl. m. Praha	1,384,732	1.45M	yes	86.9
Středočeský	1,455,940	557.64K	no	83.9
Jihočeský	654,505	480.51K	yes	83.7
Plzeňský	613,374	553.51K	yes	86.5
Karlovarský	295,077	377.89K	no	85.6
Ústecký	811,169	440.74K	yes	78.0
Liberecký	450,728	457.75K	yes	83.0
***Královéhradecký**	**556,949**	**543.11K**	**yes**	**81.4**
Pardubický	530,560	513.22K	yes	80.6
***Vysočina**	**517,960**	**474.28K**	**no**	**85.8**
Jihomoravský	1,226,749	624.76K	yes	82.3
Zlínský	632,864	524.89K	yes	83.7
Olomoucký	580,744	503.71K	yes	79.0
***Moravskoslezský**	**1,189,204**	**499.81K**	**yes**	**84.2**

*Note: These regions have been examined as part of our qualitative study and can be used for generalization to other similar regions according to the profile data provided in the columns of the table.