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Digital Literacy and Digital Transformation Activities of Service and Manufacturing SMEs

Vladimír Krajčík
Pan-European University, Prague, Czech Republic
Ota Novotný
Prague University of Economics and Business, Prague, Czech Republic
Mehmet Civelek
Pan-European University, Prague, Czech Republic
Světlana Semrádová Zvolánková
Pan-European University, Prague, Czech Republic

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Abstract
Digital literacy of the workforce, firms' digital literacy activities for their employees, and firms' stages in the digitalization process are some of the major concerns of SMEs in their digitalization process. Firms that take effective actions for those issues can reduce their concerns in their digital transformation. However, SMEs' digital transformation and digital literacy activities might differ depending on firm-level characteristics. This paper investigates whether SMEs' dynamic capabilities differ depending on their firm-level characteristics, such as firm size and sector. This paper considers digital transformation, digital literacy of workers, and digital literacy activities of SMEs as dynamic capabilities since those activities are included and identified in Resource-Based View (RBV) as dynamic capabilities. The research team employs a telephone survey to collect data. Moreover, the researchers apply purposive sampling techniques to generate research samples. The researchers perform Chi-square test and ANOVA analyses to investigate the differences in 330 small-large, manufacturing, and service SMEs' dynamic capabilities. According to the results, while the digital transformation stages of SMEs do not differ depending on their sector and size, there are significant differences between the digital literacy activities of small-large and manufacturing-service SMEs. They indicate similarities regarding concerns of small-large SMEs for their workers' digital literacy. However, compared to manufacturing SMEs, service firms indicate greater interest in their workers' digital literacy. Country-specific, firm-specific, sector-specific, and executive-specific factors, including market structure, level of financial assets, close interactions with customers, education level, and responsibilities of firm executives, respectively, might explain those results.

Key Words: SMEs, digital transformation, digital literacy, digitalization of services, digital innovation, manufacturing SMEs, service SMEs, firm size

JEL Classification: D22; L25; L26; M15

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1. Introduction

Small and medium enterprises (SMEs) are a significant economic component, especially in developed and developing economies. SMEs are undoubtedly important employers and performers of

value addition (Ključnikov et al., 2022a) and exporting activities (Ključnikov et al., 2022b). In times of economic stagnation or crisis, SMEs are the leading players that provide opportunities for unemployed people (Civelek & Krajčík, 2022; Civelek et al., 2023). Due to a dynamic and flexible structure, SMEs can also respond quickly to various changes in socioeconomic developments (Zhao, Wu, & Ye, 2021).

Although SMEs have those characteristics, they need to adopt and use digital systems for their operations to remain competitive against their rivals. In this regard, their internal resources and efficient internal operations included in Resource-based View (RBV) are highly important for their long-term survival. RBV highlights the importance of firms' resources and capabilities for their performance and competitiveness (Catanzaro & Teyssier, 2021). According to RBV, valuable, rare, inimitable and organized (VRIO framework) capabilities and resources of firms make them receive sustainable competitive advantage (Chatzoglou, et al., 2018). In this regard, SMEs' dynamic capabilities such as their initiatives in digital transformation process, their concern and activities for employees' digital literacy can enable them to compete with their rivals. However, depending on their size, and sector the dynamic capabilities of SMEs can differ and they can have various outcomes from the digitalization process (Gavurova et al. 2022). For this reason, this paper aims to explore whether the differences exist between small-large and manufacturing-service SMEs' dynamic capabilities including their movements in digital transformation phases and their interests on their workers' digital literacy and their actions regarding digital literacy. In this regard, the research questions might arise as follows: Do digital transformation stages of SMEs differ depending on their size and sector? Do concerns of SMEs regarding their workers' digital literacy differ depending on their size and sector? Do digital literacy activities of SMEs differ depending on their size and sector? RBV has been also cited by many researchers when comparing SMEs' digital readiness, and digital export depending on their size and sector (Ali & Johl, 2022; Elia et al., 2021).

Digital transformation is a process of implementing digital technologies to create and improve new or existing business outcomes (Vial, 2019). Chanias et al. (2019) view digital transformation as sectoral modifications that a firm's digital technologies can have to change the firm's products or structures or production processes. These digital technologies are based on the outcomes of the following phenomenon such as big data analytics, mobile technologies, internet of things, artificial intelligence, block chain, machine learning, social networks and other information technology solutions (Cetindamar-Kozanoglu, & Abedin, 2020). To achieve competitive advantages, many companies must significantly change their operational processes, implement IT solutions, which will allow to transform digital interaction with clients and in some cases even change the existing business model (Safar et al., 2018). Firms fully implementing those innovative tools to the most of their operations might be in higher digital transformation stages.

Digital literacy is an ability to use digital devices such as smartphones, computers and tablets (Neumeyer et al., 2020). Digital literacy also includes technical skills to use mobile applications, information and communcaition to skills to use information and communication technologies, collaboration skills to use social networks (Van Laar et al., 2017). Thus, the usage of those tools by workers of companies also enable them to access and analyze information that is required for business communication and operations. Employees having more technological intensity also make businesses having better performance (Tortorella et al., 2021). Alieva and Powell (2022) analyse manufacturing firms from Norway and Sweden and report the importance of employees in digital transformation of enterprises. Ali and Johl (2022) examine Malaysian manufacturing SMEs and infer that human resource is a crucial factor that positively affects the implementation of IoT devices by businesses and their readiness for new technological tools. In this regard, Chatterjee et al. (2021) observe some Indian SMEs and remark that the knowledge of employees regarding artificial intelligence applications eases the usage of those innovative tools. Since digital literacy of human resource is a vital factor in digital transformation of SMEs, firm executives showing more concerns on their workers' digital literacy can increase their firms' success in the process of digital transformation.

In this regard, managers of companies need to focus on the adoption of new innovative technologies by taking required actions to motivate their workers in this process (Chatterjee et al., 2021). Firms also need to increase digital skills of their workers by training by providing trainings for their employees (Elia et al., 2021). For instance, Jung et al. (2023) investigate some Korean manufacturing firms and state that since the implementation of new technologies by firms improve workers' digital literacy to use those technologies, firms' awareness of those technologies is also crucial for firms' digital literacy activities. Chatterjee et al. (2021) and Xie et al. (2023) analyse some manufacturing firms in India and China, respectively and declare the fact that organizational readiness is crucial for manufacturing SMEs' AI and digital innovation adoption. This is because employees work in firms that are not ready to implement AI-related technologies become restricted in the usage of new technologies and they cannot aware of the usefulness of those technologies (Chatterjee et al., 2021) Thus, firms with a high readiness for digitalization stimulate and motivate their workers and break their resistance to use new technologies by implementing learning interactions and learning mechanisms that include knowledge accumulation and integration (Xie et al., 2023; Olah et al. 2021). Those digital literacy activities including trainings are essential solutions for digital literacy issues that SMEs face in their digital tools adoption process.

However, depending on firm size digital literacy activities, concerns and digital transformation stage of SMEs might differ. For instance, because of their size, large firms have more complicated coordination and communication issues (Raimo et al., 2022). In this regard, they indicate a greater need for the usage of new digital technologies (Arora & Rathi, 2019). Moreover, due to having wider supply chains to manage their operations in those chains, large SMEs make more investments in information technologies (Krajčík, 2022). Another reason why large companies are more adapted to new technologies is their international operations. Since those firms want to fulfil the demands of their foreign customers, they also apply e-commerce solutions more (Choshin & Ghaffari, 2017). Many studies have confirmed the impact of firm size on the degree of digitalization (Arora & Rathi, 2019; Androniceanu et al., 2022) and the usage and adoption of digital technologies, including the usage of digital marketing channels (Taiminen & Karjaluoto, 2015), social media platforms (Raimo et al., 2022), big data analytics (Lutfi et al., 2022) and information technologies (Eggers et al., 2017). Moreover, the effects of firm size on digital literacy concerns and digital literacy activities of firms have been claimed by various researchers (Chatterjee et al., 2021).

On the other hand, firms' usage of ICT (Taiminen & Karjaluoto, 2015), adoption of technologies (Alshamaila et al., 2013) and digital transformation process might differ depending on their sectors. (Rupeika-Apoga & Petrovska, 2022; Barabashev et al. 2022). Firms can also implement different digitalization strategies depending on their industry (Krajčík, 2022). For instance, Bouwman et al. (2019) declare the radical changes that service firms make regarding the creation of products and services and communicate more effectively with customers. Moreover, Gupta et al. (2022) emphasize the key role of employees to use digital technologies in service sector. Safar et al. (2018) also highlight the interest and understanding of the importance of digital transformation by firms in service sector.

This study makes several contributions to the theory and practice. First, this paper defines a framework including three different RBV-related dynamic capabilities of SMEs that they can benefit from when performing in their digital transformation process. Second, although the differences between small-large and manufacturing-service SMEs' digital transformation, digital literacy concern and activities have been investigated by the studies that are presented in the last two paragraphs, these studies separately focus on the dynamic capabilities of SMEs and firm specific characteristics. For this reason, this paper is the only one that brings those three dynamic capabilities of SMEs in a unique research and examine the differences in those capabilities depending on firm level characteristics. Another crucial contribution that this research makes is the investigation of firm executives' perceptions regarding the digital transformation and digital literacy activities of SMEs, and also digital literacy of workers. Furthermore, performing such a study in a European country that faces with a lack

of integration of digital technologies and a lack of human capital issues (European Commission, DESI, 2022) might draw readers' attention regarding the solutions for those issues provided in this research.

The remaining parts of this paper are presented in the following sequence. The development of the research hypotheses will be presented in Literature Review section. The approaches that the researchers follow for methodological purposes are clearly explained in the Methodology section. The findings from empirical analyses will be clarified in the Results section. The researchers discuss the main results and provide prospective reasons for those findings in Discussion section. In the Conclusion section, the researchers do not only make summary for the most important points of this research, but also express the limitations, policy implications and recommendations for further studies.

2. Literature review

Firm size has been a determining factor in digital transformation process of SMEs (Raimo et al., 2022; Rupeika-Apoga & Petrovska, 2022). This is because depending on their asset size, capital, organizational structure and the extent of firms' operations digital transformation process can differ for small and large SMEs. For instance, the scarcity of resources and capital is the main obstacle for smaller SMEs to implement digital solutions and to use digital technologies such as information and communication technologies in their operations. (Krajčík,2022; Vavrecka et al., 2021; Ali & Johl, 2022). However, large firms can use their resources to ease their digital transformation adoption process and can be more active in the usage of technologies (Rahman et al., 2011) including digital networks (Žufan et al., 2020; Ključnikov et al., 2021). For this reason, firm size positively affects the digitalization and adoption of digital technologies (Androniceanu et al., 2021). This fact has been confirmed and declared by many researchers that analyse some SMEs locating in Italy (Raimo et al., 2022), Finland (Taiminen & Karjaluoto, 2015), Latvia (Rupeika-Apoga & Petrovska, 2022), the UK (Michaelidou et al., 2011), US (Rahman et al., 2011) and Malaysia (Ali & Johl, 2022).

Furthermore, Elia et al. (2021) analyse Italian companies and reckon that large enterprises are more effective when developing digital export strategies compared to small firms. Small businesses also suffer more to create quality digital infrastructure and face data security and privacy problems more than large firms (Rupeika-Apoga & Petrovska, 2022). Rupeika-Apoga et al. (2022) also examine Latvian SMEs and outline that while medium-sized enterprises do not need government's support to facilitate digital transformation, micro firms still look for government support to be adopted in digital transformation process. To sum up, large enterprises need more technical resources (Chatterjee et al., 2021; Raimo et al., 2022). Greater knowledge and awareness of large SMEs regarding to digital technologies might be another reason why large SMEs have easier adoption to digital technologies and more successful in digital transformation process than small SMEs (Taiminen & Karjaluoto, 2015; Žufan et al., 2020; Vavrecka et al. 2021).

On the other hand, some researchers find opposing results to the arguments of the studies that are mentioned above. For instance, Hassan et al. (2021) examine German SMEs and confirm the negative impacts of firm size on the usage of cloud computing and social networks. The authors explain this result with the in-house, private activities of large companies regarding clouding systems. This negative relationship has been stated by other researchers (Pezderka and Sinkovics, 2011). Large firms' rigid hierarchical structure can be a barrier for them to implement innovative activities in their operations, while flexible structure of small companies ease their adoption process of new technologies (Ključnikov et al., 2021). Large firms also encounter more obstacles concerning bureaucratic procedures and processes that can limit their creativity and innovative posture to adopt new technologies for their operations (Vavrecka et al., 2021). In the light of those arguments, it is possible to set the following hypothesis:

H1a: There are significant differences between the digital transformation stages of SMEs depending on their size.

Firms in manufacturing and service industries have different characteristics that might affect their digital transformation process (Chen et al., 2021). For instance, Ettlie and Rosenthal (2011) compare service and manufacturer companies in the US and find differences in the implementation of innovative actions by service and manufacturing companies. According to these researchers, manufacturing companies are better in identifying consumers' demands, thus, they can fulfil the needs of their customers by implementing innovative tools better than service companies. Some researchers also declare the low digitalization level of service firms by analysing firms from Taiwan (Chang et al., 2017). Having lack of resources, limited cash flows and funding options can create obstacles for service firms to adopt digital technologies. This fact might be the reason of low digitalization level of service SMEs (Chen et al., 2021; Kelemen et al. 2021). Moreover, Hwang and Kim (2021) analyse Korean manufacturing small and medium enterprises (SMEs) and find that those firms are good at adopting "AI," "Big Data," and "Robotics" in their production process thus, they develop their productivity. The reason for this fact might be related to the fact that manufacturing companies aiming to access international markets are interested in hiring professionals of digital activities including digital marketing and digital analytics.

On the other hand, Chen et al. (2021) analyse Taiwanese service firms and find that service businesses are more interested in digital transformation process to increase their business performance compared to manufacturing firms. By analysing SMEs in Austria, Germany, Liechtenstein, and Switzerland Eggers et al., (2017) declare that service firms are more likely to use social media channels than other industries. Similarly, Hassan et al. (2021) examine German SMEs and confirm the differences between service and manufacturing firms and confirm that social media and public cloud adoption is higher for service SMEs than manufacturing SMEs. Due to having those arguments next hypothesis can be set up as follows:

H1b: There are significant differences between digital transformation stages of manufacturing and service SMEs.

Having workers that have a lack of digital literacy can cause many troubles for firms when adopting the digital technologies in their operations. In this regard, Raimo et al. (2022) and Wong and Kee (2022) analyse Italian and Malaysian SMEs, respectively and prove that since large firms having more financial capital this fact can provide more advantages from them to have more qualified workers who have more capabilities to use new technologies and know how to use them. Peter et al. (2022) also observe Swiss SMEs and substantiate that large businesses are more likely to have employees that have more awareness regarding digital transformation and digital technologies. Moreover, Rupeika-Apoga and Petrovska (2022) examine some Latvian SMEs and substantiate that large SMEs can pay higher wages and present better job opportunities and conditions to employees than smaller companies such as providing better health insurance, and retirement benefits. Thus, while large firms can attract more talented technology-skilled workers, small businesses' lack of human resources and limited capital sources create obstacles for them to employ effective workers (Chen et al., 2021). This fact has been also confirmed by some other researchers that analyse SMEs in India (Arora, & Rathi, 2019) and US (Delerue & Cronje, 2015). According to Abel-Koch et al. (2019), shortage of specialists that have digital skills is the major obstacle for smaller European SMEs. By investigating US firms, Rahman et al. (2011) also find that technological information increases by the size of firms. Due to having lack of financial and qualified human resources, small firms can feel more concerned about their workers' digital literacy compared to larger firms that feel more confident and motivated to implement digital technologies. In line with the empirical results of previous studies another hypothesis might be presented as follows:

H2a: There are significant differences between digital literacy concern of SMEs depending on their size.

When it comes to the sectoral differences in digital literacy concern of SMEs, different characteristics of sectors might affect this concern. For instance, since manufacturing firms focus on production activities, they are more likely to use innovative tools not only for the production of goods

but also for collaborative and analyse purposes including communication between their colleagues and reporting activities (Alieva, & Powell, 2022). Grundström et al. (2012) and Xie et al. (2023) also investigate firms in the manufacturing sector of Sweden and China, respectively and claim that manufacturing firms implement more innovative activities and take more radical innovative actions compared to other sectors. When achieving these actions, companies in manufacturing industries need to create an effective business structure that eases and stimulates the usage of digital technologies. They can create such a structure in case of showing more concern for digital literacy of their workers. Moreover, managers of manufacturing firms can also evaluate how their workers are prepared for the usage innovative digital technologies. (Xie et al., 2023). By analysing Korean manufacturing SMEs, Jung et al. (2023) also affirm the vital role of firms executives' concern and support for their workers' digital literacy when adopting digital transformation solutions. Another crucial role that executives play in digital transformation process is to decrease employees' resistance to new technologies. In this regard, executives can break this resistance by showing more concern for digital literacy of their workers (Raj et al., 2020).

On the other hand, Alshamaila et al. (2013) analyse service firms in England and prove that workers' previous experience and familiarity that increase their digital literacy make companies to easily adopt digital technologies in their business operations. Garrido-Moreno et al. (2020) also investigate some firms operating in service sector of Spain and imply that firms' management teams showing less concerns for their workers' social media usage regarding business operations are less likely to be successful when adopting social media use. Moreover, Chen et al. (2021) examine service firms in Taiwan and infer that these firms have a lack of digital capability that creates an obstacle for digital transformation of those businesses. For this reason, managers in service sector need to develop digital literacy and digital capabilities of their workers by showing more concern for digital literacy. The outcomes of previous studies make this paper setting another hypothesis as follows:

H2b: There are significant differences between digital literacy concerns of manufacturing and service SMEs.

When it comes to digital literacy activities of small and large companies, some researchers declare the fact that the differences between those firms might stem from human, financial human and organizational sources (Raguseo et al. 2020; Ali & Johl, 2022). Since larger enterprises encounter reduced financial barriers they create more trainings for the usage of ICT tools (Žufan et al., 2020) even they do not face the problem of a shortage of digitally literate workers (Rupeika-Apoga, R., & Petrovska, K. (2022). Similarly, since large SMEs have more sufficient financial resources, they provide more supports to increase digital literacy and digital tools usage among their businesses. This fact has been confirmed by the studies that analyse SMEs in Malaysia (Wong & Kee, 2022), Sri Lanka (Samsudeen et al., 2022) and Spain (Palos-Sanchez et al., 2017).

On the other hand, larger firms have hierarchies and bureaucratic procedures that cause them to have a rigid structure when making decisions. Such a rigid structure can create barriers for larger SMEs when they want to provide digital literacy educations to their workers (Ali, & Johl, 2022). Thus, smaller firms having flexible decision making structure can take quick actions to increase digital literacy of their workers. Those opposing views of various studies on the digital literacy activities of small and large SMEs enable this paper creating another hypothesis as follows:

H3a: There are significant differences between digital literacy activities of SMEs depending on their size.

Concerning digital literacy of manufacturing and service SMEs, they can have various initiatives. In this regard, leadership, management and institutional supports are important factors for the development of automation competencies, artificial intelligence adoption and implementation of new systems by manufacturing SMEs (Hecklau et al., 2016) since those firms use artificial intelligence-embedded technologies to develop their production systems (Metallo et al., 2018). Wong and Kee (2022) analyse Malaysian manufacturing SMEs and surmise that SMEs institutional support positively

affects digital readiness of company. The reason for this might be increasing digital literacy of their workers. Moreover, when SMEs can become ready to implement Industry 4.0 implications, they can improve their productivity, production efficiency and quality control capabilities. Moreover, Alieva and Powell (2022) examine some manufacturing companies in Norway and Sweden and clarify the importance of employee education, knowledge sharing, and, training activities of companies. Suitable management practices of those firms can also facilitate learning capability of workers. Zhou and Velamuri (2018) analyze a foreign manufacturing firm operating in China and profess that firms putting emphasis on reward and pay and cross-functional cooperation motivate their workers' innovativeness. Since manufacturing industry is transformed from a labour-intensive working structure to digitalized and automated systems, their workers' digital literacy need to be improved more intensively to achieve their digital transformation targets (Wong & Kee, 2022). Due to having a labour intensive working structure and their usage of digital technologies in production activities, firms in manufacturing industry can take more actions to increase their workers' digital literacy.

On the other hand, manufacturing firms' awareness for the required skills of digital transformation is limited Tortora et al. (2021). In this regard, SMEs can fail to adopt digital technologies in their operations since they are not ready to make required organizational change. Tortora et al. (2021) examine Italian SMEs and reveal that most manufacturing firms are not proactive to know and predict opportunities that technologies can present. Thus, their lack of awareness can cause to not to provide required training and digital literacy activities for their businesses. Alshamaila et al. (2013) analyse some service SMEs in England and explain that top management support can ease technology adaption by companies such as cloud computing adoption. The supports of managers also reduce workers' concern to lose their jobs since the implementation of technologies and automated processes can cause to reduce number of workers. Due to having the arguments of the studies that are mentioned above, another hypothesis might be presented below:

H3b: There are significant differences between digital literacy activities of manufacturing and service SMEs.

3. Methods

This paper aims to investigate whether the digital transformation, digital literacy of workers and digital literacy activities of SMEs differ depending on their sectors and size. In this regard, the research on digital readiness and digital transformation was carried out in the form of a telephone survey by an external organization KANTAR.

The first phase was focused on the preparation of a telephone survey and its pilot verification (a sample of 20 respondents). It took place from January to April 2020. Based on the evaluation of data from the Czech Statistical Office and according to data from the category Numbers and size of enterprises in Industry (CZ – NACE "B-E"), it was decided on an equal representation of micro enterprises (number of employees 1-9), small enterprises (number of employees 10–49) and medium-sized enterprises (number of employees 50–249). There were 110 respondents in each respondent class. The pilot took place on the territory of the Moravian-Silesian Region with the use of methodical support from students of the University of Business and the University of Entrepreneurship and Law. Based on the piloting of the first version of the questionnaire, formal adjustments and partial changes in the wording of the questions were made. The second phase was focused on data collection. It took place in two phases (November 2020 to January 2021 and January to March 2022). The sample was selected based on the proportional representation of small and medium-sized industrial enterprises in the given regions using background data from the Czech Statistical Office. There were 38,088 enterprises in this database including microenterprises. A similar data collection method has been also implemented by some researchers when analysing digital transformation process of SMEs (Raimo et al., 2022). The sample profile is presented below in Table 1.

Table 1. **Structure of respondents**

		n
	Micro	110
	Small& medium	220
	Male	140
	Female	190
	Work exp Up to 10 years	210
	More than 10 years	110
Age	Up to 40 years old	140
	More than 40	190
Education	Less than bachelors'	90
	Bachelors and more	240
	Total	330

Source: own processing

The survey tried to clarify the readiness of the implementation of digitization processes of small and medium-sized enterprises, to find out the factors and influences of the sectoral orientation of the enterprise or the size of the enterprise on the stages of digital transformation on the issue of the importance of digital literacy of employees and on the digital literacy activities of SMEs. Finally, the survey aimed to clarify the possible influence of the implementation of business management activities on employees' digital literacy level.

The following survey question is added into the telephone survey to evaluate the digital transformation stage of SMEs: "What is your company's digital transformation phase in the digital transformation process?". The survey respondents have selected one of the following phases when answering the question that is mentioned above:

"1. Digital transformation is fully implemented (management has already taken a strategic decision)"

"2. Digital transformation is partially implemented (the management is already implementing the first measures in terms of digitizing the company)"

"3. A strategic decision in favour of a digital enterprise has not yet been taken in the organization, the organization's representatives are still familiarizing themselves with the requirements of digital transformation."

"4. The strategic decision in favour of the digital enterprise has not yet been taken, awareness of digital transformation is very low."

Following statements are added into the telephone survey to measure the importance of digital literacy of workers from the perspective of SMEs and digital literacy activities of SMEs, respectively: "The digital literacy of employees is important for your company." "Are steps/activities being taken in your company to increase the level of digital literacy of employees?" The respondents chose one of the following options: "1: Certainly not; 2: Rather not; 3: Rather yes; 4: Definitely yes" when answering the questions for the importance of the digital literacy of workers for firms and for the activities that firms take to increase digital literacy of their workers.

To determine whether the data set has a normal distribution or not, the values from Skewness and Kurtosis measurements are considered by the researchers. The values from Skewness and Kurtosis indicators are presented respectively, as follows: -0.752 and -0.309 for digital literacy of workers, -0.481 and -0.695 for digital transformation stage and -0.394 and -1.069 for digital literacy activities. Thus, since the values from those measurements differ between -1.5 to +1.5, the data has a normal distribution. According to Tabachnick and Fidell (2013), the values of Skewness and Kurtosis that differ between -1.5 to +1.5 is an evidence of normal distribution. Therefore, this paper uses parametric

tests to make comparisons between SMEs in various sectors and in various sizes. Concerning firm sector, SMEs are grouped as manufacturing and service firms. On the other hand, SMEs are categorized under three different categories regarding their size as micro, small and medium. In this regard, while sectoral differences are analysed by the Chi-square test, the differences between firm size are tested by ANOVA analyses. All those analyses are performed via SPSS statistical program.

Null hypotheses are established as the non-existence of the differences between manufacturing-service SMEs and micro-small-medium sized SMEs regarding their digital transformation stages, digital literacy concerns and digital literacy activities of SMEs. The authors select a 5% significance level to support research hypotheses. In this regard, p values that are greater than 5% make the researchers fail to support research hypotheses.

4. Results

4.1. Descriptive Statistics

Table 2 is presented below to indicate the number of enterprises that are in 1st, 2nd, 3rd and 4th digital transformation stages. According to the table, 48.2% of the research sample are in the 2nd stages that means digital transformation is partially implemented in 159 SMEs. Moreover, while 18.8% of the sample is in the first stage of digital transformation, 16.4% of the sample and 16.6% of the sample are in the 3rd and 4th stages of digital transformation, respectively.

Table 2. **The number of the firms depending on the level of digital transformation**

Levels in digital transformation	Number of firms in each level	Percent
1	62	18.8
2	159	48.2
3	54	16.4
4	55	16.6
Total	330	100.0

Source: own processing

In this regard, 62 SMEs has fully implemented the digital transformation process in their activities, while 54 SMEs are still familiarizing themselves with the requirements of digital transformation. The remaining 47 SMEs have not taken any strategic decision regarding digital transformation process yet and the awareness of digital transformation by these 55 firms is very low.

Table 3 shows the number of SMEs depending on their response for the survey question related to firms' digital literacy concerns. According to the table, the numbers of SMEs that definitely and rather do not care about their employees' digital literacy are 18 and 56, respectively. On the other hand, majority of SMEs around 77.57% of the research sample, show their interests on the importance of their workers' digital literacy.

Regarding the question for digital literacy activities of SMEs and the frequency of their responses, Table 4 is shown below. According to the table, 211 SMEs do perform some activities to increase their workers' digital literacy. On the other hand, around 119 SMEs are not or rather not interesting in performing digital literacy activities.

Respondents were further asked what specific steps or activities are being undertaken in your company to increase the level of digital literacy of employees. The most implemented activities are as follows: Training of selected employees (293 respondents), part of internal communication (159 respondents) and collaboration with mentors (65 respondents).

Table 3. **The numbers of the firms depending on their answers for their employees' digital literacy**

		Frequency	Percent
Respondents' answers	1 - definitely not	18	5.46
	2 - rather not	56	16.97
	3 - rather yes	117	35.45
	4 - definitely yes	139	42.12
	Total	330	100.0

Source: own processing

Table 4. **The frequency of the firms depending on their response for digital literacy activities**

		Frequency	Percent
Respondents' answers	1 - definitely not	52	15.75
	2 - rather not	67	20.30
	3 - rather yes	106	32.13
	4 - definitely yes	105	31.82
	Total	330	100.0

Source: own processing

4.2. Hypotheses Testing

Moreover, Table 5 is depicted below to illustrate the differences or the similarities of SMEs' digital transformation levels regarding their size. As can be seen from the table below, p value from ANOVA analysis is greater than 5% significance level. (Df = 2, F = 0.893, p = 0.410 > 0.05). Thus, a statistically significant difference does not exist between digital transformation process of micro, small and medium-sized SMEs. This fact makes this paper to fail to support H1a hypothesis that assumes the existence of differences in the digital transformation stages of SMEs depending on their size.

Table 5. **The results of ANOVA test regarding digital transformation process and firm size**

					Between Groups		
Size	**N**	**Mean**	**Std Dev.**	**95% CI**	**Df**	**F**	**P**
Micro	**110**	2.6455	1.07162	[2.4429 2.8480]	2	0.893	0.410
Small	110	2.7909	0.92959	[2.6152 2.9666]			
Medium	110	2.6364	0.87501	[2.4710 2.8017]			

Source: Own calculations based on ANOVA analyses in SPSS.

Table 6 presented below shows the results of this paper from Chi-square test regarding the level of digital transformation and firm sector. As can be seen from the table, the p values (Exact Sig. in the table) from both Fisher and Pearson Chi-Square Tests are greater than 5% level of significance. Thus, the sector of SMEs does not have a statistically significant effect on the phase of the company's digital transformation. In other words, firms' digital transformation processes are not determined by their sectors and there are not any significant differences between manufacturing and service SMEs regarding their digital transformation process. Therefore, this paper fails to support H1b hypothesis

that supposes the differences between manufacturing and service SMEs regarding their digital transformation processes.

Table 6: **The results of Chi-Square Tests for the level of digital transformation and firm sector**

	Test Statistic Value	Degrees of freedom (df)	Asymptotic Significance(2-ided)	Exact Sig. (2-sided)
Pearson Chi-Square	4,652	3	0,199	0,201
Likelihood Ratio	4,674	3	0,197	0,202
Fisher's Exact Test	4,620			0,202

Source: own processing

When it comes to the differences in the perceptions of micro, small and medium-sized enterprises regarding their concerns for workers' digital literacy, the results from ANOVA analysis are presented below in Table 7. According Table 7, p value is higher than 5% significance level (Df = 2, F = 1.432, p = 0.240 > 0.05). Thus, it can be stated that the importance of employees' digital literacy does not significantly differ with respect to the size of the company (micro, small, medium). For this reason, this study fails to support H2a hypothesis presuming the existence of differences among SMEs regarding their concerns for digital literacy of their workers.

Table 7. **The results of ANOVA test regarding the digital literacy concerns of SMEs and firm size**

					Between Groups		
Size	**N**	**Mean**	**Std Dev.**	**95% CI**	**Df**	**F**	**P**
Micro	110	3.0273	0.91330	[2.8547 3.1999]	2	1.432	0.240
Small	110	3.2182	0.88184	[3.0515 3.3848]			
Medium	110	3.1818	0.86927	[3.0175 3.3461]			

Source: Own calculations based on ANOVA analyses in SPSS.

Table 8 is presented below to indicate the results of this paper regarding sectoral differences in the digital literacy concerns of SMEs. As illustrated in the table, p-values equal to 0.0004 and 0.0004 for Fischer and Pearson Chi-square tests, respectively. Since both p values are less than the 0.05 significance level, the sectoral orientation of the company determines their digital literacy concerns. In other words, firm sector has a statistically significant effect on the interests of SMEs regarding digital literacy of their employees. Thus, the importance of employees' digital literacy for SMEs differs depending on the sectoral focus of the company. In this regard, this paper supports H2b hypothesis.

To indicate which sector shows more importance on the digital literacy of their workers, group statistics are also depicted in Table 8. As indicated in this table, while the mean value for manufacturing SMEs is 2.9636, this volume for service SMEs is 3.3212. Since higher volumes indicates more interests of SMEs for their workers' literacy, service SMEs more intensively concern about their workers' digital literacy than their counterparts in manufacturing sector.

Corresponding to the differences in digital literacy activities of micro, small, and medium-sized enterprises, the results from ANOVA analysis are shown in Table 9. According to this table, p value is lower than 5% level of significance (Df = 2, F = 5.150, p = 0.006 < 0.05). Thus, it can be explained that there is a statistically significant difference between digital literacy activities of micro, small and medium-sized enterprises. This fact makes this research to support H3a hypothesis that supposes the differences in digital literacy activities of SMEs in various size.

Table 8. The results of **Chi-Square Tests for digital literacy concerns and sector of SMEs**

	Test Statistic Value	Degrees of freedom (df)	Asymptotic Significance (2-sided)	Exact Sig. (2-sided)	Group statistics	Sectors	
						Manufacturing	Service
Pearson Chi-Square	18.093	3	0.0004	0.0004	N	165	165
Likelihood Ratio	18.325	3	0.0004	0.0004	Mean	2.9636	3.3212
Fisher's Exact Test	18.174			0.0004	Std. Deviation	0.88270	0.86241
Linear-by-Linear Association	12.324	1	0.0001	0.0001	Std. Error Mean	0.06872	0.06714

Source: own processing

Table 9. **The results of ANOVA test regarding the digital literacy activities of SMEs and firm size**

					Between Groups		
Size	**N**	**Mean**	**Std Dev.**	**95% CI**	**Df**	**F**	**P**
Micro	110	2.5455	1.06346	[2.3445 2.7464]	2	5.150	0.006
Small	110	2.8364	1.07965	[2.6323 3.0404]			
Medium	110	2.9909	0.99074	[2.8037 3.1781]			

Source: Own calculations based on ANOVA analyses in SPSS.

To find out which size of SMEs perform better in digital literacy activities, Tukey Post Hoc analysis is employed by the researchers with ANOVA analyses. This is because when the sample size is equal and equal variances are assumed, Tukey Post Hoc analysis might be performed (Field, 2009). The results of Tukey test are presented in Table 10.

Table 10. **The results from Post-Hoc Tukey Test regarding digital literacy activities**

Country(I)	**Country(J)**	**Mean difference (I-J)**	**Std. Error**	**Significance**
micro	small	-0.29091	0.14095	0.099
	medium	-0.44545*	0.14095	0.005
small	micro	0.29091	0.14095	0.099
	medium	-0.15455	0.14095	0.517
medium	micro	0.44545*	0.14095	0.005
	small	0.15455	0.14095	0.517

Source: Own calculations based on ANOVA analyses in SPSS.
*. The mean difference is significant at the 0.05 level.

According to Table 10, p values for micro and small-sized enterprises are lower than 5% level of significance (p value for micro-small=0.005 and p value for small-micro= 0.005). Moreover, as indicated in the column of Mean difference (I-J), the difference between the mean values of medium and micro enterprises is 0.44545. For this reason, compared to micro enterprises, medium-sized enterprises do more digital literacy activities. This fact is also another argument to support differences between SMEs' digital literacy actions depending on their size.

The results from Chi-square tests for the sectoral differences in the digital literacy activities of SMEs are also depicted below in Table 11. As can be seen from the table below, the specific sectoral focus of SMEs has a statistically significant effect on the implementation of activities to increase digital literacy of employees. This is because p-values for Pearson Chi-Square Test and Fisher's Exact Test are equal to 0.01 and 0.01, respectively and they are lower than the 0.05 significance level. In this regard, H3b hypothesis is supported.

Table 11. **The results of Chi-Square Tests for digital literacy activities and sector of SMEs**

	Test Statistic Value	Degrees of freedom (df)	Asymptotic Significance (2-sided)	Exact Sig. (2-sided)	Group statistics	Sectors	
						Manufacturing	Service
Pearson Chi-Square	11.282	3	0.010	0.010	N	165	165
Likelihood Ratio	11.381	3	0.010	0.010	Mean	2.5939	2.9879
Fisher's Exact Test	11.245			0.010	Std. Deviation	1.07577	1.00601
Linear-by-Linear Association	10.901	1	0.001	0.001	Std. Error Mean	0.08375	0.07832

Source: own processing

Group statistics are also included in Table 11 to illustrate which sector applies more digital literacy activities. As written in this table, while the mean volume of manufacturing SMEs is 2.5979, this value for service SMEs is 3.9879. Since greater values represent more digital literacy activities of SMEs, SMEs in service sector do perform more digital literacy actions than SMEs in manufacturing sector.

5. Discussion

According to the results of this research, digital transformation process of micro, small and medium-sized enterprises does not differ. Thus, this result is not consistent with the studies of Raimo et al. (2022), Taiminen and Karjaluoto (2015), Rupeika-Apoga and Petrovska (2022), Michaelidou et al. (2011), and Rahman et al. (2011) that validate the greater level of digital transformation that large SMEs have compared to small SMEs by analyzing SMEs from Italy, Finland, Latvia, the UK, and US, respectively. Moreover, the result of this paper regarding firm size and digital transformation process is not compatible with the study of Hassan et al. (2021) that finds the greater digital transformation process of small SMEs compared to large SMEs by investigating SMEs in Germany.

On the other hand, this paper finds similar results with the studies of Žufan et al. (2020), Ključnikov, et al. (2021), Krajčík (2022), Vavrecka et al. (2021), since those researchers do not find any differences between small and large SMEs' digital network usage, digital tools usage and digitalization by analysing SMEs from Czechia (Žufan et al., 2020; Krajčík, 2022), Slovakia, Hungary (Ključnikov et al., 2021) and Czechia, Slovakia and Hungary (Vavrecka et al., 2021). The reason why this paper finds similar results with those researchers might be related to market structure of the countries where SMEs operate. According to the European Commission's competitiveness index (2023), EU countries such as Hungary, Slovakia and Czechia have improved their rates in competitiveness index. Moreover, Czechia

has improved this rate and has had greater ratings than EU average. This competitive environment might have made small Czech SMEs in this research to indicate similar improvements in digital transformation process as their large counterparts do and as this fact has been confirmed by the studies of Žufan et al. (2020), Ključnikov et al. (2021), Krajčík, (2022). Vavrecka et al. (2021).

When it comes digital literacy concern of SMEs, this fact does not differ depending on firm size. Hence, this result contradicts with the findings of Arora and Rathi (2019), Delerue and Cronje (2015), Abel-Koch et al. (2019) that validate and cite differences in digital literacy concern of small and large firms by examining firms in India, US and the EU, respectively. On the other hand, this paper finds similar results with Peter et al. (2020) that vindicate the similarities in digital literacy of micro and large enterprises by analyzing Swiss SMEs. The reason why this paper does not find the differences between small and large SMEs' concern for digital literacy of their workers might be related to managers of small SMEs' influence on their workers' attitudes (Wong & Kee, 2022) and those managers' high responsibilities in decision making process (Samsudeen et al., 2021). Thus, their responsibilities and the managerial roles can make them feeling concerned for their workers to motivate them becoming more aware of procedures and process of digitalization as it is in large SMEs.

Another significant result that this paper finds is related to higher digital literacy activities of medium-sized enterprises compared to micro enterprises. In this regard, this result is compatible with the studies of Wong and Kee (2022), Samsudeen et al., (2022) and Palos-Sanchez et al. (2017) that verify more digital literacy activities of large enterprises compared to small enterprises by examining some SMEs from Malaysia, Sri Lanka and Spain, respectively. This result might be explained with the large SMEs' competencies to gain more financial resources for digital literacy activities compared to their smaller counterparts. For instance, since small firms lack of assets to collateralize, they face more obstacles in financing. However, higher financial assets of large enterprises enable them facing reduced financial impediments, thus, they can easily gain required financial resources to use for their digital literacy activities.

Moreover, this paper does not find any significant differences between manufacturing and service SMEs' digital transformation process. Therefore, this paper opposes to the findings of Ettlie and Rosenthal (2011), Chang et al. (2017), Hwang and Kim (2021), Chen et al. (2021), Eggers et al., 2017) and Hassan et al. (2021) that substantiate the differences in digital transformation process of manufacturing and service companies by investigating SMEs from the US (Ettlie & Rosenthal, 2011), Taiwan (Chang et al., 2017; Chen et al., 2021), South Korea (Hwang & Kim, 2021), Germany (Hassan et al., 2021; Eggers et al., 2017), Austria, Liechtenstein and Switzerland (Eggers et al., 2017). However, the result of this paper is consistent with the study of Rahman et al. (2011) that verify the similarities in digital transformation process of SMEs from different industries by observing some firms in US. The reason why this paper finds similarities in digital transformation process of manufacturing and service firms might be related to educational level of executives. This is because executives with higher level of education have more professional and scientific information to integrate digital technologies in their operations and to make effective transformation decisions (Zhang & Yang, 2023). Since most of the executives of manufacturing and service SMEs in the research data (72.7% of the total respondents) have graduated from universities, their educational level might have made their firms to show similar digital transformation developments even they operate in different industries.

Corresponding to sector and digital literacy concern of SMEs, this paper bears out the fact that service SMEs show more concern for digital literacy of their employees compared to manufacturing SMEs. Thus, this paper boosts the findings of Garrido-Morena et al. (2020) and Chen et al. (2021) that declare more intensive digital literacy concern of service firms by observing firms from Spain and Taiwan, respectively. On the other hand, this paper opposes the findings of Jung et al. (2023) that emphasize the more intensive concern of Korean manufacturing SMEs regarding their workers' literacy. Regarding digital literacy activities of service and manufacturing SMEs, this paper also corroborates the differences. However, different from the studies of Alieva and Powell (2022) and

Zhou and Velamuri (2018) that analyze firms from Norway-Sweden and China and declare more propensity of manufacturing SMEs in digital literacy activities, this paper enlighten the more digital literacy activities of service firms compared to manufacturing SMEs. For this reason, this paper finds similar results with the study of Tortora et al. (2021) that shed light on the limited digital literacy activities of Italian manufacturing SMEs. The reason of the higher digital literacy concern and digital literacy activities of service SMEs might be related to service firms' closer and more interactions with their customers (Chen et al., 2021). In this regard, service SMEs' executives might show more concern for their workers' digital literacy to fulfil the demands of their customers. Similarly, close interactions of service firms' workers with their customers can increase their awareness and understanding of the required digital literacy activities for the businesses that they work. In this regard, workers can also push and motivate their companies to take actions for their digital literacy. For these reasons, service SMEs in this research might have shown more intensive concern for digital literacy of their workers and digital literacy activities of their organizations.

6. Conclusion

Digital transformation and digital literacy are some of the main trends in small and medium-sized enterprises' development and digitization processes (SMEs). For these reasons, firms showing more interest in the developments of the digital transformation process and digital literacy activities might improve their dynamic capabilities to stimulate their digitalization. However, depending on their firm-level characteristics, such as firm size and sector, digital transformation stages, digital literacy concerns, and activities of SMEs might differ. In this regard, this paper analyses 330 micro, small and medium enterprises that operate in manufacturing and service industries.

The results show firm size and sectors do not have a statistically significant effect on the stage of the digital transformation of SMEs. The competitiveness in the country where SMEs operate and the education level of the firm executives might be the reasons for similarities among SMEs in different sizes and sectors, respectively. Similarly, the concerns of micro, small, and medium-sized enterprises regarding their workers' digital literacy do not differ too. This result might be related to the position and knowledge of micro-enterprise executives that influence workers' behaviors. On the other hand, large SMEs perform more digital literacy activities than micro enterprises since smaller SMEs lack financial opportunities. Moreover, service firms show more interest in their digital literacy activities and their workers' digital literacy due to closer interactions with their customers than manufacturing SMEs.

From a general perspective, most of the analysed companies have partially implemented digital transformation in their operations. Moreover, most of companies have moderately implemented digital literacy activities. To accelerate the digital transformation process and increase the digital literacy activities of SMEs, education, training, and financial support need to be provided by policymakers. Digital literacy education and training should not only be provided for company executives but also for university students. Since the shortage of ICT specialists is also, SMEs can also hire an issue for SMEs, well-educated and well-trained university students after their graduation. Although European Union provides different kinds of funds, such as Advanced Digital Skills, Cloud, Data, Artificial Intelligence, and Accelerating the Best Use of Technologies, executives, and students must be educated on preparing proposals to receive those funds. In this regard, there can be rapid increases not only in the digital literacy of companies but also in their financial opportunities to implement digital transformation and digital literacy activities.

As already mentioned, this paper makes theoretical and practical contributions by defining a framework for RBV-related dynamic capabilities, by bringing various dynamic capabilities in a sole study, by analysing the differences in dynamic capabilities of small-large, manufacturing-service SMEs located in a nation that face various human resource and digital transformation issues and by analysing these capabilities from the perspective of firm executives. However, this paper limited only a country's

firms from the SME segment. Moreover, this paper has limits regarding the firm level characteristics by examining only firm size and sectors based on service and manufacturing companies. This paper is limited to the basic dynamic capabilities of RBV. For these reasons, further studies can include more dynamic capabilities and more firm-level characteristics in their studies and analyse not only SMEs but also larger enterprises from various countries and from various sectors.

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Brief description of Authors:

doc. RNDr. Vladimír Krajčík, PhD.
ORCID ID: https://orcid.org/0000-0003-2234-3939
Affiliation: European Centre for Business Research, Pan-European University, Prague, Czech Republic
Email: vladimir.krajcik@peuni.cz
Vladimír Krajčík is an associace professor at Pan-European University, Prague. He has an MS in mathematical science from Palackeho University in Olomouc and an MS in information science from Palackeho University in Olomouc. In addition, he has a Ph.D. degree in Informational Management from VŠB – Technical University Ostrava, Faculty of Economics. He was awarded the title of Associate Professor in System Engineering at the University of Hradec Králové, Faculty of Informatics. He has done many academic studies, including management, IT management, service quality, human resources, leadership, and education. Since 2022, he has been working as the Rector of Pan-European University. He has many articles, conference papers, and book chapters published in international journals, proceedings, and books.

doc. Ing. Ota Novotný, PhD.
ORCID ID: https://orcid.org/0000-0001-9218-254X
Affiliation: Prague University of Economics and Business, Prague, Czech Republic
Email: ota.novotny@vse.cz
Ota Novotny works as the Vice-Rector at the University of Economics and Business, Prague, the Czech Republic. He received his Ph.D. in the measurement of information systems from the University of Economics, Prague. His main research field concentrates on data analytics, IS/ICT sector performance, and IS/ICT services measurement. He has also been working as an independent

consultant in a number of projects connected with his research field since 2000. He is a co-author of ten books and author and co-author of several textbooks, conference papers, and journal articles.

Mgr. Mehmet Civelek, PhD.
ORCID ID: https://orcid.org/0000-0002-1247-5308
Affiliation: European Centre for Business Research, Pan-European University, Prague, Czech Republic
Email: m_civelek@windowslive.com
Mehmet Civelek works as a senior researcher at European Centre for Business Research of Pan-European University. He received his Ph.D. in the Credit Risk Management of SMEs from Tomas Bata University, Zlin, Czechia. His main research fields are the Financing and Marketing activities of SMEs. He has worked on many research projects in Czechia, Slovakia, and the Netherlands. He is an author and co-author of many articles that have been published in quality journals that are indexed in WoS and Scopus.

JUDr. Ing. Světlana Semrádová Zvolánková
ORCID ID: https://orcid.org/0009-0002-8858-0208
Affiliation: European Centre for Business Research, Pan-European University, Prague, Czech Republic
Email: zvolankova@zvolankova.cz
Světlana Semrádová Zvolánková is an advocate, managing director, and sole shareholder of AK Zvolánková, a member of the Controlling Council of the Czech Bar Association, Examination Commissioner for Civil, Family, and Labour Law, member of the Disputes Committee of the Minister for the Environment. Co-author of the publication Real Estate Law in Practice CH Beck. Graduate of the Faculty of Law of Charles University in Prague, a graduate of the Faculty of Business Administration and Economics of the Czech University of Life Sciences.