IEEE Access
Multidisciplinary ⋮ Rapid Review ⋮ Open Access Journal

Received 17 April 2024, accepted 6 May 2024, date of publication 8 May 2024, date of current version 15 May 2024.

Digital Object Identifier 10.1109/ACCESS.2024.3398209

RESEARCH ARTICLE

The Strategic Path to Success: Key Aspects of Business Digital Transformation in the Post-Pandemic Era

PETER MADZÍK[1,2] **AND JAKUB SIEBER**[1]

[1]Department of Business Economics and Management, Technical University of Liberec, 460 01 Liberec, Czech Republic
[2]Department of Management, Comenius University Bratislava, 820 05 Bratislava, Slovakia

Corresponding author: Jakub Sieber (jakub.sieber@tul.cz)

This work was supported by the Student grant Competition of the Technical University of Liberec under the Project Entitled: Subjective Risks, Barriers and Predictors Associated with Digitalization of Processes.

ABSTRACT The digitization of businesses is a complex process involving a range of technological, human, and economic aspects. In a post-pandemic world, the expectations of digitalization and its prerequisites are becoming a key driver towards increasing the competitiveness of enterprises. This study aims to empirically investigate the structures of digitalization and reveal the existence of latent factors in it. This paper examines 25 aspects of digitalization identified by previous studies. The research is based on processing 443 questionnaires focused on the digitalization of enterprises and collected in the Czech Republic. Exploratory factor analysis identified five factors of digitalization (three are among the predictors, and two are among the outcomes). Personal digital skills, information, and digital capabilities are the three factors that predict successful digital transformation projects. Organizational performance and Operational efficiency are two outputs of digitalization. Our study explores the relationships between these factors and opens the way for a broader scholarly discussion regarding the conditions for enhancing the success of enterprise digital transformation projects.

INDEX TERMS Digitalization, digital transformation, business, factors.

I. INTRODUCTION

In the contemporary age of ubiquitous digitization and cutting-edge technology, the digital transformation of business processes emerges as a pivotal and innovative imperative for organizations of all kinds. The term ''digitalization'' encapsulates the dynamic process of integrating digital technology into the fabric of both enterprises and society [1]. It has evolved into an indispensable facet of modern business, compelling organizations to embrace and align with the ever-evolving digital landscape. This paradigm shift is a natural outcome of escalating demands for heightened organizational efficiency and competitiveness [2].

The dynamics intertwined with the digital revolution within literature represent a transformative force. The rapid pace of change, particularly in the realm of product development cycles, marks digitization as a profound milestone in the evolution of our civilization [3]. This shift extends well beyond the familiar mechanisms of technical progress that have shaped our understanding until now [4]. The digital revolution not only revolutionizes the way literature is created, disseminated, and consumed but also serves as a pivotal juncture in the broader narrative of societal progress. This monumental change challenges traditional paradigms, ushering in a new era where the boundaries of innovation and human expression are continually redefined [5].

Digitalization serves as a catalyst, reshaping conventional and tangible processes into sophisticated, analog systems. These transformative changes exert a profound influence on how organizations function and engage with the public, their collaborators, and internally with their workforce [6]. The degree of digitalization presently varies significantly among companies, influenced by diverse factors such as industry, organizational size, and geographical location. Consequently, while some enterprises are firmly rooted in the digital realm, others find themselves at the initial stages of the digitalization journey [7].

The associate editor coordinating the review of this manuscript and approving it for publication was Lukasz Wisniewski.

In its essence, digitalization has transcended the realm of mere technological adaptation, evolving into a strategic imperative for organizations aiming to flourish in an era defined by continual technological advancements and the pressing need for sustained innovation.

A primary driver behind the digitalization of processes is the pursuit of heightened organizational efficiency and productivity. Through digitalization, processes can be automated, leading to cost reductions and an accelerated decision-making pace. The landscape of digitization is intricate, involving a multitude of systems on an enterprise-wide scale. Simultaneously, the adoption of technology stands as a pivotal component of this transformative process [8]. However, the effective implementation of digitization necessitates the development of digital capabilities that align seamlessly with organizational policies and structures. Unfortunately, many companies face constraints such as limited resources, a shortage of skilled personnel, and a plethora of competing priorities, often resulting in the neglect of the digitization process within the enterprise. The complexity of this undertaking is further compounded by its interconnectedness across the entire organizational framework [9].

Contemporary studies underscore various barriers hindering the digital transformation process in organizations. A recent crisis aspect of digitalization is exemplified by the impact of the COVID-19 pandemic, which has not only accelerated but fundamentally altered the digitalization process for some companies [10]. In light of these events, a growing consensus in the literature emphasizes the need to view digital transformation as an ongoing process spanning the dimensions of digital maturity, recognizing that increasing digital maturity is a continuous journey with no fixed endpoint [11].

Numerous studies characterize digital transformation as a fusion of advanced information technology and the integration of digitized systems [12]. While digitalization itself is not a novel process, its form and the evolving needs businesses must address are in constant flux. Consumers now have access to a multitude of media channels, facilitating active interaction with companies and fellow consumers. They navigate effortlessly through various touchpoints, presenting businesses with diverse opportunities to engage potential customers. At the organizational level, the rise of small, innovative, and rapidly growing digital entities has surpassed many traditional companies [13]. A comprehensive understanding of the factors influencing digitalization is a cornerstone for organizations seeking to successfully implement this innovation [14]. It is imperative for an organization to comprehend the aspects shaping its digital environment, allowing it to effectively digitize processes and sustain competitiveness in this dynamic and volatile market.

II. BACKROUND

Digitalization assumes a pivotal role in bolstering business performance, yet the true challenge lies in how organizations perceive and leverage new technologies. Misunderstandings and improper utilization of digital technologies, platforms, and applications distinctly limit the digital activities within an enterprise [15]. However, digitalization stands as the foundational catalyst that ignited the fourth industrial revolution and gave rise to the Internet of Things, fundamentally reshaping our understanding of business processes and all enterprise activities [16]. The establishment of digitalized processes necessitates a nuanced consideration of the diverse needs and circumstances across organizations. The implementation of compatible technologies, enabling organizations to achieve superior performance, is a highly intricate and time-consuming endeavor [17].

The Fourth Industrial Revolution, which set the stage for the digital revolution, captured global attention in 2011. The repercussions of Industry 4.0 and the sustainable contributions this revolution can make to economic, environmental, and social development are increasingly significant [18]. The principles of this revolution are reshaping the competitive landscape, as companies reformulate their business models by embracing the concept of the Internet of Things [19]. From a market perspective, it translates into a more dynamic and responsive provision of services and products. Operationally, it revolves around minimizing lead times, materials, and costs inherent in the process.

The dynamic evolution of information and communication technologies exerts a profound impact on all facets of social and economic life. Presently, businesses are transitioning to organizational models where all activities are intricately linked by an information system, thereby enhancing overall business efficiency [20]. The digital transformation process opens avenues for the integration of new analytical tools that organizations can leverage in their daily operations [21]. In essence, the digital landscape not only transforms the operational fabric of enterprises but also serves as a catalyst for profound shifts in how businesses approach innovation and competitiveness in the contemporary landscape. Today's tools organizations have to dispense are Big Data, Cloud Computing, Cybersecurity, Collaborative Robotics, augmented reality, Artificial Intelligence, and System Integration [22]. Despite the pervasive popularity and widespread integration of digitalization concepts, many organizations grapple with challenges in their implementation and ongoing development, hindering their ability to cater to the evolving needs of the enterprise. Brodny and Tutak underscore in their research that the practical utilization of digitalization opportunities falls below the average in European Union countries. This suggests that digitalization, as a concept, is still in the developmental stages across the European Union [20]. Additionally, the absence of a singular definition for the factors influencing digitalization further complicates matters. Various authors offer diverse perspectives on digitalization, with interpretations contingent upon the specific context in which an organization operates.

A. PREDICTORS OF DIGITALIZATION

Following the literature, it can be stated that the digitalization process is complicated, and many aspects enter it, which can

positively or negatively influence it. These aspects include the following.

The first aspect that is intertwined with the organization's digitalization is the importance of information. Information is the fundamental means of connecting processes in an organization [23]. Working with and modifying information in the context of digitalization is a crucial aspect of the whole process. The first step is understanding the information and then housing it [24]. Information sharing is, therefore, a logical aspect of digitization. As such, digitization eliminates information asymmetry and improves information sharing [25]. Thus, it is evident that the process of information sharing is a clear driving aspect of digitalization. This fact and its realities then logically lead to the conclusion that another aspect of digitalization is the downstream process of better communication. Better communication then becomes a clear and absolute aspect influencing the digitalization processes of an organization. Through the innovation of this process, we can observe the need for digitalization organizations to set up a continuous improvement of communication [26]. Better communication then serves as a bridge to another aspect that is undeniably an aspect that drives the digitization process: teaching others. The process of teaching others is a precise predictor that drives digital transformation. As companies need more and more skilled professionals who can pass on the experience to other employees and thus enable this transformation, only when we have these professionals can we start the transformation itself [27]. A parallel aspect reflecting the turbulent times of changing trends is the need for quick learning. Taking this factor into consideration, which will improve the efficiency of learning and thus speed up the process, clearly enters the digitization of the enterprise [28].

Another input factor of digitalization can be identified concerning sharing information and teaching others, which is information storage. As society increasingly relies on the storage of information in digital form that is accessible, has sufficient integrity, and is confidential, a system needs to be created and maintained to hold and store information. The need for such a system fuels the need for digitization as such [29]. A prominent aspect that is linked to the need to share and store information is the DT-based processes that are a prerequisite for digital systems dealing with this issue [30]. These systems and databases through which the digitization of the enterprise takes place have clearly defined forms, including software and hardware products that an organization can use. Owning these products is a precisely defined aspect that is a precursor to enterprise digitization. The SW/HW serves as a building block for the digitalization of the organization. Concerning software and hardware, a predictor of the digitization process is modern digital technologies, which support the digitization process due to their capabilities as innovative tools that serve this purpose [31]. A sub-aspect associated with software and hardware is the aspect of access. Access to these technologies then clearly and demonstrably drives the organization's digital transformation process [32]. Implementing new technologies and access to them naturally creates another aspect: Technological problem skills. This aspect is intertwined with learning and knowledge but also with the adaptation of the technology itself; only after a proper understanding of communication technologies and the adoption of their functionalities can we organically move towards the digitalization process [33].

The aspect that links all the aspects described so far is technical enablers. By implementing these tools, we approach the vision towards Industry 5.0 and create a clear ground for enterprise digitalization [34].

Other aspects influencing digital transformation are related to the organization's management. These aspects can be identified as building blocks from the management side that support enterprise digitization from above. The first clear aspect that enters as an initiator of digitalization is seeing the potential [35]. If the potential that digitalization brings is clearly defined, it will become a driving aspect of digitalization itself. An aspect that derives from the potential that digitalization brings is the new opportunities that digitalization can bring; these opportunities then become another driving aspect that supports the digitalization process [36]. The aspect that drives management to move the business towards digitalization is the standardization of processes, activities, or any aspects within the organization. When the need for standardization arises, it goes hand in hand with automation and digitization [37]. These aspects are clear drivers that support and even directly force the digitization process.

B. RESULTS OF DIGITALIZATION

In addition to the specified inputs that initiate digitalization, digitalization has many benefits. The literature describes the following benefits. Among the first benefits that affect digitalization is business improvement. This benefit combines all the output aspects described in the previous chapter [37]. Here, the authors talk about the improvement of the business as such or the improvement of the organization area, which includes, for example, process improvement [38], [39]. The innovation of process management and process control leads to another aspect that digitalization brings in terms of benefits: Process transparency. Process transparency is one of the first steps to improve the running of the whole organization, as it leads to more transparent processes and, therefore, to the possibility of better regulation and control. Thus, we can conclude that by doing so, awareness is increased. Better awareness is an outcome that helps an organization leverage the aspect of digitalization to minimize risks and challenges and move toward sustainable development. Through awareness, we can collect better data, create better customer insight, and thus use corporate resources efficiently [40].

The result of digitalization is an unambiguous approach that digitalization brings. This is the automation of business processes and systems implemented through digitalization [41]. According to the authors, the automation process has long-term effects on the organization that will help it meet the exact requirements of potential customers precisely and according to all their needs [42].

The literature further describes digitalization as a fundamental building block for the innovation process. As such, digitalization is revolutionizing Innovations. Using digital tools and resources implemented in organizations, we can provide new opportunities for innovative management and innovation [43]. Concerning innovation and the creation of competitive advantage, the literature describes several outcomes that the process of digital transformation of an organization entails. Among the first are studies describing decision-making efficiency. Better decision-making speed is a catalyst for creating well-seeded and strategically relevant decisions that can effectively respond to today's turbulent markets [44]. All these steps then lead to increasing competitiveness. It is clear that if an organization meets all the benefits of digitalization, customers will not need to look for competitors. This implies that the digital transformation process increases competitiveness [45].

By setting up the correct process management, creating the right environment for invocation, and anchoring its position in the market, the organization benefits from what is known in the literature as organizational growth. The literature describes digitalization as a critical factor that enters the organizational growth process, specifying here that digitalization positively influences strategic flexibility and predicts organizational growth tendencies [2]. An aspect linked to organizational growth is the increase in financial performance. In their study, Kohtamäki et al. examined 131 organizations and concluded a link between digitalization and increased financial performance in manufacturing organizations [46]. The last aspect mentioned in the studies is reputation. It is a two-sided aspect where there is an increase in the transparency of organizing to the public due to modern technology. This can create a potential risk of loss of reputation. However, research shows that the increase in digitalization and the implementation of digital technologies positively affect reputation [47].

As can be seen from the above overview, a relatively large number of aspects influence the successful digitalization of businesses. In this research, we will focus on measuring their intensity and examining their correlation structure to identify the latent factors of digitalization and the relationships between them.

III. DATA AND METHODOLOGY

The research problem was empirically validated through data from a questionnaire survey. The data collection was conducted from September to November, with the sample comprising organizations of different sectoral focuses, different sizes, and different legal forms. The sample that was approached was constructed by randomly selecting a predetermined number of contacts from a public database of contacts. A total of 501 organizations were randomly selected and subsequently contacted by mail. After removing incomplete and irrelevant responses, 443 valid responses were collected. Questionnaire questions are shown in the table 1. All questions were on the scale of I totally agree, I rather

TABLE 1. Variables overview.

Aspect	Code	Attribute	Question
Input/predictor	Stora	Information storage	The organization has its own information storage accessible to the necessary employees.
Input/predictor	Stand	Standardisation	There are standardized procedures for recording and sharing information in the organization.
Input/predictor	ModDT	Modern digital technologies	In the organization, we try to use the most modern digital technologies.
Input/predictor	QuiLe	Quick learning	The adoption of new digital technologies is not problematic for me.
Input/predictor	BeCom	Better communication	The organization uses digital technologies to improve communication between departments, teams and individual workers.
Input/predictor	SwHw	SW/HW	The organization has sufficient software and hardware for improving digitization.
Input/predictor	DTPro	DT-based processes	The organization uses digital technologies in its processes.
Input/predictor	TeaOt	Teaching others	My experience in the field of digital technologies enables me to train others.
Input/predictor	InfIm	Information importance	Working with information is one of the key factors for the organization.
Input/predictor	SeePo	Seeing the potential	I see potential in the use of digital technologies in the organization.
Input/predictor	TecEn	Technical enablers	I have the technical prerequisites for using digital technologies.
Input/predictor	TecPS	Technical problems skills	I know how to solve technical problems associated with the use of information and communication technologies.
Input/predictor	Acces	Access	The organization provides employees with access to the necessary information.
Input/predictor	InfSh	Information sharing	The organization has set processes for sharing information.
Input/predictor	NOppo	New opportunities	The organization is looking for new possibilities of using digital technologies.
Output	BusIm	Business process improvement	Thanks to digitalization, the

TABLE 1. *(Continued.)* **Variables overview.**

			business process has been improved.
Output	BeAwa	Better awareness	Thanks to digitization, the company is better informed.
Output	Reput	Reputation	Digitization has contributed to the company's reputation.
Output	ProTr	Process transparency	Thanks to digitization, the processes became more transparent.
Output	Innov	Innovations	Thanks to digitization, we have caused an increase in innovation.
Output	Autom	Automation	Digitization has contributed to the automation of work.
Output	OrgGr	Organizational growth	Digitization has caused the growth of our organization.
Output	Compe	Competitiveness	Thanks to digitization, we have gained a better competitive position.
Output	FinPe	Financial performance	Thanks to digitization, the organization's financial performance has increased.
Output	DMSpe	Decision making speed	Digitization has contributed to the speed of decision-making.

agree, Neither agree nor disagree, I rather disagree, I totally disagree.

A total of 25 variables were tracked in the survey, of which 15 represented an input or predictor influencing the digitalization of businesses. The other ten variables captured various manifestations or impacts of digitalization for the organization. All 25 variables were measured by a confirmatory type of question - where a statement was stated, and respondents were asked to indicate the extent to which they agreed with the statement on a scale from 1 = ''do not agree at all'' to 5 = ''strongly agree.'' Table 1 provides an overview of these variables.

In addition to these variables, other identifying characteristics of the organization, such as gender, age, respondents' education, and the organization's operations or size, were also observed. The identifying characteristics had the role of control variables through which the reliability of the results was verified.

The data were processed using IBM SPSS Statistics statistical software, which used descriptive and multivariate statistical procedures (specifically exploratory factor analysis - EFA). The dataset was divided into two groups of variables - input/predictors and output variables. EFA was separately applied to each group to identify hidden factors that would explain the correlation structure between the variables. Kaiser, Meyer, Olkin (KMO) Measure and Bartlett's Test of Sphericity were used to assess the suitability of the data structure for EFA. At the same time, the commonalities of each variable were assessed to ensure their relevance for the next steps of EFA. The choice of the number of factors was based on the Kaiser-Guttman rule [48], which states that the number of factors equals the number of factors with eigenvalues greater than 1.0. If the exact number of factors' interpretability was insufficient, a reduction or addition of one factor was resorted to. Principal component analysis was used as an extraction method, with the number of iterations for convergence limited to 100. The Varimax rotation method was used to achieve independence among the identified factors. For further analysis of the results, factor Z-scores for each case were calculated based on linear regression.

IV. FINDINGS

Based on the processing of 443 valid responses from the respondents, the correlation structure of the observed variables was successively examined. This examination was carried out sequentially in two groups - in the first group, the relationships between all variables of the ''input/predictor'' type were examined. All variables of the ''output'' type were examined in the second group. The main reason why we analyzed the relationships separately in the two groups was that several past studies on the effects of digitization have distinguished predictors from outcomes [49], [50], [51].

A. RESULTS OF DIGITALIZATION

We had 15 variables in the questionnaire that represented data of type ''input/predictors.'' In the first step, we examined the correlation structure between these variables using bivariate linear correlation analysis. We used Pearson's linear correlation coefficient (r) to measure its strength, and we considered statistically significant relationships to be those for which the calculated p-value was less than 0.05. Figure 1 is a correlation heatmap showing the intensity of (r) between each pair of variables.

The correlation structure between the input variables is quite complex. Almost all the relationships examined were statistically significant, although their strength varies. The most correlated variables had a technical character. For example, the variables TecEn (Technical enablers) and TecPS (Technical problems skills) were strongly correlated with educational predictors such as TeaOt (Teaching others) and QuiLe (Quick learning). Since all four variables are still strongly correlated with each other, this may imply a strong connection between the education system in the organization and the development of skills that are crucial in the current digital age. Other strong connections were identified, for example, between ModDT (Modern digital technologies), BeCom (Better communication), and NOppo (New opportunities). This, in turn, indicates the significant role that digital technologies play in identifying business opportunities. In addition to the mentioned relationships, there are also several statistically significant relationships between the examined variables. Thus, such a complex correlation structure creates a suitable premise for examining the existence of latent factors. EFA was used for such an examination.

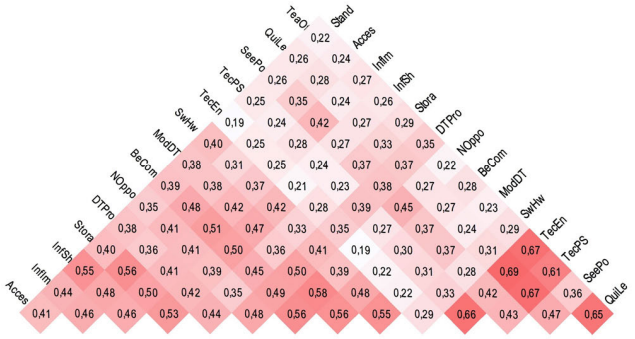


FIGURE 1. Correlation structure between predictors.

TABLE 2. Total variance explained – EFA of predictors.

Factor	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Var.	Cum. %	Total	% of Var.	Cum. %	Total	% of Var.	Cum. %
1	6.318	42.120	42.120	6.318	42.120	42.120	3.291	21.939	21.939
2	2.063	13.752	55.872	2.063	13.752	55.872	3.047	20.316	42.255
3	0.996	6.637	62.509	0.996	6.637	62.509	3.038	20.254	62.509
4	0.843	5.620	68.128						
5	0.618	4.118	72.246						
6	0.576	3.839	76.085						
7	0.558	3.721	79.806						
8	0.509	3.391	83.197						
9	0.456	3.040	86.237						
10	0.406	2.710	88.947						
11	0.391	2.605	91.552						
12	0.354	2.357	93.909						
13	0.336	2.240	96.149						
14	0.298	1.990	98.138						
15	0.279	1.862	100.000						

Although some of the correlation coefficients are lower, the relationships are statistically significant and the application of EFA is therefore appropriate. In the first step, metrics assessing the suitability of the data structure for EFA were calculated. The KMO value reached 0.918, and Bartlett's Test of Sphericity reached Approx. Chi-Square at the level of 3114.71 at $p<0.001$. As the threshold for KMO is 0.700 (values should be higher) and for Approx. Chi-Square p-value is 0.05 (values should be higher), the data structure is suitable for applying EFA.

Thus, both tests confirmed that the correlation structure is sufficiently complex to identify latent factors. Communalities analysis confirmed the significance of all variables. In the first step, two factors were identified according to the Kaiser-Guttman rule. However, when naming them, interpretive inconsistencies were identified, so the possibility of three factors was explored. The literature recommends such a procedure, precisely in cases where the interpretability rate is lower and the eigenvalue for the other factor is close to 1 [52]. This was precisely the situation in our case (the eigenvalue for the third factor was 0.996), so we added one factor. The resulting interpretation was much better, so we considered this solution optimal. Table 2 shows the Total Variance Explained. The table shows that the three extracted factors together explain more than 60% of the variability in the data, which is the usual value according to the literature [53].

TABLE 3. Rotated factor matrix of predictors.

Variable / Factor	Factor 1	Factor 2	Factor 3
TecEn	**0.867**		
QuiLe	**0.844**		
TecPS	**0.812**		
TeaOt	**0.810**		
SeePo	**0.470**		0.392
Stora		**0.784**	
Acces		**0.736**	
InfSh		**0.706**	0.332
Stand		**0.642**	
InfIm		**0.621**	0.356
ModDT			**0.816**
NOppo			**0.758**
BeCom		0.433	**0.655**
SwHw			**0.649**
DTPro	0.309	0.326	**0.566**

The resulting composition of the three extracted factors was calculated by PCA, using Varimax with Kaiser Normalization as the rotation method. The original solution using rotations converged to the final solution in five iterations. The use of rotated solution ensured that the factors are mutually independent, and there is no correlation between them. Table 3 shows the rotated factor matrix containing the factor loadings of each variable (factor loadings values less than 0.300 have yet to be shown for better readability).

The result shows that five variables significantly influence the three extracted factors. Based on the semantic analysis of the standard features of these variables, the factors were named as follows:

1) FACTOR 1: PERSONAL DIGITAL SKILLS

This factor mainly comprises the variables TecEn, QuiLe, TecPS, TeaOt, and SeePo. All of these variables are related to employees' digital skills, hence the choice of the factor name.

2) FACTOR 2: INFORMATION CAPABILITIES

The highest factor loadings for this factor were observed for the variables Stora, Access, InfSh, Stand, and InfIm. These variables have information and the organization's ability to work with it at their core. This was the basis for naming this factor.

3) FACTOR 3: DIGITAL CAPABILITIES

ModDT, NOppo, BeCom, SwHw, and DTPro are the variables that most influence the composition of this factor. Unlike the previous case, these variables are more associated with the organization's capabilities to use digital technologies, which was reflected in the naming of this factor.

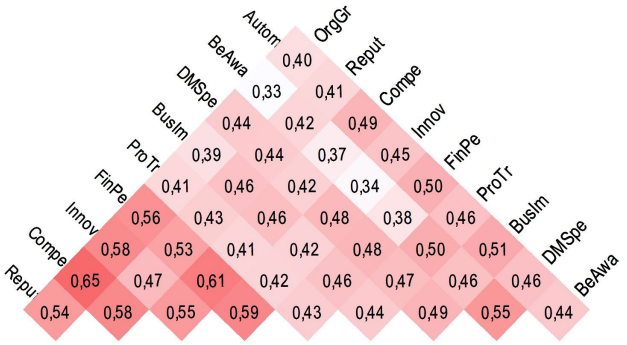


FIGURE 2. Correlation structure between outputs.

B. LATENT FACTORS SUMMARISING THE RESULTS OF DIGITALIZATION

There were ten variables in the dataset from the questionnaire that were like digitization results. We examined the relationships between these variables using bivariate linear correlation analysis, as in the previous case. Figure 2 is a correlation heatmap showing the Pearson linear correlation coefficients between all examined variables. Even in this case, we observe some stronger relationships, such as the correlation between the variable Compe (Competitiveness) and OrgGr (Organizational Growth) or FinPe (Financial performance). In these instances, the findings are logical and align with the nature of the monitored variables. Furthermore, FinPe was strongly correlated with the variable Innov (Innovations). This implies that organizations achieving a high level of innovativeness also attain better results in the realm of financial performance. Nevertheless, there are several statistically significant relationships evident in the correlation matrix.

This means that a complex correlation structure indicating the existence of latent factors was also identified in this case. Initial tests of the goodness of fit of the data structure showed a sufficient level in KMO indicators (value of 0.927), and Bartlett's Test of Sphericity reached Approx. Chi-Square of 1986.77 at $p<0.001$. Thus, the number of factors was calculated according to the Kaiser-Guttman rule. Table 4 provides an overview of the total variance explained. In this case, the interpretative level of the identified factors was sufficient. So, there was no need to change the number of factors. The eigenvalue of the third factor was only 0.619, so the possible addition of a factor would not be statistically justifiable.

The extracted two factors explain more than 60% of the variability, which is sufficient. Rotating the factors using the method ensured their mutual independence. A rotated factor matrix showing the factor loadings of each variable is presented in Table 5. Factor loading values below 0.300 have been hidden for better readability. Each of the two extracted factors was primarily made up of five variables.

The degree of cross-loading for each variable was negligible concerning the factor loadings in the dominant factor; therefore, based on the composition of the attributed variables, the factors can be named as follows:

TABLE 4. Total variance explained – EFA of outputs.

Factor	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Var.	Cum. %	Total	% of Var.	Cum. %	Total	% of Var.	Cum. %
1	5.224	52.235	52.235	5.224	52.235	52.235	3.310	33.102	33.102
2	1.008	10.076	62.311	1.008	10.076	62.311	2.921	29.210	62.311
3	0.619	6.194	68.505						
4	0.577	5.774	74.278						
5	0.551	5.512	79.791						
6	0.477	4.766	84.557						
7	0.429	4.294	88.851						
8	0.404	4.037	92.888						
9	0.396	3.962	96.850						
10	0.315	3.150	100.000						

1) FACTOR 1: ORGANIZATIONAL PERFORMANCE

This factor mainly comprises the variables OrgGr, Compe, FinPe, Innov, and Reput. All these variables are performance in nature and are the dominant indicators for the whole organization. Hence, the factor has been named organizational performance.

2) FACTOR 2: OPERATIONAL EFFICIENCY

The composition of this factor mainly consists of the variables BeAwa, DMSpe, ProTr, BusIm, and Autom. These variables are characterized by the fact that they are perspectives on the internal efficiency of the organization, hence the name chosen.

C. RELATIONSHIPS BETWEEN PREDICTORS AND OUTPUTS OF DIGITALIZATION

Relationships between predictors and In our research, we assumed that predictors would have some relationship with outcomes. This assumption was based on previous studies that have demonstrated a causal relationship between predictors and digital outcomes [54], [55]. The relationships between the identified factors were examined through bivariate correlation analysis and the results are presented in Table 6. digitization outcomes.

The results indicate that the factor of Organizational Performance, which results from digitalization, is mainly influenced by the factor of Digital Capabilities ($r=0.475$) and, to a much lesser extent, by the factor of Information Capabilities ($r=0.168$). The relationship between Organizational Performance and Personal Digital Skills was not statistically significant. However, if we examine the relationships of the Operational Efficiency factor, we can conclude that all three input factors influence it. The extent to which Personal Digital Skills influence Operational Efficiency is moderate ($r=0.280$), as is the influence of Information Capabilities ($r=0.352$) and Digital Capabilities ($r=0.298$). A visualization of the interrelationships is presented in Figure 3.

TABLE 5. Rotated factor matrix of outputs.

Variable / Factor	Factor 1	Factor 2
OrgGr	**0.822**	
Compe	**0.804**	
FinPe	**0.732**	0.346
Innov	**0.730**	
Reput	**0.654**	0.371
BeAwa		**0.833**
DMSpe	0.333	**0.703**
ProTr		**0.689**
BusIm	0.351	**0.655**
Autom	0.396	**0.612**

TABLE 6. Relationships between predictors and outputs of digitalization.

		Personal Digital Skills	Information Capabilities	Digital Capabilities	Organizational Performance	Operational Efficiency
Personal Digital Skills	Pearson Correlation	1	0.000	0.000	-0.015	0.280**
	Sig. (2-tailed)		1.000	1.000	0.756	0.000
	N	443	443	443	443	443
Information Capabilities	Pearson Correlation		1	0.000	0.168**	0.352**
	Sig. (2-tailed)			1.000	0.000	0.000
	N		443	443	443	443
Digital Capabilities	Pearson Correlation			1	0.475**	0.298**
	Sig. (2-tailed)				0.000	0.000
	N			443	443	443
Organizational Performance	Pearson Correlation				1	0.000
	Sig. (2-tailed)					1.000
	N				443	443
Operational Efficiency	Pearson Correlation					1
	Sig. (2-tailed)					
	N					443

**. Correlation is significant at the 0.01 level (2-tailed).

This figure visualizes the results of checking the mutual relations between the predicted predictors of digitization (Personal Digital Skills, Information Capabilities, Digital Capabilities) and output factors (Organizational Performance, Operational Efficiency). The figure shows a different distribution of points (each point represents one organization). A higher concentration of points around the central theoretical line means a higher correlation. The strongest relationship is, as mentioned, between Digital Capabilities

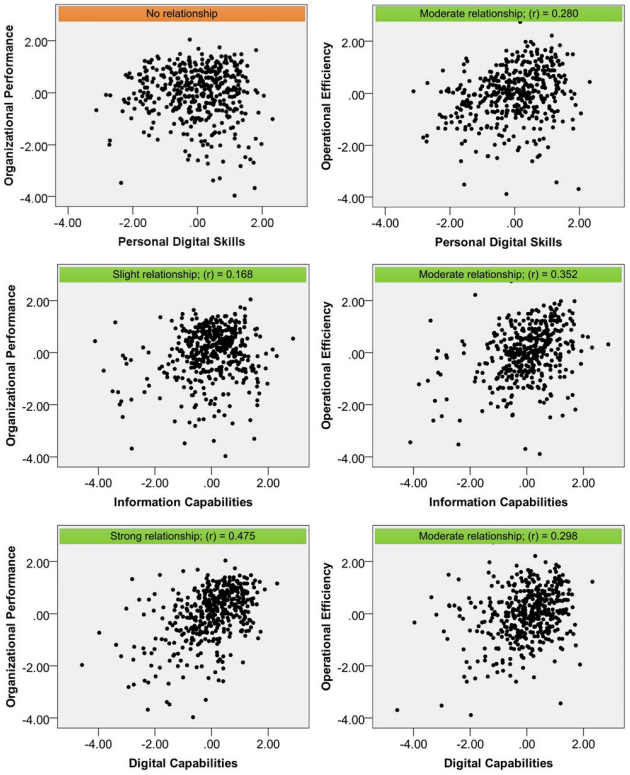


FIGURE 3. Scatter plots of output factors (y-axis) and predictor factors (x-axis).

and Organizational Performance. According to the regression equation, an increase in Digital Capabilities by 10% should lead to a rise in Organizational Performance by 4.7% (considering the risk of standard error), which is not a negligible value.

The pair Information Capabilities and Operational Efficiency showed a slightly lower intensity of the relationship. An increase in Information Capabilities by 10% should increase Operational Efficiency by 3.7%. From the results, it can be concluded that the predictor factors have the potential to influence both the internal performance of the organization (e.g. Operational Efficiency) and the external performance (e.g. Organizational Performance).

V. CONCLUSION AND DISCUSSION

Digitization represents a multifaceted process characterized by dynamic attributes that frequently mirror technological, economic, and social trends within the external environment of an organization. Through an examination of the inputs and outputs of digitization, our aim has been to shed light on the overarching factors that encapsulate the digitization process. Our research has uncovered a range of theoretical and practical implications, which we distill and elaborate upon in the subsequent chapters. These implications offer valuable insights into the intricacies and consequences of digitization, providing a nuanced understanding that extends beyond the mere technical aspects.

A. THEORETICAL IMPLICATIONS

In our study, employing Exploratory Factor Analysis (EFA), we have substantiated the presence of latent and overarching factors that elucidate the facets influencing the successful digital transformation of enterprises. In total, we identified five factors, categorizing three as predictors of digital transformation — Personal Digital Skills, Information Capabilities, and Digital Capabilities — while the remaining two represent the outcomes of digitalization — Organizational Performance and Operational Efficiency. Our empirical findings thus align with prior research that has investigated these factors individually or in various combinations.

The first factor, serving as a predictor of digitalization, is Personal Digital Skills. This aspect was a focal point in a study conducted by Saniuk & Grabowska [56], which, through structured questionnaires among experts at targeted universities and Polish firms, predominantly in manufacturing and R&D sectors, established a correlation between employees' essay competencies (personal digital skills) and their predictive role in the development and conception of Industry 5.0, along with the associated digital transformation of the company [57].

The second factor influencing the digitization process is Information Capabilities. Explored at a theoretical level by [58], this factor was subjected to a quantitative survey involving 31 organizations from Germany and Japan. The study demonstrated that the utilization of information capabilities, and capabilities in general, plays a crucial role in initiating and enhancing digital transformation. It facilitates flexibility through the implementation of new infrastructures, which, in turn, contribute to value-added digital transformation. A subsequent literature review on the emerging factor of digital capabilities by [59] characterizes digital capabilities as instrumental in enabling new functionalities, ensuring higher reliability, enhancing efficiency, and providing new optimization means that collectively contribute to increased value for organizations. This literature review positions digital capabilities as a predictive factor and foundational component for the successful digitalization of organizations.

The remaining two factors are categorized as output factors, denoting elements anticipated to yield benefits following the digitization process. The first of these is Organizational Performance. The study contends that the implementation of digital technologies and the process of digital transformation can result in enhancements in productivity and profitability. This, in turn, can lead to transformative changes in products and foster increased loyalty among enrollees [59], [60], [61]. Danielsen conducted a study on the benefits and challenges of digitalization through 13 in-depth interviews with firms in Norway, affirming that enhanced organizational performance is indeed a notable outcome of digitalization [62].

The second factor linked to the advantages of digitalization is Operational Efficiency. This factor encompasses improvements in the efficiency of production, as well as the quality and quantity of the organization's outputs. It facilitates a reduction in the time required for data collection, enhances data accessibility, and improves information handling [41]. A study by Joppen et al. identified and assessed the benefits and costs of investing in digitalization, with increasing operational efficiency among the identified benefits [63]. These findings collectively underscore the transformative impact of digitalization, not only in optimizing organizational processes but also in delivering tangible improvements in performance and efficiency.

B. PRACTICAL IMPLICATIONS

The findings of this study yield several statements that can guide organizations in digitizing both the entire firm and individual parts or processes. The first implication emphasizes the development of personal digital skills, with the enhancement of these skills contributing to improved operational efficiency. Investing in training and continuous education for employees, coupled with a strategic approach to sharing knowledge and fostering a culture that encourages employee awareness, can yield various benefits, prominently among them being operational efficiency.

The second implication, supported by research findings, underscores a moderately strong association between information capabilities and operational efficiency. This implies that achieving the desired efficiency involves creating a conducive environment for storing, sharing, and collecting information. Practical steps toward this goal include investments in information systems, training initiatives, and the subsequent utilization of data analysis tools.

The third implication reinforces the moderately strong relationship between digital capabilities and operational efficiency. This encompasses the creation, management, and innovation of digital processes and tools. Organizations are advised to invest in digital development and innovate these processes to enhance the overall digital capabilities of the organization.

The fourth implication highlights the weak relationship between information capabilities and organizational performance. This underscores that improved organizational performance can be attained by establishing effective processes for sharing, acquiring, and retaining information. Thus, organizations can enhance performance by implementing appropriate digital tools that support information capabilities, complemented by employee training.

The most crucial relationship identified in the research is the link between digital capabilities and operational performance. The study suggests that the most significant benefits for operational performance arise from investing in the digital capabilities of the organization. This involves strategic investments in automation, data analysis automation, and the digital transformation of processes. Through these innovations, the research indicates that organizations can achieve substantial added value and drive significant improvements in operational performance.

C. LIMITATIONS OF THE STUDY

Our study, based on the empirical treatment of questionnaire survey results, acknowledges certain risks inherent in such structured expert opinion studies. It's important to recognize and address potential limitations that could influence the outcomes. Sampling bias is acknowledged as a potential concern, although efforts to randomize respondents help mitigate this issue to some extent. However, the use of an electronic survey introduces an element of bias that cannot be eliminated.

Subjectivity is another acknowledged limitation, as the perception of observed phenomena may vary among respondents. While statistical procedures attempt to account for imprecision, the complete elimination of inconsistencies in perception is challenging. Geographical restriction, using data solely from the Czech Republic, is recognized as a limitation. The overall level of digitalization in the country may have impacted the results, and the study suggests that extending the research to different regions could yield varied outcomes.

D. FUTURE RESEARCH

Nevertheless, these limitations also present opportunities for further research. Extending the geographical scope, comparing results across more or less digitalized countries, and employing structural equation modelling (SEM) to explore the causality between input and output factors are proposed avenues for future investigation.

The study acknowledges the accelerated digital transition during the pandemic years and emphasizes the ongoing need for improvement in many digitalization projects. The exploratory nature of the study aims to empirically identify broader factors influencing digitization and its critical effects. By identifying five latent factors through EFA, with three as predictors and two as outcomes of digitization, the study lays the groundwork for a more extensive scholarly and practical discourse on enterprise digitalization. This opens avenues for discussions on enhancing competitiveness and realizing organization-wide benefits through information technology.

Future research can focus on understanding the specific aspects that affect the business environment. These insights can then help to create structured knowledge that, when correctly identified, can help organizations in their digitalization process. With the correct perception of the opportunities and threats associated with digitalization, we will accelerate the process. At the same time, we can reduce its costs and eliminate its risk level.

REFERENCES

[1] A. Cijan, L. Jenič, A. Lamovšek, and J. Stemberger, "How digitalization changes the workplace," *Dyn. Relationships Manage. J.*, vol. 8, no. 1, pp. 3–21, May 2019.

[2] P. Parviainen, M. Tihinen, J. Kääriäinen, and S. Teppola, "Tackling the digitalization challenge: How to benefit from digitalization in practice," *Int. J. Inf. Syst. Project Manage.*, vol. 5, no. 1, pp. 63–77, Feb. 2022.

[3] P. P. Groumpos, "A critical historical and scientific overview of all industrial revolutions," *IFAC-PapersOnLine*, vol. 54, no. 13, pp. 464–471, 2021.

[4] J. Rymarczyk, "Technologies, opportunities and challenges of the industrial revolution 4.0: Theoretical considerations," *Entrepreneurial Bus. Econ. Rev.*, vol. 8, no. 1, pp. 185–198, 2020.

[5] D. T. Matt, V. Modrák, and H. Zsifkovits, *Industry 4.0 for SMEs: Challenges, Opportunities and Requirements*. Cham, Switzerland: Springer, 2020, pp. 1–401.

[6] C. Favoretto, G. H. S. Mendes, M. G. Oliveira, P. A. Cauchick-Miguel, and W. Coreynen, "From servitization to digital servitization: How digitalization transforms companies' transition towards services," *Ind. Marketing Manage.*, vol. 102, pp. 104–121, Apr. 2022.

[7] C. Siedler, S. Dupont, M. T. Zavareh, F. Zeihsel, T. Ehemann, C. Sinnwell, J. C. Göbel, K. J. Zink, and J. C. Aurich, "Maturity model for determining digitalization levels within different product lifecycle phases," *Prod. Eng.*, vol. 15, nos. 3–4, pp. 431–450, Jun. 2021.

[8] S. Azizan, R. Ismail, A. Baharum, and N. H. M. Zain, "Exploring the factors that influence the success of digitalization in an organization's IT department," in *Proc. 6th IEEE Int. Conf. Recent Adv. Innov. Eng. (ICRAIE)*, Dec. 2021, vol. 6, pp. 1–6.

[9] D. Kiron, G. C. Kane, D. Palmer, A. N. Phillips, and N. Buckley, "Aligning the organization for its digital future," *MIT Sloan Manag. Rev.*, vol. 58, no. 1, pp. 1–4, 2016.

[10] M. D. Jones, S. Hutcheson, and J. D. Camba, "Past, present, and future barriers to digital transformation in manufacturing: A review," *J. Manuf. Syst.*, vol. 60, pp. 936–948, Jul. 2021.

[11] G. C. Kane, A. N. Phillips, J. R. Copulsky, and G. R. Andrus, *The Technology Fallacy: How People Are the Real Key To Digital Transformation*. Cambridge, MA, USA: MIT Press, 2019.

[12] F. Almeida, J. D. Santos, and J. A. Monteiro, "He challenges and opportunities in the digitalization of companies in a post-COVID-19 world," *IEEE Eng. Manag. Rev.*, vol. 48, no. 3, pp. 97–103, Jul. 2020.

[13] P. C. Verhoef, T. Broekhuizen, Y. Bart, A. Bhattacharya, J. Qi Dong, N. Fabian, and M. Haenlein, "Digital transformation: A multidisciplinary reflection and research agenda," *J. Bus. Res.*, vol. 122, pp. 889–901, Jan. 2021.

[14] V. Venkatraman, *The Digital Matrix: New Rules for Business Transformation Through Technology*. Los Angeles, CA, USA: Wonderwell, 2017.

[15] A. Bajpai and S. C. Misra, "Identifying critical risk factors for use of digitalization in construction industry: A case study," in *Proc. IEEE India Council Int. Subsections Conf. (INDISCON)*, Oct. 2020, pp. 124–128.

[16] P. Vinit, "Digitalization," in *Addressing Societal Challenges*, 1st ed. Luleå, Sweden: Grafisk Produktion LTU, 2018, pp. 23–38.

[17] A. H. Pratono, "Strategic orientation and information technological turbulence: Contingency perspective in SMEs," *Bus. Process Manage. J.*, vol. 22, no. 2, pp. 368–382, Apr. 2016.

[18] M. Ghobakhloo, "Industry 4.0, digitization, and opportunities for sustainability," *J. Cleaner Prod.*, vol. 252, Apr. 2020, Art. no. 119869.

[19] J. Dregger, J. Niehaus, P. Ittermann, H. Hirsch-Kreinsen, and M. T. Hompel, "The digitization of manufacturing and its societal challenges: A framework for the future of industrial labor," in *Proc. IEEE Int. Symp. Ethics Eng., Sci. Technol. (ETHICS)*, May 2016, pp. 1–3.

[20] J. Brodny and M. Tutak, "Analyzing the level of digitalization among the enterprises of the European union member states and their impact on economic growth," *J. Open Innov., Technol., Market, Complex.*, vol. 8, no. 2, p. 70, Jun. 2022.

[21] J. A. Saucedo-Martínez, M. Pérez-Lara, J. A. Marmolejo-Saucedo, T. E. Salais-Fierro, and P. Vasant, "Industry 4.0 framework for management and operations: A review," *J. Ambient Intell. Humanized Comput.*, vol. 9, no. 1, pp. 789–801, 2018.

[22] M. Rüßmann, M. Lorenz, P. Gerbert, M. Waldner, J. Justus, P. Engel, and M. Harnisch, "Industry 4.0: The future of productivity and growth in manufacturing industries," *Boston Consulting Group*, vol. 9, no. 1, pp. 54–89, 2015.

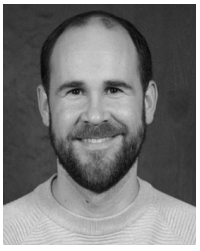
[23] R. Riedl, A. Benlian, T. Hess, D. Stelzer, and H. Sikora, "On the relationship between information management and digitalization," *Bus. Inf. Syst. Eng.*, vol. 59, no. 6, pp. 475–482, Dec. 2017.

[24] P. Haje, A. Arystanbaeva, Z. Oralbaeva, and Z. Kupenova, "The role and importance of accounting information system in the context of digitalization," *Central Asian J. Social Sci. Humanities*, vol. 5, no. 1, pp. 64–73, Jun. 2019.

[25] Z. Chen and L. Huang, "Digital twins for information-sharing in remanufacturing supply chain: A review," *Energy*, vol. 220, Apr. 2021, Art. no. 119712.

[26] I. B. Løberg, "Efficiency through digitalization? How electronic communication between frontline workers and clients can spur a demand for services," *Government Inf. Quart.*, vol. 38, no. 2, Apr. 2021, Art. no. 101551.

[27] E. Mäkiö-Marusik, A. W. Colombo, J. Mäkiö, and A. Pechmann, "Concept and case study for teaching and learning industrial digitalization," *Proc. Manuf.*, vol. 31, pp. 97–102, Jan. 2019.
[28] M. Hall, M. Kepell, and J. Bourne, "Learning technology and organizations: Transformational impact?" *Online Learn.*, vol. 15, no. 4, pp. 161–164, Nov. 2011.
[29] J. J. Wylie, M. W. Bigrigg, J. D. Strunk, G. R. Ganger, H. Kiliccote, and P. K. Khosla, "Survivable information storage systems," *Computer*, vol. 33, no. 8, pp. 61–68, 2000.
[30] B. Qi and H. S. Park, "A DT-based system for predicting process behavior," in *Advances in System-Integrated Intelligence* (Lecture Notes in Networks and Systems), vol. 546. Cham, Switzerland: Springer, 2022, pp. 245–251.
[31] V. Lang, "Digitalization and digital transformation," in *Digital Fluency: Understanding the Basics of Artificial Intelligence, Blockchain Technology, Quantum Computing, and Their Applications for Digital Transformation*. New York, NY, USA: Apress, 2021, pp. 1–50.
[32] K. Chetty, L. Qigui, N. Gcora, J. Josie, L. Wenwei, and C. Fang, "Bridging the digital divide: Measuring digital literacy," *Economics*, vol. 12, no. 1, Dec. 2018, Art. no. 20180023.
[33] O. Kohnke, "It's not just about technology: The people side of digitization," in *Shaping the Digital Enterprise: Trends and Use Cases in Digital Innovation and Transformation*, 1st ed. New York, NY, USA: Springer, 2017, pp. 69–91.
[34] S. Zeb, A. Mahmood, S. A. Khowaja, K. Dev, S. A. Hassan, N. M. F. Qureshi, M. Gidlund, and P. Bellavista, "Industry 5.0 is coming: A survey on intelligent NextG wireless networks as technological enablers," 2022, *arXiv:2205.09084*.
[35] S. Khan, S. Khan, and M. Aftab, "Digitization and its impact on economy," *Int. J. Digit. Library Services*, vol. 5, no. 2, pp. 138–149, 2015.
[36] I. Oshri and C. Weeber, "Cooperation and competition standards-setting activities in the digitization era: The case of wireless information devices," *Technol. Anal. Strategic Manage.*, vol. 18, no. 2, pp. 265–283, May 2006.
[37] M. Dumčius and T. Skersys, "Improvement and digitalization of business processes in small-medium enterprises," in *Proc. Int. Conf. Inf. Technol. (IVUS)*, vol. 2470, Kaunas, Lithuania, 2019, pp. 22–27.
[38] M.-S. Denner, L. C. Püschel, and M. Röglinger, "How to exploit the digitalization potential of business processes," *Bus. Inf. Syst. Eng.*, vol. 60, no. 4, pp. 331–349, Aug. 2018.
[39] H. Bouwman, S. Nikou, and M. de Reuver, "Digitalization, business models, and SMEs: How do business model innovation practices improve performance of digitalizing SMEs?" *Telecommun. Policy*, vol. 43, no. 9, Oct. 2019, Art. no. 101828.
[40] S. Bhutani and Y. Paliwal, "Digitalization: A step towards sustainable development," *OIDA Int. J. Sustain. Develop.*, vol. 8, no. 12, pp. 11–24, 2015.
[41] C. Trum, "Realizing the benefits of digitalization through standards," *Natural Gas Electr.*, vol. 36, no. 7, pp. 9–17, Feb. 2020.
[42] R. Hricová, "Digitization, personalization, and automation of business processes," in *Proc. 9th Int. Conf. Mobility IoT and Smart Cities*. Cham, Switzerland: Springer, 2023, pp. 53–66.
[43] I. Ivanov, T. Lukyanova, and L. Orlova, "Digitalization as a driver of innovation for industrial enterprises," *IOP Conf. Ser., Mater. Sci. Eng.*, vol. 753, no. 8, 2020, Art. no. 082023.
[44] M. Neubert, "The impact of digitalization on the speed of internationalization of lean global startups," *Technol. Innov. Manage. Rev.*, vol. 8, no. 5, pp. 44–54, May 2018.
[45] R. E. Yuleva, "Digitalization and innovation as a factor in increasing the competitiveness of small and medium-sized enterprises," *Knowl. Int. J.*, vol. 45, no. 1, pp. 83–87, 2021.
[46] M. Kohtamäki, V. Parida, P. C. Patel, and H. Gebauer, "The relationship between digitalization and servitization: The role of servitization in capturing the financial potential of digitalization," *Technol. Forecasting Social Change*, vol. 151, Feb. 2020, Art. no. 119804.
[47] P. Verhezen, "Reputation in a digitized world: Act responsibly, always," in *The Vulnerability of Corporate Reputation*. Cham, Switzerland: Springer, 2015, pp. 70–93.
[48] H. F. Kaiser, "The application of electronic computers to factor analysis," *Educ. Psychol. Meas.*, vol. 20, no. 1, pp. 141–151, Apr. 1960.
[49] B. A. Akinnuwesi, F.-M.-E. Uzoka, S. G. Fashoto, E. Mbunge, A. Odumabo, O. O. Amusa, M. Okpeku, and O. Owolabi, "A modified UTAUT model for the acceptance and use of digital technology for tackling COVID-19," *Sustain. Oper. Comput.*, vol. 3, pp. 118–135, Jan. 2022.
[50] S. Chatterjee, R. Chaudhuri, D. Vrontis, and G. Basile, "Digital transformation and entrepreneurship process in SMEs of India: A moderating role of adoption of AI-CRM capability and strategic planning," *J. Strategy Manage.*, vol. 15, no. 3, pp. 416–433, Jul. 2022.
[51] A. Santoalha, D. Consoli, and F. Castellacci, "Digital skills, relatedness and green diversification: A study of European regions," *Res. Policy*, vol. 50, no. 9, Nov. 2021, Art. no. 104340.
[52] K. A. Yeomans and P. A. Golder, "The Guttman–Kaiser criterion as a predictor of the number of common factors," *Statistician*, vol. 31, no. 3, p. 221, Sep. 1982.
[53] J. Hair and R. Anderson, *Multivariate Data Analysis*. Upper Saddle River, NJ, USA: Prentice-Hall, 1995.
[54] G. Vial, "Understanding digital transformation: A review and a research agenda," *J. Strategic Inf. Syst.*, vol. 28, no. 2, pp. 118–144, Jun. 2019.
[55] V. Fernandez and E. Gallardo-Gallardo, "Tackling the HR digitalization challenge: Key factors and barriers to HR analytics adoption," *Competitiveness Rev., Int. Bus. J.*, vol. 31, no. 1, pp. 162–187, Jan. 2021.
[56] S. Saniuk and S. Grabowska, "Skills and competencies of industrial employees in the Industry 5.0 environment," in *Proc. 4th Int. Conf. Intell. Syst. Prod. Eng. Maintenance*. Cham, Switzerland: Springer, 2023, pp. 251–264.
[57] V. Kupec, "Digital possibilities of internal audit," *Acta VŠFS*, vol. 11, no. 1, pp. 28–44, 2017.
[58] M. Doetzer and A. Pflaum, "The role of digitalized information sharing for flexibility capability utilization: Lessons from Germany and Japan," *Int. J. Phys. Distrib. Logistics Manag.*, vol. 51, no. 2, pp. 181–203, 2021.
[59] Y. L. Antonucci, A. Fortune, and M. Kirchmer, "An examination of associations between business process management capabilities and the benefits of digitalization: All capabilities are not equal," *Bus. Process Manage. J.*, vol. 27, no. 1, pp. 124–144, Jan. 2021.
[60] M. Kuusisto, "Organizational effects of digitalization: A literature review," *Int. J. Org. Theory Behav.*, vol. 20, no. 3, pp. 341–362, Apr. 2017.
[61] M. Kupec, D. Jakubíková, and V. Kupec, "Web personalization and artificial intelligence as tools for marketing communications," *Media Literacy Academic Res.*, vol. 4, no. 2, pp. 100–119, 2021.
[62] F. Danielsen, "Benefits and challenges of digitalization: An expert study on Norwegian public organizations," in *Proc. DG.O: 22nd Annu. Int. Conf. Digit. Government Res.*, Jun. 2021, pp. 317–326.
[63] R. Joppen, J. L. Tekaat, and D.-I. A. Kühn, "Identification and structuring of benefits and expenses for evaluating the profitability of investments in digitization within production," *Proc. Manuf.*, vol. 33, pp. 248–255, Jan. 2019.



PETER MADZÍK is currently a Researcher with the Department of Management, Comenius University Bratislava, and the Department of Business Administration and Management, Technical University of Liberec. His work has been published in several well-known journals, such as the *International Journal of Production Economics*, *European Journal of Innovation Management*, *Total Quality Management and Business Excellence*, *International Journal of Retail and Distribution Management*, *TQM Journal*, and *International Journal of Quality and Reliability Management*. His research interests include quality management, performance management, supply chain management, customer satisfaction, lean six sigma, quality tools, and the Kano model.

JAKUB SIEBER is currently pursuing the Ph.D. degree in business economics and management with the Faculty of Economics, Technical University of Liberec (EF TUL), Czech Republic. He works at Elmarco s.r.o. His specification concerns internal audit digitalization, both in the theoretical and practical fields of the research. He teaches seminars in audit both in the Czech and English languages. He gains his practical experience in the position of internal auditor.