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Digital Agility, Digital Competitiveness, and Innovative Performance of SMEs

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Abstract

This paper aims to discuss the role of digital agility and digital competitiveness in SMEs' innovative performance in the context of a digitally turbulent environment. While SME innovative performance is a key research topic, we did not find recent research that investigates the relationship between digital agility, digital competitiveness, and innovative performance in the context of SMEs. The research is part of ongoing work in which the IT-related practice of Hungarian organizations has been explored on an annual basis since 2009. We applied a combined research methodology; both qualitative and quantitative methods were used, including surveying digital transformation literature, developing a survey to collect quantitative data, data collection, and processing with PLS-SEM. According to our model, SMEs are worth investing in and developing risk taking and change capabilities from their organizational culture to increase digital innovation capability and digital transformation maturity, which leads to better innovative performance. The uniqueness of our research is that, according to the literature, the innovative performance of SMEs is an under-researched area, if we take into consideration digital agility and digital competitiveness. The COVID-19 pandemic also reinforced the role of these factors in SME survival. Our main contribution is that we provide a conceptual framework for improving SMEs' innovative performance through digital agility and digital competitiveness in digital turbulence.

Keywords: digital agility, digital competitiveness, innovative performance, digital transformation, SME
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1. INTRODUCTION

The innovation and innovative performance of SMEs are widely researched areas, especially when the COVID pandemic has threatened their survival (Abdul Halim et al., 2015; Abdul-Mohsin et al., 2020; R. Lee, 2021; Lopes et al., 2018; Vătămănescu et al., 2020). According to the European Commission's Regional Innovation Scoreboard (2021), innovative performance in the Central Transdanubia region in Hungary has advanced and, thus, represents an emerging area for innovation. Based on the report, the region demonstrates relative strength in employment for knowledge-intensive activities, non-R&D innovation expenditures and innovation expenditures

per person employed but has weaknesses in business process innovators, design and trademark applications. According to the Hungarian Central Statistical Office, 10.3% of the active companies of Hungary operate in this region, while the central region of Hungary bears 42.3% of active enterprises. Not considering individual entrepreneurs and micro companies, the SME sector accounts for 97.2% of the active enterprises. Moreover, the development of noncentral regions requires the development of entrepreneurship and, especially in these circumstances, the development of SMEs (Kraus et al., 2021). Digital technologies have influenced and disrupted practically every industry; the development of information and communication technology has changed economies all over the world (Bergek et al., 2013; Evans, 2017). Due to the disruptive effects of digital transformation, the topic of digitalisation has received more attention in recent years, and there have been several attempts to define the phenomenon. According to Piccinini et al., (2015), digital transformation involves the use of digital technologies by businesses to carry out large-scale improvements, improve the customer experience and develop new business models. On the other hand, Bekkhus (2016) defines digitalisation as the use of digital technologies for purposes that radically increase the performance of a business enterprise. Nwaiwu (2018) compared and analyzed ten frameworks related to the subjects of digital business transformation and digital technologies in the industry. The research conclusion is that the relevant frameworks had their origins in business publications, while academic papers focus more on technology adoption and the users' behaviour. We might think that digitalisation is mainly a tool for large companies to compete, which requires complex developments and expensive technology. However, digitalisation efforts can also be observed in small businesses alongside the public sector, and the digitalisation of the SME sector is crucial for the economy. Small and medium-sized enterprises (SMEs) play a crucial role in any country in the world. The majority of businesses operating today are also SMEs, and their numbers are growing. Improving the functioning of the SME sector is a priority for international competitiveness and the successful development of the economy. Setyawan et al. (2015) investigated the source of SME competitiveness in selected industry clusters in Indonesia and developed a theoretical model of SME competitiveness. They found that sources of the competitiveness of SMEs are the level of innovation, level of education, working capital and business strategy. The need for digitalisation is also immense in the SME sector: customer demand, competitor initiatives, performance expectations and the need to improve organizational efficiency are only a few drivers of digitalisation. There is room for improvement for Hungarian SMEs in the field of digitalisation as well; only 46% have at least a basic level of digital intensity, compared with a 60% average for the EU; the adoption of key digital technologies (big data, AI and cloud) is also low (European Commission, 2021). Although digitalisation is a popular topic, it tends to be focused more on the practices of large enterprises, with much less attention given to the SME sector. Small businesses have a much harder time initiating digitalization projects due to scarce resources, limited expertise, lower risk tolerance and many other factors. However, in today's economic environment, digital transformation could be the key to survival (Tarutė et al., 2018). Although the influencing factors of digital transformations have been widely researched, there is no consensus on what they are (Bohnsack et al., 2018; Kohnke, 2017; Verhoef et al., 2021; Weill et al., 2019). Williams et al. (2019) identified a total of sixty maturity models from the digital and general literature and selected twenty-five SME-oriented maturity models from this core collection for further analysis. The studies of the

maturity models were coded and categorized, and an initial hypothesis was formulated using descriptive analysis techniques. According to the research, the most significant dimensions of the digital maturity model for SMEs are people and culture.

This paper aims to discuss the role of digital agility and digital competitiveness in SMEs' innovative performance in the context of a digitally turbulent environment. While SME innovative performance is a key research topic, we did not find articles in Scopus that investigate the relationship between digital agility, digital competitiveness, and innovative performance in the context of SMEs. If we use innovative performance, SME keywords with digital agility or digital competitiveness, the result is the same in Scopus - no articles exist. If we limit the Scopus search to innovative performance and SME (journal papers), there are 23 articles, but they do not deal with the role of digital agility and digital competitiveness. SMEs' changing ability and risk taking are crucial factors in their digitalisation projects, and we specify digital agility as a component of these features. We define digital competitiveness as a component of digital innovation capability and digital transformation maturity, where digital innovation capability includes the expertise, ability, training programs for employees, and networks for new digital solution development. In our terminology, digital transformation maturity reflects the status of a company's digital transformation compared with competitors. This paper is structured as follows. Section 2 provides an overview of the theoretical background and hypothesis development. Section 3 details the research methodology and data collection. Section 4 presents the results of the data processing using PLS-SEM. Section 5 provides the discussion, and the conclusions are summarized in Section 6.

2. THEORETICAL BACKGROUND

Today's environment is determined by digital turbulence, which is the result of increased speed of change, greater uncertainty and transformative business models based on the emerging unpredictably and simultaneous maturing of multiple technologies and platforms that provide new functionalities (Day & Schoemaker, 2019; Schoemaker & Day, 2021). One of the most challenging situations for SMEs is the COVID pandemic, which has forced enterprises to operate in a more agile way than before. The pandemic strengthened digital turbulence, fostered the need for companies to quickly adopt digital technologies, modified their business model and made it imperative to develop or obtain the necessary skills. In the meantime, SMEs have had to deal with the maturing of multiple parallel digital technologies and the emergence of new platforms (like MS Teams, Zoom, and others) enriched with new functionalities. Day and Schoemaker (2019) emphasize three dynamic capabilities to manage uncertainty and risk: sensing change sooner than rivals, seizing opportunities more effectively, and transforming the organization as needed to stay ahead. As Birkinshaw et al. (2016) suggest, success in a business environment challenged by fast-moving, dramatic changes – digital turbulence – requires the right set of dynamic capabilities, the ability to seize opportunities more effectively, and the proactive ability to transform the business. Fig. 1 shows our conceptual model, including four main components: digital turbulence, digital agility, digital competitiveness, and innovative performance.

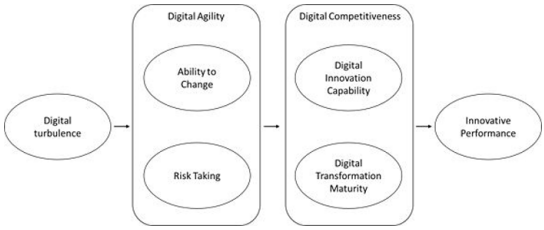

Fig. 1 – Conceptual model. Source: own research

Digital Agility

The first definitions of agility can be found in strategic management literature in the 1990s (Goldman et al., 1995; Goldman & Nagel, 1993). Enterprise agility is commonly conceived as an organizational capability consisting of two components: the ability to sense or anticipate changes in the internal and external organizational environment, and the ability to respond effectively and efficiently in a timely and cost-effective manner (Seo & la Paz, 2008). Salmela et al. (2022) discuss the conceptualization of agility in management research and information systems. Based on the review of agility in the literature, they abstract digital agility as the capability of a unit to capitalize on opportunities/threats induced by generative digital technologies under constrained or unfolding time frames. Their definition highlights that risk and risk taking are essential components of digital agility. Based on the previous studies, our definition of digital agility is that it is a combination of an ability to change and risk taking. Digital agility is not only the willingness and ability to change but also the capability to adapt to change quickly. Risk taking is the willingness of an organization to decide and act without definite knowledge of income generation and possible speculation of personal, financial and business risk (Dess & Lumpkin, 2005). Risk taking helps companies maximize their potential to seek and benefit from business opportunities (Moon, 1999). The greater the level of risk a decision maker is willing to tolerate, the greater the level of organizational agility measured (Appelbaum et al., 2017; McGrath & MacMillan, 2009). Wiklund et al. (2009) have developed a model for SME business growth that included a variable that takes into account risk taking. Games and Rendi (2019) applied risk taking as a growth path for SMEs. Isensee et al. (2020) looked at how organizational culture affects the level of digitalization as well as environmental sustainability as a systematic review. One important finding is that when using smart technologies, organizational learning capability comes from experimentation and risk taking (Nunes et al., 2019). Goran et al. (2017) also highlight risk taking as an important success factor or barrier to digital effectiveness. The willingness to experiment and invest in potentially risky projects is critically important; therefore, management should encourage them to take calculated risks and embrace bold bets. The attributes and characteristics of digital culture include risk taking, openness to change and agile attitudes. Ability to change and risk tolerance are identified as the main categories of cultural attributes. Ability to change means being open and willing to change ways of work and the ability of an organization to constantly reinvent itself, while risk tolerance refers to taking risks or having a risk appetite (Teichert, 2019). Digitalization requires new management skills, such as flexibility and risk taking, which are more important than they were previously (Kohnke,

2017). Thus, this study proposes the following hypothesis:

H1a: Digital turbulence has a positive effect on ability to change.

H1b: Digital turbulence has a positive effect on risk taking.

H1c: Digital turbulence has a positive effect on innovative performance.

H2a: Ability to change has a positive effect on risk taking.

Digital Competitiveness: Digital Innovation and Digital Transformation Maturity

We define digital competitiveness as a component of digital innovation capability and digital transformation maturity. Henfridsson et al. (2018) describe digital innovation as an intellectual descendant of Schumpeter (1934), who described innovation as "new combinations" of new or existing knowledge, resources, and equipment (Schumpeter, 1934, p. 65). This definition is more relevant today for digital innovation because of the following key features of digital technologies: editability (Kallinikos et al., 2013), reprogrammable ability (Yoo et al., 2012), and openness for reinterpretation after a long period of use (Nylén et al., 2014). Digital innovation refers to a product-centric perspective involving new combinations of physical and digital products to form new products (J. Lee & Berente, 2012; Yoo et al., 2012). Nambisan et al. (2017) define digital innovation as the use of digital technology during the process of innovating or the outcome of innovation. Digital innovation is a result of activities by which digital resources are recombined (Henfridsson et al., 2018). Kohli & Melville (2019) provided a research survey of digital innovation studies and investigated the knowledge gaps and future research directions from theoretical and practical perspectives. Their theoretical framework analysed the literature using seven dimensions: initiation, development, implementation, exploitation, the role of the external competitive environment, the role of the internal organizational environment, and product, service, and process outcomes. Their theoretical framework is similar to ours in emphasizing the role of the external competitive environment and internal organizational environment in the success of digital innovation. Their key findings from the literature review include top management support, external pressure, and organizational size as the most predictive of digital innovation adoption. According to a systematic literature review of digital transformation maturity (Teichert, 2019), digital innovation capabilities belong to the most common digital maturity areas. Digital innovation capabilities enable a more flexible/agile way of working, develop disruptive business models, use agile methods, involve customers in the innovation process, fund innovation and regularly conduct innovation. According to Swanson's tri-core model (Swanson, 1994), digital innovation capability is conceptualized as the capacity of an organization to conduct three areas of innovative IS activities: functional IS, business administration, and business technology. Digital innovation capability includes expertise, ability, training programs for employees and networks for new digital solution development.

Digital transformation is an ongoing challenge for SMEs (Li et al., 2018; Pelletier & Cloutier, 2019). SMEs are in need of new digital technologies to enhance their cooperative abilities and their production and innovation processes (OECD, 2021). Still, implementation efforts are limited in skills, resources, and organizational capabilities and are often acquired from third-party service providers (Li et al., 2018). The success of such development is seriously challenged,

as digital transformation is not simply the implementation of new technologies but also the change in business processes, operational routines, and organizational capabilities (Garzoni et al., 2020). Moreover, SMEs need to create a digital entrepreneurial culture, network, collaborate and initiate digital projects to demonstrate benefits. Chanias and Hess (2016) determine digital maturity as a reflection of a company's digital transformation status. Digital maturity is a holistic concept; it goes beyond a purely technological interpretation, covering managerial aspects as well as what a company has already achieved in terms of its digital transformation efforts (changes in products, services, processes, skills, culture, and abilities regarding the mastery of change processes). Digital maturity is not a static concept because of the continuous change in the surrounding environment. Kane et al. (2017) define digital maturity through its comparison with digital transformation: digital maturity is a systematic way for an organization to transform itself digitally. Digital readiness and digital maturity are used in several studies synonymously (Pirola et al., 2019). Weiner (2009) defines readiness as "a state of being both psychologically and behaviorally prepared to take action (i.e., willing and able)." Soanes & Stevenson (2006) determine maturity as "the state of being complete, perfect or ready," while according to Singh et al. (2015), maturity is "the degree of formality and optimization of processes, from ad hoc practices to formally defined steps, to managed result metrics, to active optimization of the processes." Pirola et al. (2019) discuss several digital readiness and assessment models detailing the analysed dimensions, targeted firms, and output. Many of those models are Industry 4.0 related (Akdil et al., 2018; Gökalp et al., 2017; Lichtblau et al., 2015; Schuh et al., 2017), and some of those target SMEs (Ganzarain & Errasti, 2016; Lichtblau et al., 2015; Mittal et al., 2018). In most of the models, the output is positioned at four, five, or six maturity levels. Teichert (2019) analyses 24 relevant studies covering 22 digital maturity models in his systematic literature review of digital transformation maturity. The dimensions of these models are very different, and just a few incorporate transformational capabilities in addition to digital capabilities. We define digital transformation maturity as the status of a company's digital transformation compared with competitors. Thus, the following hypotheses have been developed:

H2b: Ability to change has a positive effect on digital innovation capability.

H2c: Ability to change has a positive effect on digital transformation maturity.

H3a: Risk taking has a positive effect on digital innovation capability.

H3b: Risk taking has a positive effect on digital transformation maturity.

H4a: Digital innovation capability has a positive effect on digital transformation maturity.

Innovative Performance

Sousa-Zomer et al. (2020) explored the components of digital transformation capability and its effect on the competitive performance of firms using 427 large US companies and structural equation modelling (SEM) to test their proposed model. They used multiple databases and keyword searches to select those companies that have implemented digital transformation. Their constructs that define digital transformation capabilities were 1) digital-savvy skills, 2) digital intensity, and 3) conditions for actions. This latter construct was measured by the existence of a risk taking culture and the structures being agile, nimble, and multidimensional. Performance

was measured as the change in market capitalization, return on assets and return on sales. The constructs were measured by analysing the companies using publicly available documents. Their analysis confirmed the positive relationship between digital transformation capability and competitive performance. Khin and Ho (2019) analysed the effect of digital innovation on firm performance using 105 Malaysian SME ICT companies and structural equation modelling (SEM). They defined digital innovation with two subconstructs: 1) digital orientation and 2) digital capabilities. The former was measured as the commitment and acceptance to use digital technologies, as well as the search for opportunities to use digital technologies. In contrast, the latter was measured as the ability to identify, acquire, and master digital technologies. Performance was a subjective measure of satisfaction with the company's performance in sales, net profit, and cash flow, as well as an objective measure of customer satisfaction, market share, and employee turnover. The study not only confirmed that digital capabilities have a positive effect on performance but also revealed that digital orientation has a positive effect on digital innovation.

Nwankpa and Datta (2017) investigated the effect of IT capability on firm performance in the context of digital business intensity using 315 CIO responses from US firms and structural equation modelling (SEM). Digital business intensity was measured as the use of and investment in digital technologies in business transactions and operations relative to other firms in the industry. IT capabilities were measured as the subconstructs of 1) IT infrastructure, 2) IT business spanning of developing and executing clear vision and strategy, and 3) the proactive stance of IT keeping current with innovations and creating a conducive organizational climate—all measured relative to other firms in the industry. Firm performance was measured relative to direct competitors over the last three years on four dimensions: profitability, customer retention, return on investment, and sales growth. The analysis confirmed that IT capability has a positive effect on organizational performance and that digital business intensity partially mediates this influence. When measuring performance, innovative performance is an important subset of overall business performance. Innovative performance was defined by Hagedoorn and Cloodt (2003) as the performance of R&D, patenting, and new product development.

Our research focuses on the latter component of innovative performance—the performance of new product development. Accordingly, the following hypotheses have been developed:

H4b: Digital innovation capability has a positive effect on innovative performance.

H5: Digital transformation maturity has a positive effect on innovative performance.

3. RESEARCH OBJECTIVE, METHODOLOGY AND DATA

This paper aims to discuss the role of digital agility and digital competitiveness in SMEs' innovative performance in the context of a digitally turbulent environment. While SME innovative performance is a key research topic, we did not find recent research that investigates the relationship between digital agility, digital competitiveness, and innovative performance in the context of SMEs. The research is part of ongoing work in which the IT-related practice of Hungarian organizations has been explored on an annual basis since 2009. Based on the above theoretical overview, hypotheses development is detailed in part 2. This research follows

a combined approach: while a quantitative data survey provided the database for building the structural equation model and testing the hypotheses, a literature review contributed to the conceptual modelling. The research process started with surveying the literature on digital innovation, digital maturity, and innovative performance to explore the factors and identify and define the key areas relevant for innovative performance and should be included in the survey instrument. These steps were followed by formulating the research questions and hypotheses. The next step was developing the survey instrument and formulating the questions that were included in the questionnaire. Data were collected from the survey participants and subsequently processed using PLS-SEM modelling. The initial results were followed up by an expert workshop to help understand and interpret the results.

3.1 Data Collection

Data were collected in the Central Transdanubia region of Hungary from manufacturing, logistical and mechatronic companies—the largest organizational representation of the region. The sample is concentrated on regional SMEs randomly selected from the database of the Chamber of Industry and Commerce in Hungary (as chamber membership is mandatory for companies, we had access to all company data). Data were collected in 2019 Q4 and 2020 Q1, before the pandemic arrived in the region (pre-COVID dataset). Data were collected through personal interviews, recorded on hard copies of the questionnaires, and later entered into the database. Data collectors were prepared for the purpose of the research, and they were given standard guidelines and survey protocols to ensure consistent data collection. During data collection, we placed a high emphasis on collecting relevant answers; therefore, data collectors approached the top management of companies: CEOs, managing directors, founders, and owners. Altogether, 235 companies were surveyed in the sample, and the main characteristics of the companies are collected in Tab. 1.

Tab. 1 - Sample characteristics

Company size (no. of employees)	10–49 50–99 100–259	48.51% 28.51% 22.98%
Ownership	Hungarian, state-owned Hungarian, private Foreign-owned, private N/A	4.68% 77.02% 16.17% 2.13%

3.2 Constructs and Measures

Because of the shortage of measurement scales on this topic, all six constructs were self-developed. Digital turbulence was measured by four questions that assessed how important digital technology is in the industry, how competitors and customers are approaching new digital solutions and whether digital technology plays a transformative role in the industry. Ability to change was measured by three questions evaluating the openness of the organization to change and innovation. Risk taking was measured by four questions that assessed the organization's

willingness to experiment, take risks, and make bold decisions about digital innovation and new digital solutions. Digital innovation capability was measured by four questions that appraised the skills and capabilities of the staff and the organization to create new digital solutions. Digital transformation maturity was measured by three questions that compared the organization's digital products, solutions, and the general state of digital transformation with that of competitors. Finally, innovative performance was measured by three questions that assessed the organization's recent track record in developing successful new products and services.

3.3 Research Instrument

The constructs were rated in accordance with statements on a 5-point scale (1 = strongly disagree, 5 = strongly agree). All our constructs were of a reflective nature. The initial construct definitions were tested to assess answer scale validity and to ensure reliability using short open-ended interviews with a pilot sample of (n=25) respondents who were asked about their role in the transition experience. Multiple (18) items to assess the six constructs were generated based on data from the pilot study. Following the pre-test, we invited four scholars to provide expert validation and ensure item consistency.

3.4 Data Analysis

The descriptive analysis was carried out using SPSS (version 25). Our model was tested using partial least scale structural equation modelling (PLS-SEM) to investigate the associations between latent constructs, including challenges of the pandemic, loss of teaching identity, digital mastery, successful role transition, and teacher-student relationship (using path analysis). ADANCO (version 2.2.1) was applied to test the measurement and structural model used in the research (Dijkstra & Henseler, 2015; Henseler & Dijkstra, 2015). The use of PLS-SEM is justified by (1) the exploratory nature of this study; (2) the small (145) sample size; and (3) the scale development assessed in this study, in which items are measured on a 7-point scale (Hair et al., 2012). The risk of systematic measurement error was avoided by assessing internal consistency, convergent validity, and discriminant validity.

4. RESULTS AND DISCUSSION

4.1 Model Measurement: Validity and Reliability

To test our hypotheses, PLS-SEM was used. The standardized root mean square residual (SRMR) was 0.062, remaining below the threshold (Henseler et al., 2016) and suggesting a good approximate model fit (SRMR < 0.08 criterion). Dijkstra-Henseler's rho (ρA) was used to evaluate the reliability of the construct scores, where the decision criterion is $\rho A > 0.707$ (Tab. 2). The average variance extracted (AVE) index was applied to measure convergent validity (values should be above the threshold of 0.5 in each construct) (Hair et al., 2017). The AVE for each construct is between 0.76 and 0.92 (Tab. 3). We verified discriminant validity in accordance with the established guidelines (Henseler et al., 2016; Hair et al., 2011) and conducted the heterotrait–monotrait (HTMT) test. All HTMT ratios were far below the recommended

value of 0.85, and the highest value of the HTMT ratio was 0.80, providing evidence of good discriminant validity (Hair et al., 2017). To further test discriminant validity, we checked Fornell and Larcker's criterion, which demonstrated that in all cases, the AVE measurement was larger than the squared latent variable correlations (Tab. 3). All the squared intercorrelations between the constructs are lower than the AVE.

Tab. 2 - Measurement of the model constructs and reliability

Construct (Rho)	Item	Mean	SD	Loading
Digital Turbulence (ρA = 0.91)	Digital technology is a driving force of competition in our industry.	3.31	1.31	0.92
	Competitors are constantly innovating with new digital solutions.	3.29	1.24	0.74
	Customers keep seeking new digital solutions.	3.20	1.27	0.89
	Digital technologies are continuing to transform our industry.	3.17	1.31	0.93
Ability to Change (ρA = 0.92)	Change is an inherent part of our organizational culture.	3.12	1.11	0.94
	Our organization is expected to keep improving our business processes.	3.08	1.17	0.96
	We are continually looking for opportunities to innovate.	3.57	1.05	0.88
Risk Taking (ρA = 0.94)	We are willing to take risks to try new digital solutions.	3.00	1.36	0.94
	We are willing to embrace digital innovation, even at the expense of financial risk.	2.88	1.32	0.93
	We encourage experimentation with new technologies.	3.25	1.16	0.91
	We are bolder than our competitors when introducing new digital solutions.	3.06	1.13	0.91
Digital Innovation Capability (ρA = 0.94)	We have all the capabilities to create new digital solutions.	3.36	1.03	0.93
	We have the expertise to create new digital solutions.	3.35	1.09	0.94
	We continuously develop our staff to be at the forefront of creating digital solutions.	3.31	1.10	0.92
	If necessary, we find the right partners to develop digital solutions.	3.79	1.01	0.83
Digital Transformation Maturity (ρA = 0.95)	Our digital solutions are more advanced than those of our competitors.	2.95	0.96	0.96
	We are digitally more advanced than our competitors.	2.96	0.93	0.97
	We are at the forefront of digital transformation.	2.88	0.97	0.93

Innovative Performance (ϱA = 0.95)	In the past year we were able to develop new products, services or business solutions.	3.15	1.27	0.95
	The products and services launched in the last year were successful.	3.25	1.20	0.97
	In recent years, we have been able to provide more and more customized services.	3.23	1.17	0.95

Note: Items were measured with a 5-point scale.

Tab. 3 - Fornell-Larcker criterion

Construct	Digital transformation maturity	Ability to change	Digital turbulence	Risk taking	Digital innovation capability	Innovative performance
Digital transformation maturity	0.9130					
Ability to change	0.4669	0.8544				
Digital turbulence	0.5197	0.4303	0.7635			
Risk taking	0.5629	0.4412	0.4862	0.8515		
Digital innovation capability	0.4418	0.5141	0.3620	0.4046	0.8211	
Innovative performance	0.5456	0.5632	0.5496	0.5069	0.4771	0.9160

Note: AVE can be found on the diagonal; values under the diagonal are the squared correlations

4.2 Structural Model and Hypothesis Testing

The path coefficients (β) of the structural model are presented in Tab. 4. Tab. 4 and Fig. 2 show that all hypotheses are supported.

Tab. 4 - Direct effects in the model

	β	t-value	p-value
Digital turbulence -> Ability to change (H1a)	0,6560***	11,1965	0,0000
Digital turbulence -> Risk taking (H1b)	0,4591***	7,1373	0,0000
Digital turbulence -> Innovative performance (H1c)	0,3640***	4,7810	0,0000
Ability to change-> Risk taking (H2a)	0,3630***	5,6660	0,0000
Ability to change -> Digital innovation capability (H2b)	0,5271***	6,4190	0,0000
Ability to change-> Digital transformation maturity (H2c)	0,2232**	2,7167	0,0034

Risk taking -> Digital innovation capability (H3a)	0,2860***	3,6581	0,0001
Risk taking -> Digital transformation maturity (H3b)	0,4720***	7,8060	0,0000
Digital innovation capability -> Digital transformation maturity (H4a)	0,2044**	2,7872	0,0027
Digital innovation capability -> Innovative performance (H4b)	0,2779***	4,1412	0,0000
Digital transformation maturity -> Innovative performance (H5)	0,2915***	4,1514	0,0000

Note. β = Standardized Regression Weight. ***p < 0.001. **p < 0.01. *p < 0.05.

Digital turbulence defines the context of the model, so it has an impact on the whole process in the expected direction. This means that digital turbulence has a direct positive effect on ability to change ($\beta = 0.66$, $p < 0.001$), risk taking ($\beta = 0.46$, $p < 0.001$), and innovative performance ($\beta = 0.36$, $p < 0.001$); therefore, H1a, H1b and H1c are supported.

The findings indicate that the hypothesized positive effects of ability to change on risk taking ($\beta = 0.36$, $p < 0.001$), on digital innovation capability ($\beta = 0.53$, $p < 0.001$), and on digital transformation maturity ($\beta = 0.22$, $p < 0.01$) are supported, confirming H2a, H2b and H2c.

Risk taking is hypothesized to have a positive effect on digital innovation capability (H3a) and digital transformation maturity (H3b). The results reveal that digital innovation capability ($\beta = 0.29$, $p < 0.001$) and digital transformation maturity ($\beta = 0.47$, $p < 0.001$) can be significantly enhanced by risk taking, thus supporting H3a and H3b. The results show that the hypothesized positive impact of digital innovation capability on digital transformation maturity ($\beta = 0.20$, $p < 0.01$) and on innovative performance ($\beta = 0.28$, $p < 0.001$) are supported, confirming H4a and H4b. H5 suggests that innovative performance is positively affected by digital transformation maturity, which is supported ($\beta = 0.29$, $p < 0.001$).

4.3 Discussion

We analysed the effect of key factors on firms' performance, specifically their innovative performance, in the context of digital turbulence (Fig. 3). The first four questions aimed at measuring how digitally turbulent the environment is and where firms are operating. Slightly more respondents stated that the environment they are operating in is digitally turbulent. More respondents felt that competitors are constantly innovating with new digital solutions and that digital technology is a driving force in their industry. However, the answers were more balanced about the transformational role of digital technologies in their industry, and there were fewer differences between the responses that agreed with this statement than not. The majority of respondents stated that they are continually looking for new opportunities to innovate. However, they were not as dedicated to implementing innovation if change was an inherent part of their organizational culture or if business processes needed to be constantly challenged. Regarding risk taking, the respondents tended to state that they encourage experimenting with new technologies and being bolder in introducing new technologies than their competitors. However, the answers were more balanced regarding taking financial risks with new digital innovations.

More respondents felt they possessed digital innovation capabilities, especially in finding the right partners to develop new digital solutions. In contrast, their view about their digital transformation maturity was very balanced. Those digitally more confident were less confident about whether they or their competitors were at the forefront of digital transformations. Finally, their view on their innovative performance was somewhat inclined towards being optimistic about having recently been able to launch and customize products and services.

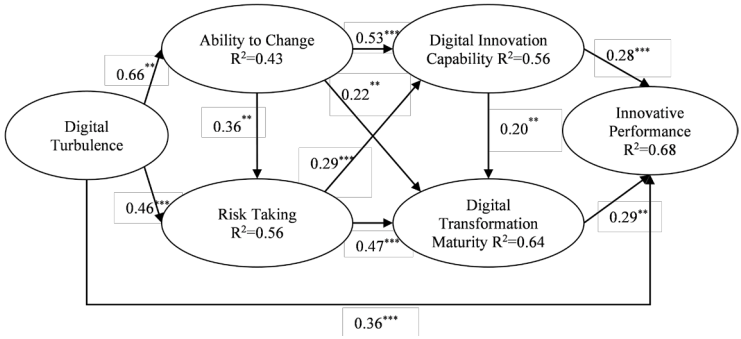

Fig. 2 - The structural model and results

There was a good spread of positive and negative answers for all questions, providing the opportunity to analyse the relationship between the factors that may influence firms' innovative performance. Digital turbulence, the prominence of digital technologies, and their transformative role in the industry have a significant positive effect on both risk taking and the ability to change. Firms that operate in a digitally turbulent environment tend to be willing to experiment more with digital technologies and undertake more financially risky projects. Furthermore, the ability to change has a positive effect on risk taking. Firms that have an organizational culture that accepts and encourages change tend to be willing to take more risks. Digital agility, the ability to change, and the willingness to take risks have a significant positive effect on firms' digital innovation capability and digital transformation maturity. Digitally agile firms tend to have stronger capabilities to digitally innovate, develop internal capabilities, or find the right partners to develop new digital solutions. Additionally, they feel that they are digitally more advanced than their competitors, and they have more advanced solutions. There are also internal synergies between these constructs. The effects within and between the subconstructs of digital agility and digital competitiveness are all significant and positive. They reinforce each other, increasing their mutually positive effect.

Finally, the measurable outcome of innovation, developing and launching new products and services was positively affected by the firms' digital innovation capability and digital transformation maturity. Firms that are digitally more advanced and have better digital capabilities or access to external partners' capabilities tend to be more successful in developing and launching new products and services. Our structural equation model also shows that digital turbulence has an overall positive effect on innovative performance. Firms that operate in a digitally turbulent environment tend to be more successful in developing and launching new products and services than those that operate in a less turbulent environment.

5. CONCLUSION

The uniqueness of our research is that, according to the literature, the innovative performance of SMEs is an under-researched area, especially if we take into consideration digital agility and digital competitiveness. The COVID-19 pandemic also reinforced the role of these factors in SME survival. Our main contribution is that we provide a conceptual framework for improving SMEs' innovative performance through digital turbulence, digital agility, and digital competitiveness. The model was tested using structural equation modelling (SEM).

According to our model, SMEs are worth investing in and developing risk taking and change capabilities from their organizational culture to increase digital innovation capability and digital transformation maturity, which leads to better innovative performance.

Future work includes additional testing of our model using a larger sample dataset and extending the research for the investigation of the COVID-19 effect on the model.

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