

The mediating role of organizational factors between environmental changes and SMEs' digital transformation

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Abstract

Purpose – Based on the technology-organization-environment (TOE) framework, the goal of this study is to examine the mediating role of organizational factors between environmental changes and SMEs digital transformation (DT). Precisely, it tests a structural model with the mediating role of top management support and digital strategy between general environmental and industry-specific factors, perceived barriers and digital technology usage, DT and firm performance. It also examines the moderating effects of sectors on the relationship between digital technology usage and DT.

Design/methodology/approach – Data were obtained from 1,000 SMEs in different sectors of Bulgaria through a standardized questionnaire and were processed using SmartPLS.

Findings – The results show that top management support and digital strategy mediate the effects of both general environmental and industry-specific factors and internal antecedents (perceived barriers and digital technology usage) on DT and firm performance. The industry sector moderates the influence of digital technology usage on DT.

Research limitations/implications – This study uses cross-sectional data, which provide only a snapshot of the current state of SMEs' DT in Bulgaria.

Practical implications – The results suggest that SMEs managers should be more open to both general and industry-specific environmental signals and should rethink their strategies regarding the use of digital technologies to improve performance.

Social implications – The advancement of DT in SMEs has great social importance as it can contribute to improving the quality of life, greater employment in technology sectors and the development of more innovative products and services.

Originality/value – This study enriches the TOE model by separating the effects of environmental factors into general and industry-specific ones. It also reveals the mediating role of organizational factors between environmental factors and DT.

Keywords SMEs, Digital transformation, Environmental changes, Organizational factors, Firm performance

Paper type Research paper

Introduction

Many researchers recognize that digitalization has become an important driving force for the competitiveness of all companies, including small and medium-sized enterprises (SMEs) (Proksch, Rosin, Stubner, & Pinkwart, 2021; Low, Seah, Cham, & Teoh, 2022). Digital transformation (DT) has emerged as a successful strategy for businesses to remain



competitive. Therefore, in the digital age, SMEs are under pressure to transform their old way of working by introducing digital technologies (Kraus *et al.*, 2022). However, the adoption of such technologies constitutes a major challenge for SMEs owing to their limited financial, human, and knowledge resources (Reim, Yli-Viitala, Arrasvuori, & Parida, 2022). Many SMEs are unable to keep pace with the new digital reality and struggle to integrate digital innovation (Zhang, Xu, & Ma, 2023). The overall level of digital adaptation of SMEs is low, and SMEs lag significantly behind large companies (Cheng, Fan, & Dagestani, 2024).

Considering the economic significance of SMEs in terms of their number and share of value-added and employment in all countries, there is a need for further research on these issues (Telukdarie, Dube, Matjuta, & Philbin, 2023). Understanding the key factors for SMEs' DT could help them turn disruptive challenges into new opportunities.

However, the SMEs' DT remains an understudied topic in the literature (Dörr, Fliege, Lehmann, Kanbach, & Kraus, 2023). We know little about how these firms transform digitally, and some studies provide conflicting findings (Fayos, Calderón, Cotarelo, & Frassetto, 2023). Most studies focus on the antecedents of adopting specific types of digital and not on DT antecedents from a broader perspective (Omrani, Rejeb, Maalaoui, Dabić, & Kraus, 2024). Empirical studies on the factors that determine DT in SMEs and its influence on firm performance are insufficient (Stentoft, Wickstrøm, Philipsen, & Haug, 2020; Yu & Liu, 2023). In response to various calls for a better understanding of SMEs' DT (Soluk & Kammerlander, 2021; Verhoef *et al.*, 2021), this study aims to investigate the factors that influence DT in SMEs and their effects on SMEs' performance.

In contrast to digitization, digitalization, and Industry 4.0, the literature understands DT as a large-scale organizational change resulting from the adoption of digital technologies (Melo *et al.*, 2023). One of the most commonly used concepts for examining DT in SMEs is the TOE model (Ramdani, Raja, & Kayumova, 2021). Using this framework, studies have investigated DT as a result of a combination of three types of antecedents: technological, organizational, and environmental (Hanelt, Bohnsack, Marz, & Marante, 2021).

General environmental factors refer to changes in digital technologies, consumer needs and preferences, suppliers' and competitors' behavior, government regulations, and others (Peter, Kraft, & Lindeque, 2020). The impact of these factors on organizations differs according to the economic sector, which allows for the identification of industry-specific environmental factors (OECD, 2021; Rupeika-Apoga & Petrovska, 2022). These factors reflect changes in industry market structure and competition (Krajcik, Novotny, Civelek, & Zvolankova, 2023). Organizational factors include management support, digital strategy, employee skills, perceived benefits and barriers, culture, finance, and others (Omrani *et al.*, 2024). The technological dimension includes new technologies available to firms, internal digital resources, and digital competencies (Low *et al.*, 2022).

In line with the TOE concept, we aimed to examine the mediating role of organizational factors between environmental changes and SMEs DT. Particularly, we tested a structural model with the mediating role of top management support and digital strategy between two external and two internal antecedents and DT and firm performance. External antecedents refer to general environmental and industry-specific factors, while internal antecedents are the perceived barriers and digital technology usage. The main research questions were:

- (1) How do general and industry-specific environmental factors impact digital strategy and top management's support for DT in SMEs?
- (2) What is the influence of perceived barriers and digital technology usage on digital strategy and top management support for DT in SMEs?
- (3) Does the DT contribute to the SMEs' performance?

We also examined the moderating effects of SMEs' industry sectors (manufacturing and services) and technological level (high-tech vs. low-tech) on the relationship between digital technology usage and DT. We obtained data from 1,000 SMEs in different sectors of Bulgaria using a standardized questionnaire.

The remainder of this article is organized as follows. The literature review will extract the variables within the scope of this study and present the development of a conceptual model and hypotheses. Subsequently, we will present the research methodology, main results, discussion, and conclusions.

Literature review

The role of general and industry-specific environmental factors for DT in SMEs

General environmental factors and their combinations influence the market structure and competition in different sectors (Melo *et al.*, 2023), which allows for analyzing the specificity of DT in different industries. For example, the OECD (2021) finds significant cross-industry differences in digitalization between SMEs in knowledge-intensive and less-knowledge-intensive sectors. Other studies have shown that SMEs in the manufacturing and service industries have different characteristics that affect their DT processes (Ghobakhloo & Iranmanesh, 2021; Xie, Zhang, & Blanco, 2023).

As part of the external context, industry-specific factors influence SMEs' DT together with general environmental factors, but to different degrees. Most studies examining the impact of environmental factors on SMEs' DT often do not specify exactly which internal constructs these factors influence, with a few exceptions (Luo & Yu, 2022; Zhang, Xu, & Ma, 2023). For example, Luo and Yu (2022) investigated the mediating role of internal conditions (digital strategy, organizational capability, and leadership) between the external environment and DT, while Zhang *et al.* (2023) revealed that environmental factors indirectly affect SMEs' DT through organizational factors (top management and digital strategy). Environmental dynamics exercise pressure on SME managers to develop a vision for using new technologies and integrating them into their strategy (Ghobakhloo & Iranmanesh, 2021).

In addition to management support, strategic responses to digital disruption include the adoption of digital business and digital transformation strategies (Vial, 2019). New digital technologies require a combination of IT and business strategy into a digital business strategy (Bharadwaj, Sawy, Pavlou, & Venkatraman, 2013), whereas the digital transformation strategy goes further in the direction of DT (Matt, Hess, & Benlian, 2015).

Significance of top-management support and digital strategy for SMEs' DT

Researchers have identified the critical role of top management support for DT in terms of strategic vision and human, technological, and financial resources (Stentoft *et al.*, 2020; Luo & Yu, 2022). Considering the crucial role of leadership in defining and implementing digital strategies, Wrede, Velamuri, and Dauth (2020, p. 1551) call top managers "shapers of firm strategy." According to Kringelum, Holm, Holmgren, Friis, and Jensen (2024), it is a leadership task to identify the new requirements of a strategy to succeed with DT.

Digital strategies involve the transformation of products and services in combination with digital technologies, from a business-centric perspective (Kane, Palmer, Phillips, Kiron, & Buckley, 2015). Many researchers consider digital strategy a key internal factor for successful DT (Hess, Matt, Benlian, & Wiesboeck, 2016; Becker & Schmid, 2020). Although technology is a key precondition, this strategy plays a decisive role in DT (Kane *et al.*, 2015).

Studies reveal that SMEs' performance does not stem only from the use of new technology but also depends on an effective digital strategy supported by leaders (Verhoef *et al.*, 2021). Firms can pursue different digital strategies such as better integration with customers, greater process efficiency, and higher performance (Krajčák *et al.*, 2023). Chen *et al.*'s (2022) analysis of manufacturing SMEs shows that digital strategy and information technology positively impact SMEs' DT performance. Other studies also find that the implementation of digital strategies in SMEs significantly improves their performance (Haq & Huo, 2023).

Digital technology usage

The technological dimension of the TOE model refers to the firm's internal digital equipment as well as externally available technologies (Omrani *et al.*, 2024). Today, SMEs can use advanced digital technologies such as cloud computing, radio frequency identification (RFID), Internet of Things (IoT), big data, social media, blockchain systems, and artificial intelligence (AI) (Fayos *et al.*, 2023).

These technologies significantly impact strategic management and redefine the role of top executives in organizations (Mihu, Pitic, & Bayraktar, 2023). López-Muñoz and Escribá-Esteve (2022) use the concept of "imbrication" to explain how human agency (top management team) and material agency (digital technologies) are cooperatively involved in digitalization and shape each other over time. The involvement of executives reflects their attitudes toward digital technologies, which are critical to a firm's success (Kaariainen *et al.*, 2020). Therefore, managers need a minimum level of digital knowledge to capitalize on these technologies.

Scholars also associate the adoption of digital technologies with changes in strategy, reflecting a tight connection between technological structure and strategy. Nadkarni and Prügl (2021) found that digital technologies lead to significant changes in business models and organizational strategies. Meanwhile, Van Zeebroeck *et al.* (2023) showed that more extensive technology adoption leads to larger strategy changes. According to Zhang *et al.* (2023), digital technology induces new forms of business strategy by altering the old ways of value creation. Therefore, digital technology usage requires the renewal of an organizational business strategy (Verhoef *et al.*, 2021).

Researchers generally agree that firms' use of digital technologies increases DT (Oduro, De Nisco, & Mainolfi, 2023; Yao, Tang, Liu, & Boadu, 2024). Digital technology usage is related to the development of new skills and competencies that are crucial to a company's DT (Sousa & Rocha, 2019). Therefore, combining various digital technologies and skills is essential for DT (Vial, 2019).

Barriers to DT in SMEs

Studies have found that DT in SMEs is more challenging due to resource scarcity and a lack of technical or marketing expertise (Eller, Alford, Kallmünzer, & Peters, 2020). Researchers have indicated specific financial constraints, organizational inertia, lack of strategy, data security, privacy considerations, and others (Reim *et al.*, 2022). Regarding organizational barriers, the knowledge and perceptions of SME owners/managers play a central role in decisions regarding DT (De Mattos, Pellegrini, Hagelaar, & Dolfisma, 2023).

Effects of DT on firm performance

Empirical research on the effects of DT on firm performance is scarce (Eller *et al.*, 2020; Verhoef *et al.*, 2021) and offers controversial evidence (Luo, 2023). Some studies have demonstrated that DT can improve the quality of products and services, reduce costs, and promote innovation (Denicolai, Zucchella, & Magnani, 2021). Fayos *et al.* (2023) found that the SMEs that have already embarked on their DT are more competitive, while Bordeleau and Felden (2019) equalize "digitalization" and "performance." Luo and Yu (2022) argue that applying DT leads to an improvement in enterprise performance. Therefore, DT seems to be the best option for SMEs to grow.

Methodology

Theoretical framework

The TOE model assumes that three components of a firm's context (technological, organizational, and environmental) influence decisions to adopt new technology (Tornatzky & Fleischer, 1990). Many researchers use it to explain the adoption of new information and

digital technologies (Nguyen, Le, & Vu, 2022; Omrani *et al.*, 2024). This is because the model includes both multiple internal and external factors, which impact adoption decisions.

Based on the literature review and TOE framework, this study tests a model with the mediation roles of top management support and digital strategy between two external and two internal factors and DT, as well as the impact of these factors on firm performance (Figure 1). The model contains eight constructs and seven main hypotheses (with some sub-hypotheses):

- H1. General environmental factors influence industry-specific conditions, which affect SMEs DT
- H2. General environmental and industry-specific factors positively impact both top management support for DT (H2a and H2b) and SMEs’ digital strategy (H2c and H2d).
- H3. Top management support positively influences SMEs’ digital strategy.
- H4. Digital strategy positively impacts both SMEs’ DT (H4a) and performance (H4b).
- H5. Digital technology usage positively influences top management support for DT (H5a), digital strategy (H5b), and DT (H5c) in SMEs.
- H6. The perceived barriers negatively impact top management support for DT (H6a), digital strategy (H6b), and SMEs’ DT (H6c).
- H7. Digital transformation positively relates to firm performance.

Sample and data collection

The total number of non-financial SMEs in 2022 in Bulgaria was 393,372, of which 92.6% were micro-enterprises (0–9 employees), 6.2% were small (10–49 employees), and 1.14% were medium-sized (50–249 employees) (NSI, 2024). The study is based on a representative sample of 1,000 SMEs from the total number of SMEs with a confidence level of 95%, a population proportion of 50%, and a margin of error of ± 3.1%. It was formed by the stratified selection according to the degree of technological intensity (4 strata under the NACE Rev. 2). We divided each of these strata into three sub-groups depending on the SMEs’ size (micro-, small-, and medium-sized). For better comparability, we aimed for the distribution of SMEs by both technological intensity and size to be approximately equal. We prepared a comprehensive list of all SMEs from the national Commercial Register, indicating which stratum they fell into. We randomly selected a set number of companies for each stratum and subgroup using the SPSS software and provided about 30%–40% reserves for each stratum.

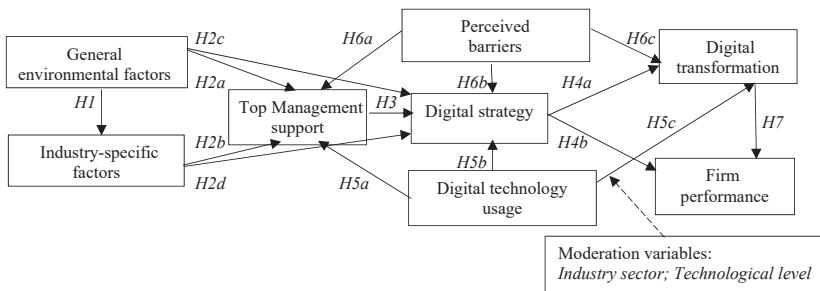


Figure 1. Conceptual model. Source: Own elaboration

We collected the data with the help of interviewers from the research agency Noema (noema.bg) through computer-assisted personal interviews. They contacted 1,461 firms with a response rate of about 68%. Thus, the sample covered 58 sectors under the NACE rev. 2: 7 high- and medium-high tech industries (208 firms); 20 medium-low and low-tech industries (277 firms); 16 knowledge-intensive services (174 firms); and 15 low-knowledge-intensive services (341 firms). The share of micro-enterprises was 41.9%, small firms were 33.4%, medium-sized – 23.6%, and large companies – 1.1%. Moreover, SMEs from manufacturing prevailed (45.0%), followed by services (31.7%), trade (19.8%), and construction (3.5%) (Appendix A, Table A1 and A2) [1].

The majority of respondents were owners/partners (33.9%) or high-level directors (37%), indicating that they were well-informed about DT in their enterprises. However, as we interviewed only one manager from each SME, we addressed the problem of common method variance (CMV) by applying Harman's one-factor test (Podsakoff, MacKenzie, Lee, & Podsakoff, 2003). We included all the construct items in a principal component factor analysis. The total variance extracted by one factor was 32.391%, indicating that the CMV was not a significant issue for this sample (Appendix A, Table A3).

The sample includes SMEs from different sectors to test a general combination of theoretically proposed factors that influence DT across industries (Prosch *et al.*, 2021; Rupeika-Apoga & Petrovska, 2022). We excluded eleven large companies (1.1%) from the model.

Variable measurement

In this study, we used a part of a larger questionnaire regarding SME digitalization in Bulgaria. It contains eight questions in the form of statements with 42 items. We measured all items on a 5-point scale, ranging from 1 (completely disagree/not at all important) to 5 (completely agree/very important). We adopted and adapted the items from previous research to include the main features of the TOE model, with a separate question on industry-specific environmental factors. We adapted general environmental factors from Luo and Yu (2022) and De Mattos *et al.* (2023) and based the industry-specific factors on the results of OECD (2021) and Krajcik *et al.* (2023). We operationalized top management support, according to Slimane, Coeurderoy, and Mhenni (2022). We took the items of digital strategy from Leischnig, Wölfel, Ivens, and Hein (2017) and the items of perceived barriers from Rupeika-Apoga and Petrovska (2022) and Müller *et al.* (2024). We adapted digital technology usage from Tsou and Chen (2021) and Hanelt *et al.* (2021) and the three items for DT from Nwankpa and Roumani (2016). Finally, we adapted the indicators of firm performance from Barba-Sánchez, Meseguer-Martínez, Gouveia-Rodrigues, and Raposo (2024). Readers may find the questionnaire with items in Appendix A (Table A4).

Before running the survey, ten SMEs' representatives assessed the questionnaire. After the pre-test with the managers of these companies, we revised and updated some questions according to the managers' feedback.

Evaluation of measurement and structural models

Evaluation of measurement model

We processed the data using the Smart PLS software. All composite variables were reflective, and we assessed the model for indicator reliability, internal consistency, convergent validity (AVE), discriminant validity (HTMT), and collinearity (Hair, Hult, Ringle, & Sarstedt, 2022). In total, we excluded 13 indicators due to low loadings (<0.7). The outer loadings of the remaining 29 indicators were above 0.7, suggesting sufficient levels of indicator reliability (Appendix B, Table B1) [2]. Cronbach's alpha for all constructs was between 0.806 and 0.903, composite reliability rho_c was between 0.873 and 0.938, the reliability coefficient rho_a was between 0.811 and 0.910, and the AVE value of all constructs was above 0.50 (Appendix B, Table B2). All

bootstrap confidence intervals for AVE, rho_c, rho_a, and Cronbach's alpha were significant (Appendix B, Tables B3-B6). The data showed good internal consistency and convergent validity.

The Fornell-Larcker criterion revealed that the square root of the AVE values of each construct was higher than the construct's highest correlation with any other construct (Appendix B, Table B7). We assumed an HTMT value of 0.85 for all construct combinations except for digital strategy and top management support. For this pair of constructs, the assumed threshold was 0.90 because they were conceptually close. Particularly in SMEs, digital strategy is impossible without management support, as it is often not formally documented, but exists in the owner/manager's mind (Kallmuenzer, Mikhaylov, Chelaru, & Czakon, 2024).

All the HTMT values were lower than the suggested threshold of 0.85 (Appendix B, Table B8). The bootstrap confidence intervals showed that the HTMT values computed from the 10,000 bootstrap samples were lower than the threshold of 0.85 for all combinations of constructs, and lower than the threshold of 0.90 for the above-mentioned pair (Appendix B, Table B9). Therefore, the model responded to the evaluation criteria, which supported the measures' reliability and validity (Appendix A, Table A5).

Evaluation of structural model

The VIF values of the predictor constructs were below 3, suggesting that collinearity was not a significant issue in the structural model (Appendix B, Tables B10-B11). The direct effects of general environmental factors on industry-specific constructs explained approximately 47% of the variance, whereas the effects of the two external factors on top management support explained almost 40% of the variance. The explained variance of digital strategy was approximately 64%, the explained variance of DT was approximately 37%, and the explained variance of firm performance was 25% (Appendix A, Table A6). These results demonstrated the model's explanatory power.

The data showed that all Q^2 prediction values were positive. The *root mean square error* (RMSE) values of the indicators of the key endogenous constructs (DT, digital strategy, and top management support) were lower than the linear regression model (LM) RMSE values (Appendix A, Table A7). The majority of indicators in the PLS analysis had smaller prediction errors than LM, which indicated medium predictive power (Hair *et al.*, 2022, pp. 200–201).

Main results

Table 1 shows the results of the model testing, which includes the standardized regression coefficients and their significance by confidence intervals.

The data showed that general environmental factors significantly influenced industry-specific factors (0.684), thus supporting H1. The two external factors (general and industry-specific) positively and significantly impacted top management support and digital strategies, which supported H2 (H2a, H2b, H2c, and H2d). Top management significantly and positively impacted digital strategy (0.518), thus supporting H3. Digital strategy significantly and positively influenced both DT and firm performance (0.308 and 0.444, respectively), confirming H4 (H4a and H4b). Digital technology usage positively influenced top management support and digital strategy (H5a and H5b), but not very strongly, whereas these technologies had a greater direct impact on DT (0.432) (H5c). The two organizational factors (top management support and digital strategy) were negatively, although not very strongly, influenced by perceived barriers. Perceived barriers also had a negative impact on DT (−0.167). These data supported H6 (H6a, H6b, and H6c). DT significantly and positively influenced firm performance (0.116), which was in line with H7.

All specific indirect effects (Appendix B, Table B12), total effects (Appendix B, Table B13), and total indirect effects were also significant, confirming the important role of both general environmental and industry-specific factors for greater management support, better digital strategy, higher DT levels, and greater firm performance (Table 2).

Table 1. Path coefficients: confidence intervals

	Path coefficients		Confidence intervals	
	Original sample (O)	Sample mean (M)	2.5%	97.5%
DT → Firm performance	0.116	0.116	0.072	0.160
Digital strategy → DT	0.308	0.307	0.269	0.345
Digital strategy → Firm performance	0.444	0.444	0.382	0.504
Top management support → Digital strategy	0.518	0.518	0.462	0.572
Perceived barriers → DT	-0.167	-0.168	-0.219	-0.115
Perceived barriers → Digital strategy	-0.093	-0.093	-0.133	-0.053
Perceived barriers → Top management support	-0.083	-0.085	-0.137	-0.033
General environmental factors → Digital strategy	0.221	0.220	0.163	0.279
General environmental factors → Top management support	0.288	0.288	0.217	0.358
General environmental factors → Industry-specific factors	0.684	0.684	0.650	0.716
Industry-specific factors → Digital strategy	0.156	0.156	0.096	0.216
Industry-specific factors → Top management support	0.381	0.381	0.309	0.452
Digital technology usage → DT	0.432	0.433	0.368	0.497
Digital technology usage → Digital strategy	0.051	0.051	0.012	0.088
Digital technology usage → Top management support	0.070	0.070	0.025	0.113

Source(s): Own elaboration

Table 2. Total indirect effects: confidence intervals

	Coefficients		Confidence intervals	
	Original sample (O)	Sample mean (M)	2.5%	97.5%
Digital strategy → Firm performance	0.036	0.036	0.022	0.050
Top management support → DT	0.160	0.159	0.133	0.186
Top management support → Firm performance	0.248	0.248	0.209	0.289
Perceived barriers → DT	-0.042	-0.042	-0.058	-0.026
Perceived barriers → Digital strategy	-0.043	-0.044	-0.072	-0.017
Perceived barriers → Performance	-0.084	-0.085	-0.109	-0.060
General environmental factors → DT	0.188	0.188	0.161	0.215
General environmental factors → Digital strategy	0.391	0.391	0.346	0.437
General environmental factors → Top management support	0.261	0.261	0.210	0.313
General environmental factors → Firm performance	0.293	0.293	0.250	0.336
Industry-specific factors → DT	0.109	0.109	0.085	0.134
Industry-specific factors → Digital strategy	0.197	0.197	0.155	0.241
Industry-specific factors → Firm performance	0.169	0.170	0.131	0.211
Digital technology usage → DT	0.027	0.027	0.012	0.041
Digital technology usage → Digital strategy	0.036	0.036	0.013	0.060
Digital technology usage → Firm performance	0.092	0.092	0.064	0.121

Source(s): Own elaboration

Discussion

Figure 2 shows the hypotheses with standardized regression coefficients and R² values (See also Appendix A, Figure 1).

According to Hanelt *et al.* (2021), enterprises are under increasing influence of external factors outside their control. The COVID-19 pandemic has strongly accelerated DT in all

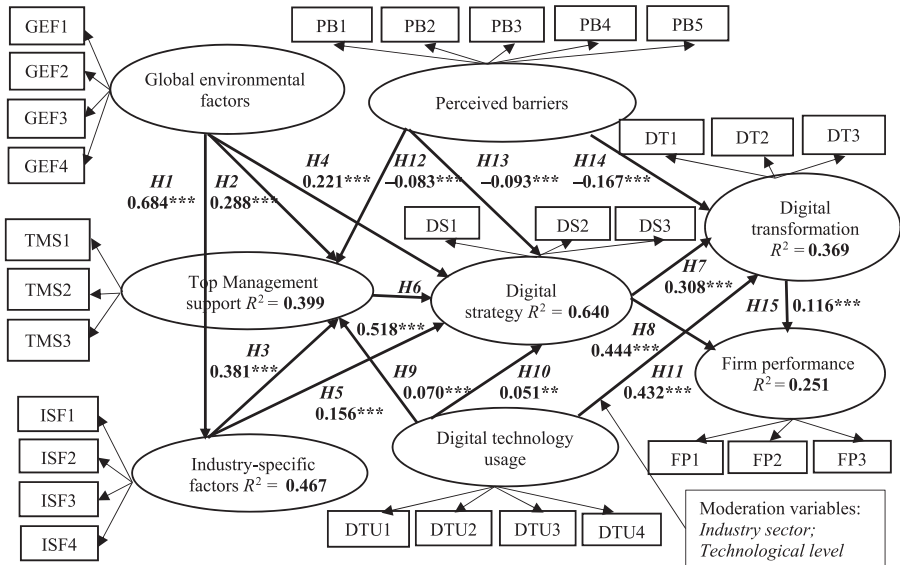


Figure 2. Model with standardized regression coefficients and R^2 (** $p < 0.05$; *** $p < 0.001$). Source: Own elaboration

companies, including SMEs (Grijalba, Hernández, Perez-Encinas, & Urda, 2024). General environmental factors have different effects on the market structure and competitors' behavior in different sectors by changing their business ecosystems into digital ones (Kraus et al., 2022). Thus, the industry's business environment also influences the technologies adopted and plays an essential role in DT (De Mattos et al., 2023).

Studies found that environmental factors induce significant changes in management and organizational strategies (Low et al., 2022; Slimane et al., 2022). The impact of these factors on top managers helps them recognize the potential benefits of DT, which in turn favors decisions towards more digitalization (Zulu, Saad, Ajayi, Unuigbe, & Dulaimi, 2023). At the industry level, digital business ecosystems also influence managers' decisions and strengthen their support towards DT (Jacobides, Cennamo, & Gawer, 2018). These data suggest that SME senior management needs a new digital mindset to successfully lead DT (Nadkarni & Prügl, 2021).

The impact of both general and industry-specific external factors on SMEs' digital strategies can help SMEs clarify the goals and direction of DT (Nair, Chellamy, & Singh, 2019). Therefore, SMEs should align environmental changes with their DT strategies. Only after transforming these changes into valuable organizational capabilities can firms succeed in DT (Zhang et al., 2023).

The adoption of new digital technologies, particularly in SMEs, is related to greater risk-taking, which requires stronger management support (new digital leadership) (De Mattos et al., 2023). Top managers' support is important for SMEs, as they are responsible for the allocation of resources to DT as well as for implementing digital strategies (Omran et al., 2024). Thus, SMEs need digitally supportive staff in higher management positions (Zulu et al., 2023). To maintain market competition in the digital age, SMEs must adopt digital strategies in which information technologies are unified with the business strategy (Scuotto, Nicotra, Del Giudice, Krueger, & Gregori, 2021). A digital strategy is necessary for SMEs to orchestrate all digital resources, while the lack of such a strategy leads to poor DT (Kallmuenzer et al., 2024; Cheng et al., 2024). The results of this study also show that we cannot separate DT from SMEs' strategies nowadays (Sagala & Óri, 2024).

The execution of a digital strategy involves the implementation of digital technologies to increase performance in many business areas. Thus, a digital strategy enhances e-collaboration capability, which improves firm performance (Chi, Lu, Zhao, & Li, 2018). According to Haq and Huo (2023), effective digital strategies and DT initiatives contribute to long-term company performance. The present data also reveal that digital strategy significantly and positively impacts both DT and firm performance.

New digital technology usage provokes transformations beyond a firm's internal processes and triggers strategic management reform (Yu & Liu, 2023). These technologies enable advanced data collection and processing, which support faster decision-making. Thus, digital technology usage significantly influences company management and requires faster decision-making, new management skills, and new (digital) leadership (Mihu *et al.*, 2023).

When digital technologies enter organizations, they interact with organizational antecedents, particularly with organizational strategies (Hanelt *et al.*, 2021; Cheng *et al.*, 2024). Tsou and Chen (2021) indicate that digital technology usage positively influences digital transformation strategy, which in turn influences firm performance. The analysis of manufacturing SMEs by Chen, Zhang, Jin, Wang, and Dai (2022) shows that digital strategy and information technology play a key role in the DT of these firms. Therefore, digital technology usage requires strategies to ensure the integration of digital technologies throughout the organization.

Researchers generally agree that digital technology usage is a key driver of enterprise DT (Kraus *et al.*, 2022; Oduro *et al.*, 2023). For example, Oduro *et al.* (2023) demonstrate that digital technologies are instrumental for firms to enhance their DT, while Sagala and Óri (2024) show that the use of digital technologies is at the core of DT to improve organizational models.

The present data reveal that the sectors moderate the influence of digital technology usage on DT. This moderation is positive and significant for manufacturing SMEs, and negative for service SMEs (Appendix B, Table B14-B15). These data support Xie *et al.*'s (2023) findings that manufacturing firms implement DT more intensively. The technology level is a positive and significant moderator of the influence of digital technology usage on DT for high-tech SMEs, whereas it is not significant for low-tech SMEs (Appendix B, Tables B16). These results are in line with the significant differences in digitalization between SMEs in high- and low-tech sectors (OECD, 2021). Therefore, the DT of SMEs also depends on their sector (Krajcik *et al.*, 2023).

The major risks for the adoption of Industry 4.0 in SMEs include a lack of expertise and a short-term strategy mindset (Moeuf *et al.*, 2019). Slimane *et al.* (2022) found that limited financial resources and weaknesses in management skills are among the main obstacles to SMEs' DT. However, Stentoft *et al.* (2020) show that Industry 4.0 barriers, such as a lack of knowledge and standards, do not have any significant connection with practicing Industry 4.0. The present data confirm their results, as they reveal weak negative impacts of perceived barriers on top management support, digital strategy, and DT.

Successful DT provides many benefits, particularly for SMEs. It may lead to better operational efficiency, improvement in business processes, cost savings, the introduction of new products, and higher organizational performance (Vial, 2019; Kraus *et al.*, 2022). Merín-Rodríguez, Dasí, and Alegre (2024) show that DT can significantly enhance the performance of SMEs, regardless of the risks and costs associated with it. Although DT can have some negative outcomes (e.g., employee resistance and high investments), most studies found a positive association between DT and firm performance (Fayos *et al.*, 2023; Kallmuenzer *et al.*, 2024). In line with these studies, the present results also suggest that SMEs should implement DT to improve their performance.

According to our data, top management support partially mediates the influence of general environmental and industry-specific factors on digital strategy and fully on DT and firm performance. Moreover, digital strategy fully mediates the impact of general and industry-

specific factors and top management support on DT and firm performance. It also partially mediates the effects of perceived barriers and digital technology usage on DT.

These results confirmed the findings of previous studies on the mediating role of organizational factors between environmental factors and DT. For example, [Luo and Yu \(2022\)](#) found that internal conditions mediate the relationship between the external environment and DT. [Zhang et al. \(2023\)](#) showed that DT strategy fully mediates the relationship between IT infrastructure and enterprise DT, whereas [Tsou and Chen \(2021\)](#) demonstrated that DT strategy and organizational innovation play full mediating roles between digital technology usage and firm performance. [Yao et al. \(2024\)](#) revealed that digital strategic consensus partially mediates the positive impact of digital leadership on DT.

Conclusions

Theoretical implications

The results support the theoretical proposals of other researchers regarding DT by providing empirical evidence ([Vial, 2019](#); [Kraus et al., 2022](#); [Hanelt et al., 2021](#); [De Mattos et al., 2023](#); [Dörr et al., 2023](#)). We may summarize these proposals as follows. Environmental disruptions and changes in the industry sectors require strategic responses in terms of higher management support, digital strategy implementation, and digital technology usage, which enables new models of value creation along with the effects of perceived barriers and other organizational factors on DT.

In particular, the study enriches the TOE model by separating environmental factors into general and industry-specific factors for the first time. Based on this, we tested a structural model with the mediating role of top management support and digital strategy between these external factors, digital technology usage, and perceived barriers to DT and firm performance.

The results showed that general environmental factors influence industry-specific factors, and together as external forces, they directly and positively impact top management support and SMEs' digital strategies. These two types of environmental factors contribute significantly and positively, albeit indirectly, to SMEs' DT and firm performance. [Plekhanov, Franke, and Netland \(2023\)](#) also argue that DT ultimately results in tight interconnectivity with the external environment, implying that firms must redefine their internal and external boundaries.

In line with the findings of a few studies ([Zhang et al., 2023](#); [Yao et al., 2024](#)), this study confirms the mediating role of organizational factors (top management support and digital strategy) between environmental factors and DT and firm performance. It also revealed that the DT process in SMEs is industry-specific.

Future research could explore the impact of the identified factors in individual sectors, different size groups of SMEs, and different country contexts.

Practical implications

The influence of environmental factors on SME managers' decisions suggests that they should be more open to environmental signals by paying more attention to market changes in their sectors, including the behaviors of competitors, suppliers, and customers. Other researchers have shown that managers' openness fosters the detection of innovation opportunities ([Slimane et al., 2022](#)). Thus, the strategic task of SMEs should be to develop digital leadership capabilities as an adequate response to environmental changes. In general, SMEs' management concentrates on the owners' hands, which implies that the digital strategy or plan is in their head ([Kallmuenzer et al., 2024](#)).

However, as [Dörr et al. \(2023\)](#) observe, many SMEs do not have a digital strategy, which can hinder their efforts to implement DT. Therefore, SMEs' managers need to be aware that successful DT relies on a clear digital business strategy ([Kane et al., 2015](#)). In particular, managers of low-tech and low-knowledge-intensive firms, which predominate in Bulgaria and other less developed EU countries, should be convinced about the benefits of new digital technologies.

In this regard, the role of the government is important. The SME managers should receive encouragement to apply more actively to the various European and national financial and expert support programs (Scuotto *et al.*, 2021). This support should aim both at raising SME managers' awareness of DT and at training employees in digital skills. Without such support and training, the use of digital technologies as a key factor for DT and company performance will be significantly hampered. For its part, the government should facilitate the application of these programs, which people often perceive as excessively bureaucratic. The advancement of DT in SMEs also has great social significance as it can contribute to improving the quality of life, increasing employment in the technology sectors, and developing more innovative products and services.

This study had several limitations. First, we used only two external and four internal antecedents and determinants of SMEs' DT. Additional factors would provide a more comprehensive understanding of this process. Especially, we did not include specific cultural and economic influences that may be important for the DT of SMEs in this country. Second, we used cross-sectional data, which provides a snapshot of the current state of DT in Bulgarian SMEs. These SMEs are of quite different sectors and sizes, which may potentially distort the results and make them difficult to interpret unambiguously. Further well-target longitudinal and international comparative studies would provide more detailed data on DT changes in SMEs.

Notes

1. Tables in the [Appendix A](#) include: sample characteristics; distribution of sample SMEs by technology intensity and size; Harman's single factor analysis; questionnaire with items; summary for measurement model; R-square adjusted – Confidence intervals; PLSpredict MV summary; model with the names of items of each construct and the hypotheses, and are available online at: [Supplementary material Appendix A](#).
2. Tables in the [Appendix B](#) come from the model's assessment by SmartPLS, and are available online at: [Supplementary material Appendix B](#)

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Further reading

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Supplementary material

The supplementary material for this article can be found online.

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