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Relationship Between Digital Transformation and Sustainable Competitive Advantage: a Moderated Mediation Model among Banking and Insurance Institutions

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Abstract :

This study examines the relationship between digital transformation (TDI) and sustainable competitive advantage (SCA), focusing on the mediating role of innovation capacity (CIN) and the moderating effect of organizational support for learning (SOR) in the banking and insurance sectors in Tunisia. Based on a survey of 203 managers, the findings indicate that TDI significantly enhances innovation capacity. SOR also positively influences CIN and moderates its relationship with TDI - suggesting that strong support may dampen the direct effect of digital initiatives on innovation outcomes. Interetingly, CIN shows a slightly negative yet marginally significant impact on SCA, implyung that higher levels of innovation may paradoxically erode long-term competitive positioning. Moreover, the indirect effect of TDI on SCA -nmediated by CIN - is also contingent upon the level of SOR. Despite certain limitations, this study has important theoretical and managerial implications.

Keywords: digital transformation, innovation, capability, organizational support, sustainable competitive advantage.

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I. Introduction

In an increasingly volatile and complex environment, sustaining a competitive advantage over time has become a strategic imperative. This concept, initially introduced in [4] and later expanded in [9], emphasizes the creation of resources and skills that are difficult to imitate and substitute, enabling a company to stand out in the long term.

Among the most transformative forces driving organizational change today is TDI. The rise of advanced technologies - including artificial intelligence, big dataanalytics, and the Internet of Things - has fundamentally altered not only internal business processes but also how firms interact with their broader ecosystem [1]. This digital shift is reshaping how organizations innovate, differentiate themselves, and respond to increasingly sophisticated market demands.

In Tunisia, the banking and insurance sectors—historically viewed as conservative—are undergoing a rapid digital transition. Facing heightened competition and evolving customer expectations, firms in these sectors have been compelled to accelerate their modernization efforts.

One of the most significant outcomes of TDI is its potential to enhance a firm's capacity for innovation. CIN refers to an organisation's ability to transform its resources and knowledge into new products, services, or processes. The relationship between innovation and digital transformation cannot be fully leveraged without SOR. This support encompasses all practices aimed at fostering the continuous acquisition of knowledge—through training, mentoring, or the promotion of a learning culture. In an evolving technological landscape, learning support becomes a strategic lever that enhances firms' adaptive capacity and, in turn, their competitive advantage.

Despite the growing body of literature on TDI and organisational innovation, few studies have integrated these elements within a systemic analytical framework. Specifically, there is limited research examining the interplay between TDI, CIN, and SOR in fostering SCA.

Much of the existing literature approaches these dimensions in a fragmented manner. For instance, the work of Martínez-Caro et al. [7] is notable, yet they often overlook the interdependence of these factors and the potential moderating role of learning support in the relationship between digitalisation and innovation. This lack of integration hinders a comprehensive understanding of the mechanisms through which firms can leverage digital technologies to achieve sustainable differentiation. This gap highlights the need for targeted empirical investigation and leads to the following central research question : ***What is the effect of digital transformation on firms' sustainable competitive advantage?***

This study investigates how TDI affects SCA, considering the moderating role of SOR and the mediating role of CIN.

To address the research question, the study begins with a comprehensive literature review to develop the research hypotheses. This is followed by a detailed presentation of the research methodology. The subsequent sections present the empirical findings, discuss the results, and conclude with implications for theory and practice.

II. Literature review and hypotheses development

A. The Impact of TDI on CIN

TDI—encompassing the adoption of new technologies and the implementation of digital strategies—plays a critical role in enhancing firms' innovation capabilities. It encourages the rise of knowledge-intensive

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processes and services, bolstering firms' global competitiveness through the exploitation of big data, analytics, and business intelligence tools [6]. More specifically, digitalization is revolutionizing entire industries by reshaping lifestyles, value chains, and operational frameworks. For some researcher the adoption of digital processes directly enhances organizational competitiveness by improving both innovation outcomes and operational efficiency. Otherwise, TDI influences not only technological implementation but also the formulation of innovation strategies, thereby strengthening overall business performance. These findings underscore the catalytic role of TDI in fostering organizational innovation.

Zhang et al. [17] further highlight the impact of TDI on innovation efficiency in construction firms operating under carbon neutrality objectives. They found that digitalization enhanced firms' innovation levels by easing financing constraints, improving human capital, and facilitating access to knowledge.

From the perspective of RBV theory, capabilities such as innovation, technology integration, and knowledge management are core strategic assets that underpin long-term competitiveness. In digitally transforming environments, the ability to innovate becomes a key dynamic capability that enables firms to respond effectively to external change. In light of this evidence, we propose the following hypothesis: **H1**: TDI has a positive effect on a company's CIN.

B. The Effect of CIN on SCA

Empirical evidence confirms the positive influence of CIN on firm competitiveness. In a more recent contribution, Shahzad et al. [12] examined the relationship between CIN and competitiveness in market-oriented firms, particularly in the pharmaceutical sector. They highlighted the mediating role of supply chain and marketing-technical integration in reinforcing CIN, which in turn boosted firm competitiveness.

Theoretically, CIN is widely recognized as a strategic resource within the RBV. Theory. It enables firms to differentiate themselves, respond quickly to environmental change, and develop hard-to-imitate solutions. Innovation is thus not merely a performance-enhancing activity; it is a source of long-term, SCA.

Based on these insights, the following hypothesis is proposed: **H2**: A company's CIN has a positive effect on its SCA.

C. The Strategic Effect of TDI on SCA

According to Martínez-Caro et al. [7], digital technologies—such as information systems, connectivity tools, and IT infrastructure—enable firms to enhance internal efficiency, reconfigure customer experiences, and rethink traditional business models. These capabilities contribute to firms' ability to outperform competitors and adapt to evolving market demands. Verhoef et al. [15] emphasize that integrating digital tools into all aspects of operations and strategy enhances a firm's capacity to respond to environmental challenges. Technologies like cloud computing, big data analytics, and social platforms offer opportunities to improve profitability and operational flexibility [11]. These tools enhance agility, responsiveness, and resilience in globalized, competitive environments [10], [2], [3]. In addition, TDI improves information flow and managerial efficiency, thereby reducing innovation-related risks and strengthening competitive positioning [15], [5]. It is vital for sustaining competitiveness in rapidly evolving markets [8], [14]. The process also entails developing new capabilities that allow firms to sense and seize opportunities while responding effectively to threats—core elements of DCT . Based on this reasoning, we propose the following hypothesis: **H3:** TDI has a positive effect on a company's SCA.

D. The Moderating Role of SOR

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SOR plays a critical role in enhancing the outcomes of TDI, particularly with regard to CIN. This form of support encompasses formal and informal initiatives—such as training programs, coaching, mentorship, resource allocation, and a culture that promotes continuous learning. In a digital context marked by rapid technological evolution, such support is essential for ensuring that employees are able to understand, adopt, and maximize the potential of digital tools.

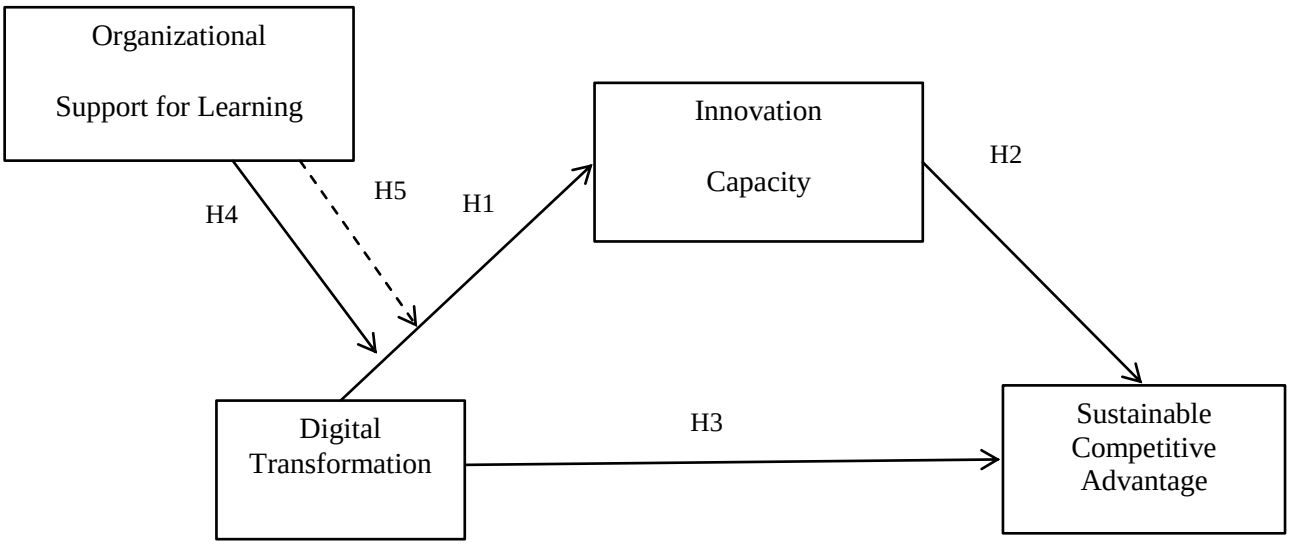
Previous research also suggests that learning support plays a role in facilitating open innovation, promoting cross-functional knowledge sharing, and encouraging the exploration of new ideas [16]. It helps organizations shift from reactive adaptation to proactive innovation—transforming TDI from a technical upgrade into a strategic opportunity.

From the perspective of DCT, SOR is a key enabler of adaptation and renewal. It allows firms to reconfigure internal resources in response to digital disruption, ultimately enhancing their innovation potential and competitiveness. Furthermore, SOR can moderate the relationship between TDI and CIN. When such support is strong, employees are more likely to engage in learning behaviors, apply new technologies creatively, and contribute to product and process innovation. In contrast, in the absence of learning support, TDI may result in technological upgrades without corresponding innovation gains. Based on this theoretical and empirical foundation, the following hypotheses are proposed : **H4**: SOR positively moderates the relationship between TDI and CIN.

H5: SOR moderates both the direct and indirect effects of TDI on CIN.

The development of these hypotheses leads us to propose the following conceptual model (figure 1).

Fig. 1. Conceptual model



III. Methods

This study employed a structured questionnaire as the primary method of data collection. The sample presented in the table below, consisted of 203 managers from the banking and insurance sectors in Tunisia. Data were collected during the first quarter of 2025.

Table I

Main Characteristics of the Sample

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	Banking sector		Insurance sector	
	Ferquency	Percentage (%)	Ferquency	Percentage (%)
Directors	25	24.27	25	25
Assistant directors	25	24.27	25	25
Department heads	25	24.27	15	15
Technical experts	20	19.41	25	25
Cashiers and documentalists	8	7.78	10	100
Total	103	100%	100	100%

All participants demonstrated a high level of awareness regarding the strategic importance of TDI within their respective sectors. A convenience sampling technique was employed, selected for its ease of implementation, cost-effectiveness, and adaptability given time and access constraints. To ensure the robustness of our measurement instruments, we adopted scales that have been validated in prior research.

All variables were measured using a five-point Likert scale, ranging from 1 ("strongly disagree") to 5 ("strongly agree") and valudated in previous studies. TDI, SCA, and CIN were measured using scales adapted from [13]. For SOR, it was measured using a five-item scale developed by [13].

IV. Results

A. *Exploratory Findings*

The analysis of the metric properties of the scales used in this study supports their strong psychometric quality.

Table II

Overview of Variable Metric Properties

Variable	Cronbach's alpha	KMO index	Eigenvalue	Factor saturation	Variance explained (%)
Digital Transformation	0.968	0.895	5.177	0.814-0.889	86.29%
Organizational Support for Learning	0.892	0.892	4.837	0.688-0.901	80.62%
Capacity for Innovation	0.929	0.765	3.320	0.783-0.904	83.01%
Sustainable Competitive Advantage	0.919	0.611	3.809	0.526-0.874	76.17%

B. Testing assumptions

To test our hypotheses, we used Hayes Process Macro Model 7. The analysis emphasizes the importance of the overall model summary, detailed as follows :

- ✓ The overall model fit is strong, with $R = 0.9738$, $R^2 = 0.9482$, $F(3, N) = 1214.73$, $p < 0.0001$, indicating that the model explains approximately 95% of the variance in CIN.
- ✓ The following results were obtained:
  - ➢ TDI has a significant positive effect on CIN *($b = 0.8546$, $t = 31.20$, $p < 0.001$)*, supporting **H1**.
  - ➢ SOR also significantly influences CIN *($b = 0.7820$, $t = 3.95$, $p = 0.0001$)*.
  - ➢ The interaction term TDI × SOR (Int_1) has a significant negative effect on CIN *($b = -0.0283$, $t = -2.25$, $p = 0.0253$)*, indicating a moderating effect.

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- The Johnson-Neyman technique revealed no statistically significant transition points within the observed range of the moderator. Thus, the moderating effect of SOR on the relationship between TDI and CIN is consistent across levels of SOR.

- ✓ There are no statistically significant transition points in the observed moderator interval found using the Johnson-Neyman method (tables 3 and 4 summarize these effects).

Table 3 presents the conditional effects of the focal predictor TDI at specific values of the moderator SOR.

Table III

Conditional effects of focal predictor on moderator values (s)

SOR	Effect	SE	T	p	LLCI	ULCI
-1.2997	0.8913	0.0222	40.0692	0.000	0.8474	0.9352
0.000	0.8546	0.0274	31.1974	0.000	0.5005	0.9086
1.2997	0.8178	0.0392	20.8628	0.000	0.7405	0.8951

Table 4 presents the conditional effects of TDI on SCA at various levels of the moderator, SOR.

Table IV

Conditional effect of focal predictor at values of the moderator

SOR	Effect	SE	T	p	LLCI	ULCI
-2.3654	0.9214	0. 0261	35.2999	0.0000	0.8699	0.9729
-2.1749	0.9160	0.0249	36.7354	0.0000	0.8668	0.9652
-1.9844	0.9106	0.0240	38.0208	0.0000	0.8634	0.9579
-1.7939	0.9053	0.0232	39.0675	0.0000	0.8596	0.9509
-1.6034	0.8999	0.0226	39.7851	0.0000	0.8553	0.9445
-1.4130	0.8945	0.0223	40.0967	0.0000	0.8505	0.9385
-1.2225	0.8891	0.0223	39.9570	0.0000	0.8452	0.9330
-1.0320	0.8837	0.0225	39.3639	0.0000	0.8395	0.9280
-0.8415	0.8783	0.0229	38.3602	0.0000	0.8332	0.9235
-0.6511	0.8730	0.236	37.0230	0.0000	0.8265	0.9195
-0.4606	0.8676	0.0245	35.4471	0.0000	0.8193	0.9158
-0.2701	0.8622	0.0256	33.7269	0.0000	0.8118	0.9126
-0.0796	0.8568	0.0268	31.9448	0.0000	0.8039	0.9097
0.1108	0.8514	0.0282	30.1651	0.0000	0.7958	0.9071
0.3013	0.8460	0.0298	28.4336	0.0000	0.7874	0.9047

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0.4918	0.8407	0.0314	26.7796	0.0000	0.7788	0.9026
0.6823	0.8353	0.0331	25.2197	0.0000	0.7700	0.9006
0.8727	0.8299	0.0349	23.7616	0.0000	0.7610	0.8988
1.0632	0.8245	0.0368	22.4063	0.0000	0.7520	0.8971
1.2537	0.8191	0.0387	21.1512	0.0000	0.7428	0.8955
1.4442	0.8138	0.0407	19.9914	0.0000	0.7335	0.8940
1.6346	0.8084	0.0427	18.9204	0.0000	0.7241	0.8926

Further analysis yielded the following model summary: R = 0.3272, R^2 = 0.1071, MSE = 1.1867, F(2, 200) = 11.99, p < 0.0001. This indicates that approximately 10.7% of the variance in SCA is explained by the model.

The key result is as follows: TDI has a significant positive effect on SCA *(b = 0.8402, t = 2.93, p = 0.0038)*, thereby supporting **H3**. Table 5 provides a summary of the model used to test Hypotheses 2 and 3.

Table V

A summary of the model used to test Hypotheses 2 and 3.

	Coef	**SE**	**T**	**p**	**LLCI**	**ULCI**
Constant	5.5746	1.0583	5.2673	0.0000	3.4877	7.6616
TDI	0.8402	0.2866	2.9314	0.0038	0.2750	1.4053
CIN	-0.5639	0.2942	-1.9164	0.0567	-1.1441	0.0163

Hypothesis 2 is not supported but H3 is supported.

Importantly, the findings also reveal a moderating effect of SOR, which appears to weaken the relationship between TDI and SCA. Therefore, **H4** is not supported. The indirect effect of TDI on SCA—potentially mediated by CIN and moderated by SOR—has not yet been fully examined.

To address this, the direct effect of TDI on SCA was analyzed and found to be positive and statistically significant:
Effect = 0.8402, SE = 0.2866, t = 2.9314, p = 0.0038, 95% CI [0.2750, 1.4053].

Further analysis of the indirect and conditional (moderated) mediation effects is therefore necessary to fully understand the role of SOR in this relationship. We find 0.8402 as the effect, 0.2866 as SE, 2.9314 as T, 0.0038 as p, 0.2750 (LLCI), and 1.4053 (ULCI).

The way in which SOR influences the indirect effect of TDI on SCA—with CIN as the mediator—is summarized in Table 6.

Table VI

Conditional Indirect Effects of TDI on SCA (Mediated by CIN)

SOR	Effect	BootSE	BootLLCI	BootULCI

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-1.2997	-0.5026	0.2315	-0.9477	-0.0393
0.0000	-4.819	0.2206	-0.9041	-0.0379
1.2997	-0.4612	0.2100	-0.8626	-0.0370

The final step in the analysis involves testing whether SOR significantly moderates the indirect effect of TDI on SCA via CIN. Specifically, we assess whether the strength of this indirect effect varies depending on the level of the moderator—an effect known as moderated mediation.

This is evaluated using the Index of Moderated Mediation, which tests whether the slope of the conditional indirect effect significantly differs from zero. A significant index indicates that the indirect effect is contingent upon the moderator. The results show that the index is statistically significant: (Index = 0.0159, BootSE = 0.0104, BootLLCI = 0.0004, BootULCI = 0.0402).

Since the 95% bias-corrected bootstrap confidence interval does not include zero, we conclude that the indirect effect of digital transformation on sustainable competitive advantage is significantly moderated by SOR.

Finally, Table 7 provides a comprehensive overview of the moderated mediation analysis results, along with the direct and indirect relationship hypotheses tested in this study.

Table VII

Summary of Moderated Mediation Results and Hypotheses on Direct and Indirect Relationships

Direct relations	Unstandardized coefficient	T values
TDI → CIN	0 ,8546	31,1974
CIN → ACD	-0,5632	-1,9164
TDI → ACD	0,8402	2,9314
TD * SOR → ACD	-0,0283	-2,2543

Indirect relations	Direct effect	Indirect effect	Confidence interval (low/High)	T value
TDI → CIN → ACD	0,8402	-0,4819 (0,2206)	-0,9041 (-0,379)	-2,1845
Probing Moderated Indirect relationship	effect	SE	Confidence interval low/high	T statistic
Low level of SOR	-0,5026	0,231	-0,9477/-0,0393	-2,1767
High level of SOR	-0,4612	0,210	-0,8626/-0,0370	-2,1962
Index of Moderated Mediation	0,0159	0,0104	0,0004/0,0402	1,528

- ✓ **H5** proposes that the indirect effect of digital transformation on SCA through CIN is moderated by SOR. It is supported, as evidenced by the significant moderated mediation index (index = 0.0159, 95% CI [0.0004, 0.0402]), with the confidence interval excluding zero.

V. Discussion

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This study investigates the impact of TDI on companies' SCA by focusing on two critical mechanisms: (i) the mediating role of CIN and (ii) the moderating role of SOR. Each hypothesis was empirically tested, and the following discussion analyzes the results and their theoretical and managerial implications.

H1 is strongly supported, demonstrating a positive and significant effect of TDI on CIN. The notably high coefficient highlights the robustness of this relationship, confirming digital initiatives as essential catalysts for innovation. These results are consistent with [5], who found digitization facilitates the creation and global adoption of innovative products and services.

The positive influence of TDI on CIN can be explained by several mechanisms. Integration of digital technologies improves management of vast data sets, enabling better market trend analysis and faster innovation cycles. Adoption of advanced tools like artificial intelligence and the Internet of Things provides companies with novel ways to develop products and services.

Contrary to expectations, H2, positing that CIN leads to SCA, was rejected. The analysis revealed a marginally significant *negative* relationship, suggesting that in certain contexts, higher CIN might reduce SCA. This contradicts much prior research emphasizing innovation as a key strategic lever.

Several explanations are possible. Innovation poorly aligned with market needs or costly to implement may reduce competitiveness. Lack of a clear innovation strategy or inefficient resource management can dilute innovation efforts, undermining stability. Moreover, frequent or rapid innovation without proper control can disrupt organizational processes, negatively impacting competitive position. Some firms may suffer from "innovation overload," spreading resources thinly across initiatives not aligned with long-term strategy, thereby weakening their competitive advantage.

H3 is confirmed, supporting the idea that TDI strengthens long-term competitiveness by enhancing adaptability and performance. Our results echo findings by [15], [11] who highlight how digital technologies like cloud computing and big data increase profitability and flexibility. The positive effect on SCA is explained by improved operational efficiency, market responsiveness, and customer experience personalization. This resonates with dynamic capabilities framework, which underscores the necessity for organizational agility in rapidly evolving technological landscapes.

Regarding the moderating role of SOR, the results are nuanced. While SOR moderates the indirect effect of TDI on SCA via CIN, partially validating Hypothesis H5, it does not significantly moderate the direct relationship between TDI and CIN, thus H4 is rejected.

The lack of moderation in H4 contrasts with [16], who emphasized learning culture as crucial for enhancing innovation in digital contexts. This suggests that other organizational factors—such as structure or strategic vision—may play more prominent roles. However, the significant moderated mediation in H5 aligns with the findings of several researchers who highlighting that organizational environments fostering learning amplify the benefits of CIN.

SOR creates a setting where employees not only adopt new technologies but also leverage them innovatively. Yet, this support alone may not be sufficient to directly influence the impact of TDI on CIN. This discrepancy could stem from varying degrees of learning culture maturity across organizations.

The significant moderated mediation effect implies that innovation as a complex process thrives in learning-oriented environments, allowing companies to better exploit digital technologies and enhance competitiveness. This concurs with [7], who emphasize the synergy between digital integration and continuos organizational learning inu SCA.

Theoretical Implications

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This study contributes to the literature by confirming TDI as a lever for CIN (H1), consistent with [5] and [6]. The unexpected negative effect of CIN on SCA (H2) suggests this relationship is complex and context-dependent, meriting further investigation into internal resource management and adaptive capabilities.

The confirmation of H3 and H5 reinforces the applicability of dynamic capabilities theory (Teece, 2007) in explaining how digital transformation and organizational learning jointly shape competitive advantage.

Managerial Implications

For managers, the validated hypotheses highlight several strategic priorities. Investment in digitization—especially AI and big data—is essential to enhance CIN (H1). However, managers should avoid assuming innovation automatically leads to competitive advantage, remaining mindful of risks related to rapid innovation and potential overload (H2).

The positive impact of digital transformation on sustainable competitive advantage (H3) underscores the need to adapt business models alongside technology adoption. Though H4 was not supported, H5 emphasizes that fostering strong SOR is critical to fully leverage innovation potential and competitive gains from digital transformation.

VI. Conclusion

TDI, CIN, and SOR are interdependent drivers of SCA. In a fast-evolving, competitive environment, firms must combine unique resources with adaptive learning cultures to maintain a lasting competitive edge.

While TDI unlocks innovation opportunities, optimizing SOR is crucial. Poorly implemented support can stifle agility and creativity, whereas targeted, effective support enhances exploitation of digital technologies and competitive sustainability.

This study has limitations: the regression model leaves substantial variance unexplained, suggesting other factors such as organizational culture, leadership, or industry effects warrant examination. The cross-sectional design also limits insight into long-term dynamics, highlighting the need for longitudinal studies.

Future research should deepen understanding of these complex relationships, incorporating moderating and mediating variables and contextual elements like digital maturity, firm size, and culture to enrich theory and practice.

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