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Article

Effects of digital technology capability on enterprise innovation performance: Mediating effects of network responsiveness and moderating effects of environmental dynamism

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Abstract: In today's highly competitive environment, enterprises strive for competitive advantages by actively responding to changes in the network environment through digital technology. This approach fosters continuous innovation and establishes new paradigms by creating new network structures and relationships. However, research on the relationship and transmission mechanisms between digital technology and innovation performance in dynamic environments is still in its early stages, which does not fully address the demands of current social practice. Therefore, exploring the impact mechanisms of digital technology applications on enterprise innovation performance is an important research area. Based on the dynamic capability theory, this paper utilized SPSS 26.0 and AMOS 24.0 software to conduct an empirical analysis of 490 valid samples from the network perspective, exploring the pathways through which digital technology capability influences enterprise innovation performance. The results indicate that (1) digital technology capability is positively correlated with enterprise innovation performance; (2) digital technology capability is positively correlated with network responsiveness; (3) network responsiveness is positively correlated with enterprise innovation performance; (4) network responsiveness plays a mediating role in the impact of digital technology capability on enterprise innovation performance; (5) environmental dynamism positively moderates the relationship between digital technology capability and enterprise innovation performance. This paper enhances the understanding of how digital technology capability influences enterprise innovation performance in dynamic environments, offering new insights for future research. The results suggest that enterprises should focus on enhancing their digital technology capabilities, optimizing network structures, and strengthening network relationships to drive digital innovation.

Keywords: digital technology capability; network responsiveness; enterprise innovation performance; environmental dynamism

1. Introduction

The current era is a digital one, in which the application of digital technology has exerted a profound impact on human society and life, fueling the rapid expansion of the digital economy and driving significant changes in business models. Digital technology has triggered a shift towards quantified market information, increased customer diversity, and innovative value creation, creating new production, organizational, and marketing approaches. Consequently, the role of digital technology in societal and economic development and innovation has become increasingly pronounced (Wu and Yan, 2021).

However, the acceleration of the global spread of COVID-19 in 2020 and 2021 has severely impacted the real economy in the short term. The COVID-19 pandemic

disrupted offline interactions among enterprises, damaged pre-existing industrial structures and social networks, weakened or even cut off links within social networks, and led to an insufficient supply of resources required in production. In addition, traditional sales channels were significantly affected. In contrast, the development of a wide range of information and communication technologies and online services has accelerated considerably. Numerous enterprises adopted digital technologies and flexible management models to navigate the network disruptions caused by COVID-19. Digital technology has facilitated the restoration and strengthening of weakened network connections and enabled enterprises to optimize and restructure their network relationships, creating high-quality resource delivery channels that support innovative digital business models. Moreover, digital technologies have supported the development of additional service layers, resulting in additional revenue and reinforcing customer relationships.

Previous research has shown that digital technology alone is insufficient to create value; instead, it must be integrated into a broader business value-creation process. While there is no clear definition of the mechanism by which digital technology improves innovation performance (Martinez-Caro et al., 2020), Kamalaldin et al. (2020) found that digital technology changes the overall structure of business models, particularly concerning value propositions and corporate relationships. Nambisan et al. (2019) suggest that digital technologies encourage manufacturing enterprises to generate new value and develop relationships with network members in their servitization process by accelerating the delivery of integrated products and services. Cai et al. (2019) argue that digital technology can enhance communication among diverse participants, promoting cooperation and facilitating access to vital resources such as capital and knowledge, thus improving enterprise innovation performance. Tao et al. (2016) believe that rapid technological change and market shifts have diversified and complicated the relationships between enterprises and stakeholders, leading to the restructuring of traditional vertical chain networks. Chi et al. (2020) confirmed that environmental turbulence moderates the relationship between digital business strategy and organizational restructuring.

Despite these insights, there remains a lack of research on the specific mechanisms by which digital technology capabilities impact enterprise innovation performance. The environmental dynamism caused by COVID-19 has inflicted substantial damage on enterprise social networks, which has led enterprises to explore new methods of utilizing digital technology to enhance network responsiveness and further improve enterprise innovation performance. Therefore, based on dynamic capability theory, this paper constructs a conceptual model with digital technology capability as the independent variable, enterprise innovation performance as the dependent variable, network responsiveness as the mediating variable, and environmental dynamism as the moderating variable. The inclusion of environmental dynamism as a moderating variable enables a nuanced analysis of how varying levels of digital technology capability influence enterprise innovation performance across different environmental contexts, thereby contributing to a deeper understanding of theoretical frameworks in this area.

2. Literature background and hypotheses development

2.1. Dynamic capability theory

Dynamic capabilities refer to the ability of an enterprise to integrate, build, and reconfigure internal and external resources to adapt to the rapidly changing external environment (Teece et al., 1997). Unlike ordinary capabilities that function in production processes to complete basic tasks such as management and operation, dynamic capabilities are high-level abilities that guide other capabilities and resources, involving advanced activities including sensing, seizing, and transforming to maintain enterprise adaptability (Wang et al., 2024). Khin and Ho (2019) suggest that digital technology capability is an essential dynamic capability, which plays an important role in digital transformation and innovation. Based on the dynamic capability theory, Zhu et al. (2020) explored the effect of digital technology on business model innovation in new startups. Therefore, this paper adopts the dynamic capability theory to analyze how enterprises use digital technology capabilities to overcome spatial barriers and restore connections between network members in the digital age.

2.2. Digital technology capability and innovation performance

Fichman et al. (2014) describe digital technology capability as the ability of enterprises to deeply integrate digital technology with traditional physical components to accelerate technological and product innovation. This definition emphasizes the significant impact of digital technology capabilities on enterprise innovation. Elia et al. (2021) and Zhuang et al. (2020) view digital technology capability as the ability to obtain relevant resources and information through the application of digital technology, thereby improving the competitive advantage of enterprises.

Saunila (2016) defines innovation performance as the overall effectiveness generated by technological, product, and service innovation, while Blichfeldt and Faullant (2021) highlight the profound impact of digital technologies on enterprise innovation performance. According to Zhu and Kraemer (2005), a higher degree of digital technology development increases the likelihood that organizations will develop valuable and sustainable digital technology capabilities, thus enhancing value creation and improving enterprise performance. Based on these arguments, this paper proposes the following hypothesis:

H1: Digital technology capability has a significant positive (+) influence on enterprise innovation performance.

2.3. Digital technology capability and network responsiveness

Gulati and Puranam (2009) define network responsiveness as the behavioral process by which enterprises identify and capitalize on development opportunities in response to evolving external network characteristics. Kleinbaum and Stuart (2014) divided network responsiveness into network adaption and network coordination. They describe network adaption as the activity of severing outdated connections and forming new ones as internal and external network structures change. Network coordination involves activities, such as the interaction, maintenance, and strengthening of internal and external network relations, that strengthen interactions

among network members, improving trust and ensuring efficient sharing of material and information resources.

From the perspective of network adaption, digital technology capability enhances openness and reshapes social network structures, fundamentally transforming the degree, scale, and scope of enterprise interactions (Nambisan et al., 2019). This reshaping is reflected in the increased sharing of boundary resources and the open exchange of knowledge among network actors in product and service development projects. In terms of network coordination, digital technology capability enables stronger and more efficient relationships among network members. Zhuang et al. (2016) explored the impact of information technology capability on the quality of the relationship between enterprises and partners, demonstrating that higher levels of information technology capability contribute to improved quality in cooperation relationships between enterprises, particularly through formal governance mechanisms. Based on this, the following research hypotheses are proposed:

H2: Digital technology capability has a significant positive (+) influence on network responsiveness.

H2a: Digital technology capability has a significant positive (+) influence on network adaption.

H2b: Digital technology capability has a significant positive (+) influence on network coordination.

2.4. Network responsiveness and innovation performance

Network responsiveness reflects the reactive behavior of enterprises in adapting to environmental changes, facilitating the reconfiguration of their resources and value chains. Kleinbaum and Stuart (2014) pointed out that higher network responsiveness enables enterprises to adjust to complex structural changes, coordinate effectively with network members, access necessary resources for enterprise development, and improve cooperation efficiency, thereby achieving synergy. At the level of network adaption, enterprises can expand network scale by increasing the number of network members, augmenting the overall resources occupied by the network, expanding network transmission and reception channels, and improving access to valuable assets that drive innovation (Wang, 2015). At the network coordination level, enterprises can expand network relationships to improve innovation performance by optimizing relationship strength, improving relationship durability, and strengthening relationship quality (Chen, 2007). Based on the discussion, the following hypotheses are proposed:

H3: Network responsiveness has a significant positive (+) influence on enterprise innovation performance.

H3a: Network adaption has a significant positive (+) influence on enterprise innovation performance.

H3b: Network coordination has a significant positive (+) influence on enterprise innovation performance.

2.5. The mediating effect of network responsiveness

As previously discussed, the advancement, openness, and interconnectedness inherent in digital technology capabilities significantly influence an enterprise's

network responsiveness. In adapting network structures and coordinating network relationships, enterprises can enhance innovation performance through multiple channels. The breadth and depth of digital technology applications facilitate extensive data collection and accurate market analysis (Blichfeldt and Faullant, 2021), providing a competitive advantage in technological development and market operations. However, in dynamic environments and with limited internal resources, enterprises frequently seek external resources, positioning the network as a crucial external resource supply base (Zhang and Luo, 2020). Thus, enterprises strategically coordinate relationships with other network members, leveraging the relevance of digital technology capabilities.

By constantly updating and adapting network structures and coordinating network relations, enterprises can fully utilize resource circulation channels, promoting internal and external resource reorganization and knowledge integration. This adaptability enables enterprises to secure key resources and gain innovation insights, ultimately enhancing innovation performance (Ritala et al., 2015; Wang et al., 2018).

The preceding discussion illustrates that digital technology capabilities enable enterprises to expedite network structure updates, reduce network coordination costs, and support effective network adaption and coordination. These capabilities help optimize innovation elements within the enterprise and enhance competitive advantages. Based on these insights, this paper proposes the following research hypotheses:

H4: Network responsiveness plays a mediating role in the influence of digital technology capability on enterprise innovation performance.

H4a: Network adaption plays a mediating role in the influence of digital technology capability on enterprise innovation performance.

H4b: Network coordination plays a mediating role in the influence of digital technology capability on enterprise innovation performance.

2.6. The moderating effect of environmental dynamism

Yu et al. (2023) suggest that significant differences exist in the environmental conditions and characteristics of enterprises across different industries, with one primary characteristic being environmental dynamism. Simerly and Li (2000) describe environmental dynamism as a comprehensive reflection of the degree and rate of environmental change, capturing the entire process of market environment shifts in which enterprises operate and resulting from the combined catalytic effects of various factors (e.g., policies, technologies, and markets). Sinaga (2019) defines environmental dynamism as the fluctuations in technology and market environments that drive changes in environmental performance. Similarly, Balodi (2019) describes environmental dynamism as a moderating variable in the relationship between start-up strategic orientation and enterprise performance, emphasizing that it reflects the uncertainty and unpredictability brought about by the rapid changes in technological market environments.

Digital technology can also enhance enterprise adaptability to environmental uncertainty and variability, enabling firms to seize opportunities brought by a dynamic

environment and thereby supporting sustainable development. Therefore, when the environment exhibits high dynamism, the application of digital technology significantly improves enterprise performance (Bai et al., 2022). Sun and Guo (2021) explored environmental dynamism as a moderating variable and found that it strengthens the relationship between dual innovation and enterprise performance. In addition, Bai et al. (2022) observed that environmental dynamism positively moderates the impact of digital transformation on enterprise financial performance. Based on these findings, this paper proposes the following research hypothesis:

H5: Environmental dynamism plays a positive moderating role in the influence of digital technology capability on enterprise innovation performance.

The theoretical model developed in this paper is presented in **Figure 1**.

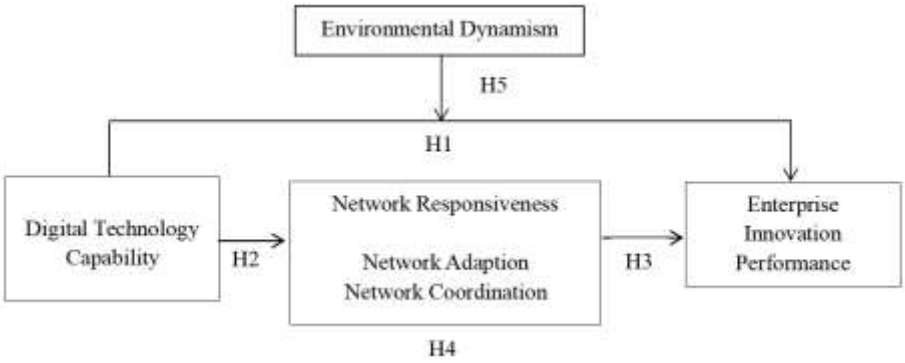

Figure 1. Conceptual model.

3. Research methodology

3.1. Sample and data collection

This study collected relevant data by sending questionnaires to enterprise personnel in various industries within Beijing, Tianjin, and Hebei Province. Respondents were selected based on their familiarity with their enterprises' digitalization processes. Sampling across multiple industries was essential due to China's vast geographic and industrial diversity, alongside the growing presence of high-tech enterprises. The questionnaire collected basic enterprise information, such as type and number of employees, as well as measurements of five key variables.

The survey was conducted from December 2023 to February 2024, and the questionnaires were disseminated both online and offline. Online responses were collected mainly through "Questionnaire Star", and offline data was collected through social networks and field investigations. Out of 550 questionnaires distributed, 526 were returned, and after excluding invalid responses, 490 valid questionnaires remained, resulting in an effective response rate of 93.2%.

Detailed respondent demographics are summarized in **Table 1** and include the following: (1) in terms of gender, males accounting for 57% of the respondents; (2) in terms of age, the largest age group was 31–40, representing 52% of the sample; (3) in terms of education level, undergraduate and associate degrees were most common, with 387 respondents, accounting for 79%; (4) in terms of operating years, enterprises with 1 to 10 years of operation made up 64% of the sample; (5) in terms of enterprise

nature, employees in private enterprises accounted for 53% (260 individuals); (6) in terms of industry category, the construction/real estate industry had the highest proportion at 22%, followed by high-tech manufacturing at 20%; (7) in terms of enterprise scale, companies with 100–1000 employees were the most represented, comprising 65% (319 enterprises).

Table 1. Sample description.

Variable		Attribute	Frequency	Percentage
Individual Level	Gender	Male	279	57%
		Female	211	43%
	Age	Under 30 years old	69	14%
		31–40 years old	255	52%
		41–50 years old	137	28%
		Over 50 years old	29	6%
	Educational level	High school degree or below	10	2%
		College degree	103	21%
		Bachelor degree	284	58%
		Graduate degree	93	19%
Enterprise Level	Operating life	1–5 years	117	24%
		6–10 years	196	40%
		11–20 years	113	23%
		More than 20 years	64	13%
	Enterprise Nature	State-owned enterprise	162	33%
		Private enterprise	260	53%
		Sino-foreign joint venture	34	7%
		Wholly foreign-owned enterprise	34	7%
	Industry Category	High-tech manufacturing industry	98	20%
		Traditional manufacturing industry	88	18%
		Construction or real estate industry	108	22%
		Wholesale and retail trade	25	5%
		Transportation and logistics industry	29	6%
		Finance and insurance industry	49	10%
		Service industry	64	13%
		other	29	6%
	Enterprise Scale	Less than 100 people	44	9%
		100–300 people	147	30%
		301–1000 people	172	35%
		1001–2000 people	88	18%
		More than 2000 people	39	8%

3.2. Measures

To measure the constructs in this study, variables such as digital technology capability, network responsiveness, environmental dynamism, and enterprise

innovation performance were assessed. A five-point Likert scale was used, ranging from 1 = strongly disagree to 5 = strongly agree, allowing respondents to rate their level of agreement with each item. To ensure accuracy and scientific rigor, the questionnaire design incorporated established scales and empirical findings from the literature, expert suggestions, and modifications to fit the digital context and research setting. The specific constructs and scales are as follows:

(1) Digital Technology Capability: For digital technology capability, this study adopted the scale proposed by Zhou and Wu (2010), which includes five items: technological capacity, opportunity identification, transformation response, product development, and proficiency and adeptness. Known for its reliability and validity, this scale has been widely used in empirical research to demonstrate how digital technology capabilities can strengthen opportunity identification and promote digital transformation in enterprises. Hence, this scale was adopted in this study.

(2) Innovation Performance: This study analyzes how network structure adjustments and changes in network relationships impact enterprise innovation performance within a digital context. The measurement scale for innovation performance, derived from Xiao (2018) and based on the work of Bell (2005) and Ritter and Gemunden (2004), examines the impact of knowledge-oriented IT capability on innovation performance, with network relationships as a moderating variable. Given its alignment with this study's variables and applicability across multiple industries, this scale was adopted with modifications to account for the digital environment, resulting in a final scale consisting of five items.

(3) Network Responsiveness: Luo (2020), building on the work of Gulati and Puranam (2009) and Kleinbaum and Stuart (2014), developed a network responsiveness scale that evaluates the impact of network responsiveness on enterprise performance when used as a mediating variable. With close relevance to the current study, this scale was modified to suit the digital context, resulting in a measurement scale that separately assesses network adaption and network coordination through eight items.

(4) Environmental Dynamism: Zhang (2016) employed environmental dynamism as a moderating variable, examining its effects on network structure and relationship embedding, referencing the methods of scholars such as Jaworski and Kohli (1993). Given that environmental dynamism is also studied as a moderating variable in this paper, Zhang's six-item scale was adopted. However, unlike Zhang's multi-dimensional approach, this study treats environmental dynamism as a single, one-dimensional variable.

3.3. Reliability and validity analysis

SPSS26.0 and AMOS24.0 were used to analyze the reliability and validity of the scales, and the test results are shown in **Table 2**. The reliability analysis showed that Cronbach's α values for all variables were greater than 0.8, indicating high internal consistency of the scale. In terms of convergent validity, the factor loading for each item exceeded 0.5, indicating that the items are strongly representative of their respective variables. In addition, all *CR* values were greater than 0.8 and *AVE* values were above 0.5, indicating strong convergent validity of the questionnaire.

Table 2. Reliability and validity analysis of the scale.

Variable Names	Measurement Questions	Factor Loading	Cronbach's α	*CR*	*AVE*
Digital Technology Capability	DTC1 In the context of digital technology, enterprises have important digital technology capabilities.	0.776	0.870	0.870	0.572
	DTC2 In the context of digital technology, enterprises have the ability to identify new digital opportunities.	0.776			
	DTC3 In the context of digital technology, enterprises have the ability to cope with digital transformation.	0.760			
	DTC4 In the context of digital technology, enterprises have the ability to use digital technology to develop innovative products, services, or processes.	0.762			
	DTC5 In the context of digital technology, enterprises have the ability to master the most advanced digital technology.	0.705			
Enterprise Innovation Performance	EIP1 In the context of digital technology, enterprises often take the lead in launching new products and technologies in the industry.	0.708	0.895	0.896	0.633
	EIP2 In the context of digital technology, enterprises often take the lead in applying new processes and technologies in the industry.	0.809			
	EIP3 In the context of digital technology, the enterprises's product and technological improvement and innovation have a very good market response.	0.819			
	EIP4 In the context of digital technology, the enterprises's products contain first-class advanced processes and technologies.	0.838			
	EIP5 In the context of digital technology, the success rate of new products and new technology development for enterprises is very high.	0.799			
Network Adaption	NA1 In the context of digital technology, enterprises flexibly adjust their network structure to adapt to changes in strategic priorities.	0.804	0.840	0.844	0.576
	NA2 In the context of digital technology, enterprises encourage employees to break old traditions and practices and adapt to the evolution of network relationships.	0.679			
	NA3 In the context of digital technology, enterprises grasp the direction of network evolution and adapt quickly.	0.815			
	NA4 In the context of digital technology, enterprises can quickly adapt to the changing speed of network relationships.	0.730			
Network Coordination	NC1 In the context of digital technology, enterprises coordinate the relationship between various departments to cope with the changing network relationship.	0.812	0.844	0.849	0.587
	NC2 In the context of digital technology, enterprises coordinate relations with network members to obtain necessary resources.	0.842			
	NC3 In the context of digital technology, enterprises coordinate the breadth and depth of cooperation to cope with changes in network relationships.	0.725			
	NC4 In the context of digital technology, enterprises coordinate the allocation of various resources to keep up with changes in network relationships.	0.673			

Table 2. (*Continued*).

Variable Names	Measurement Questions	Factor Loading	Cronbach's α	*CR*	*AVE*
Environmental Dynamism	ED1 In the context of digital technology, the technology of the industry in which the enterprise is located changes rapidly.	0.749	0.878	0.879	0.548
	ED2 In the context of digital technology, it is difficult for enterprises to predict the dominant technology in the future.	0.775			
	ED3 In the context of digital technology, enterprise development is greatly affected by external technological changes.	0.730			
	ED4 In the context of digital technology, the customer preference of enterprises changes rapidly.	0.696			
	ED5 In the context of digital technology, customers of enterprises are always inclined to seek new products or services.	0.700			
	ED6 In the context of digital technology, the product life cycle of the industry in which enterprises operate is becoming shorter and shorter.	0.786			

In this study, confirmatory factor analysis was employed to develop a nested model, assessing the discriminant validity of digital technology capability, enterprise innovation performance, network adaption, network coordination, and environmental dynamism. To rigorously evaluate model fit, four alternative models were proposed alongside the 5-factor model. The 4-factor model combines digital technology capability with enterprise innovation performance. The 3-factor model combines digital technology capability, enterprise innovation performance, and network adaption. The 2-factor model groups digital technology capability, enterprise innovation performance, network adaption, and network coordination. The 1-factor model combines digital technology capability, enterprise innovation performance, network adaption, network coordination, and environmental dynamism.

As shown in the results of the discriminant validity test in **Table 3**, the 5-factor model exhibited the best fit indices, significantly outperforming the alternative models. The fit indices for the model are as follows: x^2/df = 1.822, RMSEA = 0.041, SRMR = 0.042, CFI = 0.967, TLI = 0.962, IFI = 0.967. These values indicate a strong model fit across all criteria, underscoring the scale's robust discriminant validity. These above test results confirm the good reliability and validity of the scales employed in this study, supporting their suitability for further analysis.

Table 3. Results of the discriminant validity test.

Fitting index	x^2	*df*	x^2/df	RMSEA	SRMR	CFI	TLI	IFI
Standard			< 3.00	< 0.08	< 0.08	> 0.9	> 0.9	> 0.9
5-factor model	440.854	242	1.822	0.041	0.042	0.967	0.962	0.967
4-factor model	1142.383	246	4.644	0.086	0.072	0.852	0.834	0.852
3-factor model	1528.505	249	6.139	0.103	0.082	0.788	0.765	0.789
2-factor model	1964.029	251	7.825	0.118	0.090	0.717	0.688	0.718
1-factor model	3147.345	252	12.489	0.153	0.141	0.521	0.476	0.523

3.4. Common method bias test

Harman's single-factor test was used to test common method bias. The results showed that the variance explanation rate of the first common factor obtained by

unrotated exploratory factor analysis was 32.464%, lower than 40%. The model fitting by confirmatory factor single factor was x^2/df = 12.489, RMSEA = 0.153, SRMR = 0.141, CFI = 0.521, TLI = 0.476. IFI = 0.523, the model fitting is far lower than the judgment standard, so the common method bias has little impact on the results of this study.

4. Results

4.1. Descriptive statistics and correlation analysis

Table 4 presents the mean, standard deviation, and correlation coefficients for the key variables: digital technology capability, enterprise innovation performance, network adaption, network coordination, and environmental dynamism. The results indicate a significant positive correlation between digital technology capability and enterprise innovation performance (r = 0.461, p < 0.01), network adaption (r = 0.375, p < 0.01), and network coordination (r = 0.391, p < 0.01). Similarly, network adaption shows a significant positive correlation with innovation performance (r = 0.551, p < 0.01), and network coordination has a significant positive correlation with innovation performance (r = 0.496, p < 0.01). These findings provide preliminary support for the relationships among the variables, justifying further hypothesis testing.

Table 4. Descriptive statistics and correlations of the variables.

Variable	Mean	S.D.	DTC	EIP	NA	NC	ED
DTC	3.604	0.904	1				
EIP	3.555	0.965	0.461**	1			
NA	3.582	0.927	0.375**	0.551**	1		
NC	3.601	0.890	0.391**	0.496**	0.447**	1	
ED	3.627	0.872	0.225**	0.213**	0.171**	0.165**	1

Note: * p < 0.05, * * p < 0.01.

4.2. Mediating effect test

This paper utilized AMOS24.0 to perform structural equation modeling for testing the mediation model, represented in **Figure 2**. **Table 5** shows that the mediation model has good fit indices (x^2/df = 2.916, RMSEA = 0.063, SRMR = 0.075, CFI = 0.947, TLI = 0.938, IFI = 0.947). Digital technology capability has a significant positive impact on enterprise innovation performance (β = 0.227, p < 0.001), confirming that higher digital technology capabilities enhance enterprise innovation, thereby improving innovation performance. Hypothesis H1 is verified. Digital technology capability has a significant positive impact on network adaption (β = 0.472, p < 0.001), validating Hypothesis H2a. This suggests that the higher the digital technology capability, the higher the enterprise network adaptability. Similarly, digital technology capability positively influences network coordination (β = 0.490, p < 0.001), verifying Hypothesis H2b. This indicates that higher digital technology capabilities would result in better network coordination.

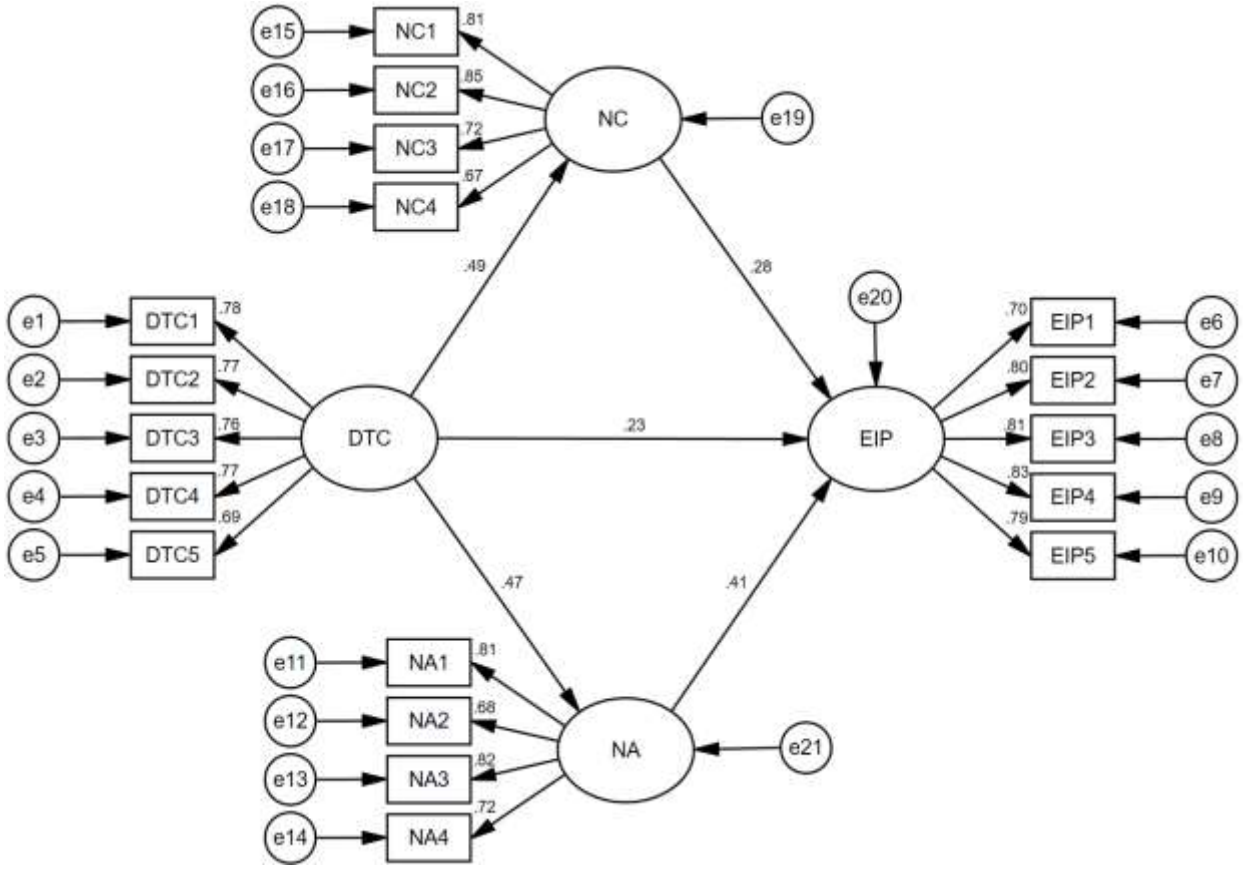

Figure 2. Mediating effect model.

Network adaption has a significant positive impact on enterprise innovation performance (β = 0.405, p < 0.001), suggesting that enhanced enterprise network adaptability boosts information transfer efficiency and innovation performance. Hypothesis H3a is verified. Network coordination also positively influences innovation performance (β = 0.276, p < 0.001), indicating that the higher the network coordination, the greater the efficiency for resource transfer between network entities, thereby improving innovation performance. Hence, Hypothesis H3b is verified.

Table 5. Path analysis.

Path			**Standardized Coefficients**	***S.E.***	***t*-value**	***p***
DTC	→	EIP	0.227	0.052	4.092	***
DTC	→	NA	0.472	0.056	8.891	***
DTC	→	NC	0.490	0.052	9.263	***
NA	→	EIP	0.405	0.046	7.683	***
NC	→	EIP	0.276	0.048	5.512	***
x^2/df = 2.916, RMSEA = 0.063, SRMR = 0.075, CFI = 0.947, TLI = 0.938, IFI = 0.947						

Note: *** p < 0.001.

To further validate the mediating effects, this study employed the non-parametric percentile Bootstrap method for deviation correction, as recommended by Wen et al. (2022), with 5000 Bootstrap samples and a 95% confidence interval. The results in **Table 6** show a significant total effect of digital technology capability on enterprise

innovation performance (0.553, with a confidence interval excluding zero: 0.478 to 0.620). The direct effect of digital technology capability on innovation performance is also significant (0.227, with a confidence interval excluding zero: 0.123 to 0.329), accounting for 41.05% of the total effect.

The mediating effect of network adaption on the relationship between digital technology capability and innovation performance is 0.191 (confidence interval excludes zero: 0.144 to 0.249), indicating a partial mediating effect with an effect size of 34.54%. This suggests that digital technology capability influences network adaption, subsequently affecting innovation performance. Hypothesis H4a is verified. The mediating effect of network coordination on the relationship between digital technology capability and innovation performance is 0.135 (confidence interval excludes zero: 0.086 to 0.191), indicating another partial mediation with an effect size of 24.41%. This suggests that digital technology capability affects network coordination, which in turn enhances innovation performance. Thus, Hypothesis H4b is verified.

Table 6. Results of mediating effect test.

Path	Effect Value	*S.E.*	95% Confidence Interval		Effect size
			Lower Limit	Upper Limit	
Total effect: DTC → EIP	0.553	0.036	0.478	0.620	100%
Direct effect: DTC → EIP	0.227	0.052	0.123	0.329	41.05%
Mediating effect 1: DTC → NA → EIP	0.191	0.027	0.144	0.249	34.54%
Mediating effect 2: DTC → NC → EIP	0.135	0.026	0.086	0.191	24.41%

4.3. Moderating effect test

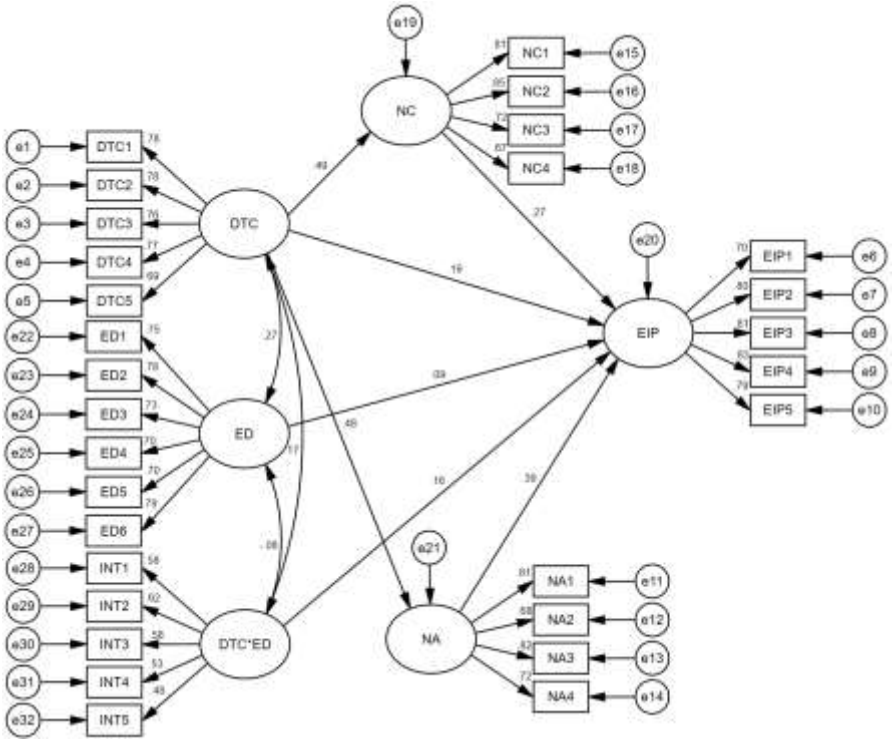

Figure 3. Moderating effect model.

Following the method proposed by Wu et al. (2009), this study examines the moderating effect of environmental dynamism on the relationship between digital technology capability (independent variable) and enterprise innovation performance. After centralizing digital technology capability and environmental dynamism, an interaction term was constructed to examine the moderating effect of environmental dynamism. The results of the moderating effect model are presented in **Figure 3**.

The results, as presented in **Table 7**, indicate that the moderating effect model demonstrated a good fit (x^2/df = 1.677, RMSEA = 0.037, SRMR = 0.056, CFI = 0.961, TLI = 0.957, IFI = 0.961). The interaction term between digital technology capability and environmental dynamism shows a significant positive impact on enterprise innovation performance (β = 0.155, p < 0.01). The results confirm that environmental dynamism has a positive moderating effect on the relationship between digital technology capability and innovation performance.

Table 7. Path analysis.

Path			**Standardized Coefficients**	***S.E.***	***t*-value**	***p***
DTC	→	NA	0.477	0.056	8.975	***
DTC	→	NC	0.494	0.052	9.339	***
NA	→	EIP	0.393	0.046	7.545	***
NC	→	EIP	0.268	0.047	5.404	***
DTC	→	EIP	0.190	0.053	3.316	***
ED	→	EIP	0.092	0.041	2.210	0.027
Interaction term	→	EIP	0.155	0.057	3.011	0.003
x^2/df = 1.677, RMSEA = 0.037, SRMR = 0.056, CFI = 0.961, TLI = 0.957, IFI = 0.961						

As shown in **Figure 4** and **Table 8**, when environmental dynamism is low, digital technology capability has no significant impact on enterprise innovation performance, with β = 0.035 and a confidence interval containing zero (−0.150, 0.186). However, when the environmental dynamism is high, digital technology capability has a significant positive influence on innovation performance, with β = −0.346 and the confidence interval excluding zero (0.208, 0.491).

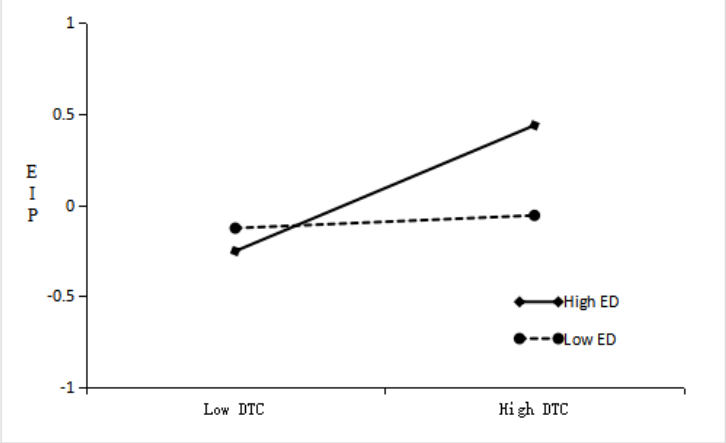

Figure 4. Moderating effect diagram.

The difference in the impact of digital technology capability on enterprise innovation performance between high and low environmental dynamism values is 0.311, with a confidence interval of (0.111, 0.562) that excludes zero, indicating a significant difference. This suggests that as environmental dynamism increases, the positive impact of digital technological capability on enterprise innovation performance gradually strengthens. Therefore, the analysis reaffirms that environmental dynamism positively moderates the relationship between digital technological capability and innovation performance, verifying Hypothesis H5.

Table 8. Results of moderating effect test.

Path	Environmental Dynamism	Effect Value	*S.E.*	95% Confidence Interval	
				Lower	Upper
DTC → EIP	Low value	0.035	0.085	−0.150	0.186
	High value	0.346	0.072	0.208	0.491
	High value-low value	0.311	0.113	0.111	0.562

4.4. Summary of hypothesis testing

This paper examines the impact of digital technology capability on enterprise innovation performance, with each hypothesis tested and validated. **Table 9** presents a summary of the hypotheses testing results, based on the findings from the empirical data analysis outlined above.

Table 9. Summary of hypothesis testing.

Number	Research Hypotheses	Test Results
H1	Digital technology capability has a significant positive (+) influence on enterprise innovation performance.	Supported
H2	Digital technology capability has a significant positive (+) influence on network responsiveness.	Supported
H2a	Digital technology capability has a significant positive (+) influence on network adaption.	Supported
H2b	Digital technology capability has a significant positive (+) influence on network coordination.	Supported
H3	Network responsiveness has a significant positive (+) influence on enterprise innovation performance.	Supported
H3a	Network adaption has a significant positive (+) influence on enterprise innovation performance.	Supported
H3b	Network coordination has a significant positive (+) influence on enterprise innovation performance.	Supported
H4	Network responsiveness plays a mediating role in the influence of digital technology capability on enterprise innovation performance.	Supported
H4a	Network adaption plays a mediating role in the influence of digital technology capability on enterprise innovation performance.	Supported
H4b	Network coordination plays a mediating role in the influence of digital technology capability on enterprise innovation performance.	Supported
H5	Environmental dynamism plays a positive moderating role in the influence of digital technology capability on enterprise innovation performance.	Supported

5. Conclusion and discussion

5.1. Research conclusion

Based on the dynamic capability theory, this paper conducted a questionnaire survey across various industries to explore how digital technology capability influences enterprise innovation performance. Using 490 valid samples, the study

analyzed the relationships and influence paths between digital technology capability, network responsiveness, and environmental dynamism. The main findings are as follows:

(1) Digital technology capability is positively correlated with enterprise innovation performance. The advanced capability of digital technology itself can inject new momentum into enterprises' innovation activities and improve the efficiency of innovation performance output of enterprises.

(2) Digital technology capability is positively correlated with network adaption and network coordination. The openness and relevance of digital technology capabilities accelerate the interconnection among network subjects and provide technical support for enterprise network adaption and network coordination behavior.

(3) Network adaption and network coordination are positively correlated with enterprise innovation performance. The optimization of network structure and the coordination behavior of network relations improve the efficiency of information and resource transfer among networks and improve innovation performance.

(4) Network adaption and coordination mediate the relationship between digital technology capability and innovation performance. Digital technology capability can influence the enterprise's network adaption and coordination behavior, thereby affecting innovation performance.

(5) Environmental dynamism positively moderates the impact of digital technology capability on innovation performance. The dynamic changes in the environment encourage enterprises to rely more on digital technology capabilities to improve their innovation performance and improve enterprise innovation performance.

5.2. Theoretical contributions

(1) Previous studies have mainly focused on the direct effects of digital technology capability on innovation, with limited research on the transmission paths between them. Based on the dynamic capability theory, this paper expands on existing literature by examining the mediating and moderating factors that link digital technology capability with innovation outcomes. Using various analyses, including reliability and validity assessments, descriptive statistics, correlation analysis, and tests for mediation and moderation, this study clarifies the relationships among digital technology capability, network responsiveness, and innovation performance, offering fresh perspectives on how digital technology capability affects innovation performance.

(2) This paper incorporates environmental dynamism as a moderating variable, exploring how varying levels of environmental change affect the influence of digital technology capability on enterprise innovation performance. The results suggest that environmental dynamism strengthens the influence of digital technology capability on innovation performance: the greater the environmental dynamism, the greater the impact of digital technology capability on enterprise innovation performance. This conclusion enriches and complements the relevant theoretical research.

5.3. Management implications

Through theoretical research and empirical testing, this paper addresses the pathways and influencing factors of digital technology capability on innovation performance, leading to several key management implications for enterprise management:

(1) Digital technologies are increasingly essential for future competitiveness, unlocking pathways for new value creation and revenue opportunities. To harness this potential, enterprises should proactively integrate digital technology into various areas such as product production, market analysis, and value-added services. By overcoming technological barriers and fostering synergy between digital technology and production mode, enterprises can accelerate digital transformation, building a unique distinct competitive advantage that could propel them toward industry leadership. Enterprises should also attract high-tech and digital-savvy talent. The introduction of skilled professionals enhances the effective application of digital technologies and drives innovation. At the same time, enterprises should invest in comprehensive digital technology training systems to strengthen employees' digital literacy and skills. A supportive culture of digital innovation encourages employees to actively engage in digital innovation business, fostering an environment where continuous improvement and creativity thrive.

(2) In the digital age, enterprises should constantly pursue partnerships with an open and inclusive mindset, while fostering relationships with integrity and responsibility. This includes regularly reviewing and evaluating the effectiveness of existing partnerships, discontinuing relationships that no longer yield value, cultivating relationships with reliable business partners, and optimizing the network structure. After establishing cooperative relationships, enterprises should prioritize open communication and exchanges and enhance mutual trust to reduce information asymmetry that can lead to misunderstandings and avoidable losses. In addition, enterprises should make use of the inherent openness of digital technology to achieve broader cooperation not only with other enterprises but also with academic institutions.

(3) Digital technologies have opened vast opportunities for enterprises to innovate, making innovation a core performance indicator beyond economic pursuits. Enterprises should consider implementing digital solutions into various innovation pathways, including technological, product innovation, service, and business model innovation, to foster cohesive development that aligns management, production, and organizational goals. At the same time, digital technology can be integrated with production methods to create intelligent production technology or equipment that improves efficiency. For example, blockchain technology facilitates the traceability and visualization of operational information of business processes. Big data analytics enables the storage and retrieval of customer information, giving enterprises insights into preferences and facilitating more targeted product and service strategies.

5.4. Limitations and future research

(1) The research samples were primarily drawn from high-tech manufacturing and service industries, leaving out sectors such as agriculture and mining. The applicability of the research conclusions may be limited, as certain industries might

have different capacities or needs regarding digital technology adoption. Future studies can compare the responses from similar enterprises to different environmental changes or analyze how diverse industries react to the same environmental shifts, providing more insights into the relationship between digital technology capability, network responsiveness, environmental dynamism, and enterprise innovation performance.

(2) This study employed cross-sectional data collected through surveys, without accounting for the time factor. Digital technology capabilities, network responsiveness, and environmental dynamism are all influenced by time, which could influence their relationships. Subsequent studies could employ longitudinal data collection to observe how these relationships evolve. This approach would provide a more dynamic understanding of how digital technology capability can impact network adaptation and coordination behavior, particularly in response to changes in environmental dynamism. In addition, introducing moderating and mediating variables such as corporate culture attributes and knowledge integration capabilities could further clarify the mechanisms through which digital technology influences enterprise innovation performance over time.

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