

## HOW ENTERPRISE NETWORK CAPABILITIES, TECHNOLOGICAL CAPABILITIES, AND SOCIAL CAPITAL CONTRIBUTE TO DIGITAL PERFORMANCE: THE MEDIATING ROLE OF DIGITAL CAPABILITIES

### COMO AS CAPACIDADES DA REDE EMPRESARIAL, AS CAPACIDADES TECNOLÓGICAS E O CAPITAL SOCIAL CONTRIBUEM PARA O DESEMPENHO DIGITAL: O PAPEL MEDIADOR DAS CAPACIDADES DIGITAIS

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**Tao Huang\***

\*Suan Sunandha Rajabhat University, Thailand  
[88922662@qq.com](mailto:88922662@qq.com)

**Srochinee Siritwattana\***

\*Suan Sunandha Rajabhat University, Thailand  
[srochinee.si@ssru.ac.th](mailto:srochinee.si@ssru.ac.th)

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#### Abstract

With the rapid development and application of emerging technologies, digital transformation has become a crucial approach for enterprises to enhance their competitiveness and achieve sustainable development. In this context, conducting a multi - dimensional analysis of digital transformation performance holds significant theoretical and practical value. This study aims to explore the impacts of corporate network capability, social capital, technological capability, and digital capability on corporate digital performance. The research findings indicate that corporate network capability, social capital, and technological capability have a significant positive impact on digital capability, and they indirectly promote the improvement of digital performance through digital capability. Digital capability plays a key role in enhancing enterprise operation efficiency and innovation ability, and has a significant positive impact on digital performance. Theoretically, this study enriches the multi - dimensional analysis framework in the field of digital transformation, especially providing new insights into the action mechanisms of technology, networks, and social capital. In practice, the research results offer important management implications for corporate managers, emphasizing the importance of strengthening network capability building, enhancing technological capability, cultivating digital capability, and optimizing the utilization of social capital, so as to better promote the digital transformation of enterprises and achieve higher digital performance.

#### Resumo

Com o rápido desenvolvimento e a aplicação de tecnologias emergentes, a transformação digital tornou-se uma abordagem crucial para que as empresas aumentem sua competitividade e alcancem o desenvolvimento sustentável. Nesse contexto, realizar uma análise multidimensional do desempenho da transformação digital reveste-se de grande valor teórico e prático. Este estudo tem como objetivo explorar os impactos da capacidade de rede corporativa, do capital social, da capacidade tecnológica e da capacidade digital no desempenho digital corporativo. Os resultados da pesquisa indicam que a capacidade de rede corporativa, o capital social e a capacidade tecnológica têm um impacto positivo significativo sobre a capacidade digital e promovem indiretamente a melhoria do desempenho digital por meio da capacidade digital. A capacidade digital desempenha um papel fundamental no aumento da eficiência operacional e da capacidade de inovação das empresas, além de ter um impacto positivo significativo sobre o desempenho digital. Teoricamente, este estudo enriquece a estrutura de análise multidimensional no campo da transformação digital, especialmente ao fornecer novos insights sobre os mecanismos de ação da tecnologia, das redes e do capital social. Na prática, os resultados da pesquisa oferecem importantes implicações gerenciais para os gestores corporativos, enfatizando a importância de fortalecer a construção da capacidade de rede, aprimorar a capacidade tecnológica, cultivar a capacidade digital e otimizar a utilização do capital social, de modo



**Keywords:** Digital Performance. Network Capability. Technological Capability. Social Capital. PLS-SEM.

*a promover melhor a transformação digital das empresas e alcançar um desempenho digital mais elevado.*

**Palavras-chave:** Desempenho Digital. Capacidade de Rede. Capacidade Tecnológica. Capital Social. PLS-SEM.

## 1 INTRODUCTION

### 1.1 Background

In the digital age, the rapid development of information technology and the intensification of market competition have made digital transformation a crucial strategy for enterprises to maintain competitiveness (Seo, 2020). Enterprises not only have to face the challenges of technological upgrading but also need to deeply understand the dynamics of social networks and the transformation of social capital to ensure the success of transformation and enhance performance (Xie *et al.*, 2022; Gölgeci & Kuivalainen, 2020). Research on digital transformation has expanded from the application and efficiency of information technology to its impacts on business models (Bagale *et al.*, 2023), organizational structures (Li *et al.*, 2023), and market relationships (Zhang *et al.*, 2020). Social capital theory provides a new perspective for analyzing digital transformation, emphasizing the roles of social networks, trust, and knowledge sharing in promoting innovation and enhancing performance (Jeong & Chung, 2023). This study aims to analyze how technology, networks, and social capital influence the digital transformation performance of enterprises (Albrecht, 2024; Ji *et al.*, 2022), and explore how these factors jointly shape the digital success of enterprises. Thereby, it can assist enterprise leaders and decision - makers in more effectively planning and implementing digital transformation to ensure success in the digital age.

## 1.2 Research questions and objectives

The research question of this study is: to explore how corporate network capabilities, technological capabilities, and social capital affect digital capabilities, and how they directly and indirectly affect the digital transformation performance of enterprises through digital capabilities, so as to reveal the action mechanisms of these factors in the success of digital transformation.

The main objectives of this study are: to analyze the impacts of corporate network capabilities, technological capabilities, and social capital on digital capabilities, as well as the direct and indirect effects of these factors in enhancing the digital transformation performance of enterprises.

## 1.3 Significance of the research

This study focuses on the multi - dimensional impacts of social capital, network capabilities, and technological capabilities on the digital transformation performance of enterprises, aiming to provide new perspectives and guidance for digital transformation theory and practice. At the theoretical level, existing studies mostly focus on the role of single factors (e.g., Matt *et al.*, 2015). However, this study deepens the understanding of how these factors jointly affect digital performance by comprehensively considering their synergistic effects. This not only provides empirical support for the integration of social capital and digital transformation theory but also promotes the dialogue and cooperation between disciplines such as management and economics, expanding the knowledge boundaries of related fields.

At the practical level, the research results provide specific guidance for enterprise managers to formulate digital transformation strategies. By identifying and optimizing social capital, promoting technology adoption, and strengthening network relationships, enterprises can achieve more efficient digital transformation. In addition, this study also provides a basis for policymakers to help them design more effective policy tools to encourage enterprises to invest in social capital, promote technological innovation and network collaboration, and accelerate the digitalization process of the industry.

## 2 LITERATURE REVIEW

### 2.1 Basic theories

This paper aims to explore how networks, technology, and social capital promote digital performance through the mediating role of digital capabilities. Its theoretical basis is rooted in digital transformation theory, the resource - based view (RBV), network theory, and social capital theory. Digital transformation theory has evolved from initially focusing on how enterprises optimize internal processes and enhance efficiency through digital technologies to the current understanding that digitalization is an all - encompassing change involving corporate strategy, organizational structure, and business models (Matt *et al.*, 2015). The resource - based view (RBV) theory emphasizes the role of internal resources and capabilities of enterprises in gaining a competitive advantage, regarding corporate network capabilities, social capital, and technological capabilities as unique resources and capabilities of enterprises (Barney, 1991; Teece *et al.*, 1997). Network theory studies the network structure and position among organizations and how these factors affect an organization's ability to access resources and information, highlighting how digital technologies reshape the structure and function of organizational networks (Granovetter, 1985; Michie & Burt, 1994). Social capital theory has become an important concept in the field of social sciences since the end of the 20th century, used to explain the ability of individuals or groups to access resources and advantages through social relationship networks (Bourdieu, Pierre, 1982). In the context of the digital age, social capital theory has begun to focus on the impact of virtual communities and online social networks on social capital (Ellison *et al.*, 2011), and emphasizes the role of social capital in promoting knowledge sharing, innovation, and organizational learning (Adler & Kwon, 2002).

### 2.2 Influencing factors of enterprise digital transformation

Enterprise digital transformation is a multi - dimensional and complex process, influenced by multiple factors such as internal technological capabilities, the external environment, market trends, management strategies, financial conditions, and social

capital. Internal technological capabilities are the core of digital transformation. They not only enhance supply chain resilience (Gölgeci & Kuivalainen, 2020) but also play a mediating role between social capital and entrepreneurial orientation (Rodrigo - Alarcón *et al.*, 2020). The external environment and market demands, such as industry competition and policies and regulations, have a significant impact on the transformation process (Švarc *et al.*, 2021). Technological factors, especially big data and business analysis ecosystems, play a crucial role in driving digital transformation (Pappas *et al.*, 2018). Management strategies and governance mechanisms are essential for coordinating internal digital activities within an organization (Matt *et al.*, 2015), and the importance of financial resources during the transformation process cannot be ignored (Cherkasova & Slepushenko, 2021). Social capital, including networks and relationships, also has a significant impact on digital transformation, helping enterprises overcome obstacles to knowledge diffusion and resource sharing (Gu & Meng, 2022).

### **2.3 Performance of enterprise digital transformation**

Enterprise digital transformation has a significant impact on enhancing operational efficiency, market competitiveness, and financial performance. Research shows that social capital is positively correlated with enterprise innovation performance, with corporate network prestige playing a mediating role (Y. Zhou *et al.*, 2023). Each dimension of social capital can also encourage R&D alliance enterprises to adopt an entrepreneurial orientation, thereby improving technological and business performance (Seo, 2020). Gölgeci & Kuivalainen (2020) emphasize the mediating role of enterprise absorptive capacity between social capital and supply chain resilience, especially when marketing and supply chain management are highly coordinated. Challenges in supply chain digitalization, such as digital capability asymmetry and partner opportunism, require effective governance mechanisms to mitigate (Son *et al.*, 2021). Yu *et al.* (2021) found that relational capital and green management initiatives can improve the financial performance of the supply chain, and digital transformation has a positive moderating effect on enterprise financial performance, especially in enhancing operational efficiency. In addition, Cherkasova & Slepushenko (2021) verified the positive relationship between

digitalization and operational efficiency, while the work of Xie *et al.* (2022) revealed the U - shaped impact of green process innovation on financial performance.

## **2.4 Social capital and digital transformation**

Social capital is widely regarded as a key factor in promoting enterprise technology adoption and integration, enhancing supply chain resilience, promoting green innovation, and optimizing operational processes. It has been pointed out that the integration of digital technologies significantly improves efficiency and product quality (Bagale *et al.*, 2023), thus stimulating the growth of market demand. The research of Wang *et al.* (2020) emphasizes the mediating role of information technology capabilities in enhancing the efficiency of small and medium - sized enterprises, strengthening the connection between digital business strategies and enterprise efficiency. Gölgeci & Kuivalainen (2020) found that when marketing and supply chain management are highly consistent, the positive impact of social capital on supply chain resilience is more significant. The research of Ji *et al.* (2022) further confirms that digital transformation alleviates the cost increase in the initial stage of innovation by improving the financial situation of enterprises, promoting the realization of long - term financial benefits.

## **2.5 Enterprise technological capability and digital transformation**

Technological capabilities have a significant positive impact on innovation performance and play a mediating role between IT capabilities and process innovation and product innovation (Chu *et al.*, 2019). The improvement of technological capabilities is closely related to the accumulation and utilization of internal and external social capital of enterprises. Social capital can promote the sharing and dissemination of knowledge, providing support for the improvement of technological capabilities (Jeong & Chung, 2023). In addition, enterprise absorptive capacity plays a mediating role between social capital and supply chain resilience (Gölgeci & Kuivalainen, 2020), indicating that the combination of technological capabilities and social capital can enhance an enterprise's response speed to market fluctuations and risk - resistance ability. Digital transformation provides a platform for the deepening and expansion of enterprise technological

capabilities by reconstructing business models and market positioning (Albrecht, 2024; Soellner *et al.*, 2024). Therefore, enterprises should attach importance to the coordinated development of technological capabilities and social capital to achieve the comprehensive benefits of digital transformation and promote the sustainable growth of enterprises and the enhancement of their market competitiveness (Zhang *et al.*, 2020).

## 2.6 Network capability and digital transformation

In the process of digital transformation, corporate network capabilities play an irreplaceable and crucial role (Q. Zhou & Zhao, 2020). By collaborating with technology providers and research institutions, enterprises can introduce advanced technologies and apply them to practical business scenarios. Relying on extensive and close connections with external partners, enterprises can keenly capture industry trends, quickly obtain the latest technologies and market information, accelerate the adoption and integration of digital technologies (Gölgeci & Kuivalainen, 2020), improve operational efficiency and product quality, and stimulate market demand. At the same time, strong network capabilities help enterprises accurately grasp customer needs, expand market territory, and enhance the flexibility and response speed of the supply chain (Bagale *et al.*, 2023). Through knowledge sharing and collaborative innovation, enterprises' innovation capabilities are continuously upgraded, further promoting digital transformation (Li *et al.*, 2023). In addition, enterprises reshape the supply chain operation process and deeply integrate with network relationships, which has a positive impact on operational performance (Xu *et al.*, 2022).

## 2.7 Hypothesized relationships

Network effects and enterprise dynamic capabilities determine the success of digital transformation (Bagale *et al.*, 2023; Pappas *et al.*, 2018; Y. Zhou *et al.*, 2023) (Pappas *et al.*, 2018). High connectivity and tie strength in social networks have a positive impact on digital construction (Li *et al.*, 2023). Structural holes and network centrality, with information integration capabilities as a mediator, have a significant positive impact on innovation performance (Farida & Nuryakin, 2021). Tie strength and other factors in

networks have a positive impact on digital transformation (Yang *et al.*, 2023). Network power indirectly enhances innovation performance (Xu *et al.*, 2022), and corporate network capabilities have a significant positive impact on digital capabilities (Q. Zhou & Zhao, 2020). Hypotheses: H1a: Corporate network capabilities have a positive impact on digital capabilities; H1b: Corporate network capabilities have a positive impact on corporate digital performance.

Social capital promotes enterprise digital transformation (Xu *et al.*, 2022), and social capital affects digital transformation in many aspects (Bagale *et al.*, 2023). The drivers of enterprise digital transformation are diverse, among which the balance of internal and external social capital is crucial for enhancing digital capabilities (Gu & Meng, 2022), and knowledge sharing plays a full mediating role, strengthening the connection between digital business strategies and enterprise efficiency (Seo, 2020). Social capital promotes the integration of technologies and improves enterprise performance (Ji *et al.*, 2022). Therefore, social capital plays an important role in enterprise digital transformation (Jeong & Chung, 2023) and has a significant positive impact on digital capabilities. Hypotheses: H2a: Social capital has a positive impact on digital capabilities; H2b: Social capital has a positive impact on corporate digital performance.

Technological capabilities drive the improvement of enterprise production management efficiency and business model transformation and are the foundation of digital transformation (Jeong & Chung, 2023). Digital and intelligent technologies can improve production management efficiency and promote business model transformation (Lang *et al.*, 2023). Digital knowledge management has a positive impact on enterprise technological innovation (Chu *et al.*, 2019), and resource orchestration promotes the evolution of digital capabilities (Tsai & Hsu, 2019). Therefore, technological capabilities have a positive impact on digital capabilities and digital performance. Hypotheses: H3a: Technological capabilities have a positive impact on digital capabilities; H3b: Technological capabilities have a positive impact on digital performance.

Digital capabilities have a positive impact on innovation performance and can also indirectly improve performance (Yu *et al.*, 2021), such as improving the quality of internal control (Y. Zhou *et al.*, 2023), promoting business model innovation (Abdurrahman *et al.*, 2024; Li *et al.*, 2024), and improving inefficient investment (Teng

*et al.*, 2022). Enterprise digital capabilities have a positive effect on supply chain innovation performance and can continuously improve enterprise performance by promoting innovation (Xu *et al.*, 2022). Hypothesis H4: Digital capabilities have a positive impact on digital performance.

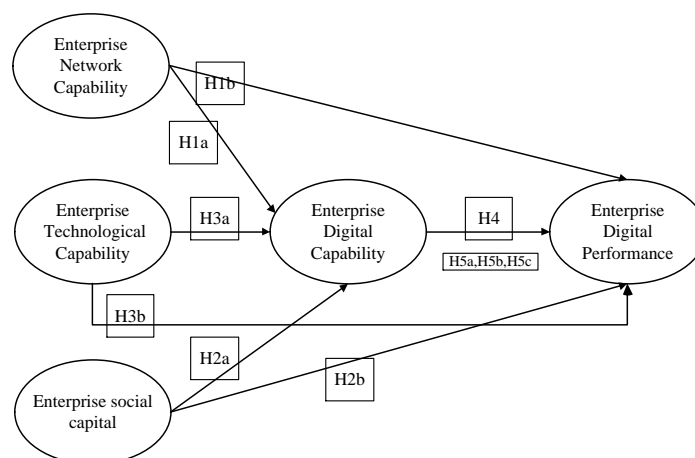
Corporate networks provide the foundation and impetus for transformation (Ji *et al.*, 2022; Y. Zhou *et al.*, 2023); social capital promotes transformation in various ways (Doan *et al.*, 2023; Švarc *et al.*, 2021); enterprise technologies drive the improvement of production management efficiency and business model transformation (Goi, 2023). Hypotheses: H5a: Corporate network capabilities indirectly affect digital performance through digital capabilities; H5b: Social capital indirectly affects digital performance through digital capabilities; H5c: Technological capabilities indirectly affect digital performance through digital capabilities.

## 2.8 Research framework

The conceptual framework has three independent variables, namely network capabilities, social capital, and technological capabilities. The mediating variable is digital capabilities, and the dependent variable is digital performance. The conceptual framework is as follows.

**Figure 1**

### *Conceptual Framework*



## 3 METHODOLOGY

### 3.1 Research design

A mixed - method design can fully leverage the advantages of both qualitative and quantitative research methods, ensuring the comprehensiveness and reliability of research results. Therefore, this study combines the precision of quantitative research with the depth of qualitative research. Data are collected through two methods: interviews and cross - sectional surveys to explore the impacts of technological capabilities, network capabilities, and social capital on digital transformation performance.

### 3.2 Quantitative methods

#### 3.2.1 Population

This research selects enterprises in Zhejiang Province, China as the research objects. According to the data from the Zhejiang Economic Statistical Yearbook 2022, the total number of legal person enterprises in 2022 was 2,690,600.

#### 3.2.2 Sample size

Based on the number of free parameter estimates, this study initially sets the sample size as 20 times the number of variables and dimensions (Creswell, 2008). The sampling method used is stratified sampling, which strictly adheres to the central limit theorem of independent and identically distributed variables. Samples are selected with the number of enterprises in each region of Zhejiang Province in 2022 as the weight. It is planned to survey 400 enterprises to meet the basic requirements of statistical analysis.

#### 3.2.3 Data collection

This research follows strict ethical norms. Before conducting the survey, it is necessary to obtain the consent of relevant enterprises or individuals (such as enterprise

managers) to ensure legality and ethics. Data collection combines online and offline methods. Online data collection is achieved through a survey APP in China, which facilitates the acquisition of a large amount of data efficiently. The offline part involves face - to - face communication with relevant enterprise personnel through direct contact and questionnaire distribution, ensuring the authenticity and detail of the data.

#### *3.2.4 Data analysis*

Data analysis relies on two tools, SPSS and SmartPLS. SPSS is used for descriptive statistical analysis to present the basic characteristics of enterprises, such as the distribution of main businesses, industry status, industry technological changes, and R&D investment, providing necessary context for the research. To further explore the interactions between variables, the structural equation model (SEM) method is employed. A mediating model is constructed to focus on analyzing the mediating role of digital capabilities among networks, technology, social capital, and digital performance. Meanwhile, the structural equation model will verify the hypothesized relationships between variables, thereby revealing the interaction mechanism of the core factors in the research framework.

### **3.3 Qualitative research**

In the collection of qualitative data, this study selects managers of enterprises in Zhejiang, China as the interview subjects and plans to conduct semi - structured interviews with 10 managers. The sample size is determined using the grounded theory method to ensure that data collection stops when theoretical saturation is reached. The designed interview questions are as follows:

1. Each enterprise can be regarded as a node in the social network, and enterprises have their own network relationships, such as supplier relationships and supply chain relationships. What are the network relationships of your company?
2. When implementing new digital projects or technologies, what steps does your company usually take to ensure the successful implementation of the projects?

3. Please give an example to illustrate how your company uses customer feedback to improve its digital experience and services.
4. Compared with your main competitors, what unique advantages do you think your company has in establishing and maintaining partnership relationships?
5. When it comes to cross - organizational cooperation, what measures does your company take to enhance trust and understanding with partners?
6. Since your company implemented digital transformation, what significant changes or improvements have there been in aspects such as business process efficiency, decision - making efficiency, speed of responding to customer needs, product and service innovation capabilities, enterprise revenue, market share, customer satisfaction, and employee work efficiency?
7. Please share specific improvement cases or data to support your views. In the process of digital transformation, which core business processes are covered by your company's information system? At the same time, please describe the new technologies adopted by your company and their specific impacts on enhancing operational efficiency and innovation capabilities.
8. Compared with your main competitors, what unique advantages does your company have in technology research and development? Please describe your company's R&D investment (including capital and human resources), the advancement of equipment, and the support of the organizational structure for technological innovation, and provide specific examples to illustrate how these factors promote the technological development of the enterprise.
9. How is the collaboration between your company's technology department and other departments? In addition, please share your company's practices and achievements in promoting close communication between the technology department and the outside world (such as other enterprises and research institutions), and the specific impacts of these collaborations on promoting technological innovation.

### *3.3.1 Data collection process*

This study collects data through semi - structured interviews. Each interview lasts approximately 60 minutes, and all interview processes are recorded and transcribed verbatim to ensure the integrity and authenticity of the data. The grounded theory method is adopted, and data collection and analysis are carried out simultaneously.

### *3.3.2 Data analysis*

Qualitative data analysis focuses on multiple themes related to enterprise digital transformation performance. These themes closely correspond to the research objectives, ensuring that the analysis focuses on the roles of networks, technology, social capital, and digital capabilities. First, all interview contents are fully transcribed to ensure the accuracy and originality of the data. Subsequently, the qualitative data analysis software NVivo is used for coding. The entire process is divided into three stages: open coding, axial coding, and selective coding. In the open - coding stage, researchers extract key concepts and categories from the data; in the axial - coding stage, the relationships between different categories are further explored to reveal their internal logical connections; finally, in the selective - coding stage, the core themes are integrated to form a complete theoretical framework. This series of coding steps is a progressive process. By continuously exploring the details and relationships in the data, it helps researchers construct the complex action mechanism of networks, technology, and social capital in promoting digital performance.

## **3.4 Ethical considerations in the research**

This study strictly adheres to research ethics to ensure the privacy of respondents and the credibility of research results. Ethical principles such as confidentiality, anonymity, and voluntary participation are followed to ensure that each respondent is respected and protected throughout the process. Appropriate measures will be taken to protect all personal data and information to avoid leakage or abuse. Such ethical

considerations contribute to ensuring the integrity of the research process and enhancing the reliability and academic value of research conclusions.

## **4 RESULTS**

This section presents the empirical analysis results regarding how networks, technology, and social capital promote digital performance through digital capabilities. By integrating quantitative and qualitative data, and applying the structural equation model and grounded theory methods, the analysis is conducted from the perspectives of variable relationships and key - theme exploration. Through the statistical testing of questionnaire data and the coding of interview data, the mediating role of digital capabilities and their impact mechanism on digital performance are clarified, providing empirical support for the research hypotheses.

### **4.1 Data input and coding**

#### *4.1.1 Response rate*

In this survey, initially 450 questionnaires were retrieved, and finally 388 valid questionnaires were determined. The proportion of valid questionnaires is 86.2%.

#### *4.1.2 Data Coding and missing values*

The retrieved questionnaires were carefully and rigorously screened. Firstly, a preliminary check was carried out on the integrity of each questionnaire. Questionnaires with missing key information or those that were obviously incompletely filled were excluded to eliminate missing values. Subsequently, a logical consistency review was performed on the questionnaire content. For example, when dealing with questions related to enterprise digital transformation, the logical relationship between various measures and their effectiveness was examined. Questionnaires with logical contradictions or inconsistent answers were excluded.

## 4.2 Data evaluation

### 4.2.1 Reliability and validity tests

Reliability and validity analysis aims to examine the consistency and stability of data, thereby judging the reliability of the collected information. This mainly involves inspections of internal consistency and composite reliability. Common evaluation indicators include the Cronbach's  $\alpha$  coefficient and composite reliability (CR). In this study, the factor loadings of the observed variables corresponding to all latent variables met the expected standards. The specific results are shown in Table 4.1.

**Table 1**

*Reliability and validity analysis of variables*

Variable	Number of Items	KMO	CR	Cronbach's $\alpha$ Value
Digital Capability (DC)	7	0.944	0.936	0.935
Digital Performance (DP)	9	0.932	0.940	0.939
Network Capability (NC)	7	0.903	0.911	0.907
Social Capital (SC)	10	0.922	0.906	0.907
Technological Capability (TC)	7	0.903	0.911	0.907

The KMO value of all variables is above 0.900, indicating that the data is highly suitable for factor analysis. For latent variables such as digital capability (DC), digital performance (DP), network capability (NC), social capital (SC), and technological capability (TC), their Cronbach's  $\alpha$  coefficients are all higher than 0.900, and the composite reliability (CR) is also above 0.911. These indicators jointly demonstrate that each variable has extremely high internal consistency and composite reliability.

In the partial least squares (PLS) method, the discriminant validity test is designed to ensure that the measurement indicators of different constructs or latent variables have sufficient differences.

**Table 2***Heterotrait-Monotrait Ratio Matrix*

	DC	DP	NC	SC	TC
DC					
DP	0.839				
NC	0.864	0.809			
SC	0.760	0.831	0.861		
TC	0.804	0.878	0.799	0.791	

According to the research recommendations of Clark & Watson (1995), Kline (2011), and Henseler *et al.* (2015), the HTMT value should be less than 0.85 or 0.90 to ensure good discriminant validity. Gold *et al.* (2001) and Teo *et al.* (2008) also support using an HTMT value less than 0.9 as one of the evaluation criteria. This paper adopts the standard of HTMT < 0.9 for validity testing. As can be seen from the HTMT matrix in Table 4.2, the HTMT values between all cross - constructs are lower than 0.9, indicating that the constructed measurement model has good discriminant validity.

To further verify the validity of the model, the Fornell - Larcker criterion is also used to evaluate the average variance extracted (AVE). According to this criterion, if the AVE of each latent variable is greater than the maximum of its correlation coefficients with other latent variables, the model is considered to have good discriminant validity.

**Table 3***Fornell-Larker criteria*

	DC	DP	NC	SC	TC
DC	0.849				
DP	0.791***	0.821			
NC	0.803***	0.750***	0.801		
SC	0.714***	0.782***	0.796***	0.802	
TC	0.753***	0.820***	0.735***	0.738***	0.827

Note: \*\* p<0.05 , \*\*\* p<0.01 ; the numbers on the diagonal are the square roots of AVE.

As shown in Table 4.3, all AVE values exceed 0.6, and the square root of the AVE of each construct is higher than the maximum of its correlation coefficients with other constructs. For example, the AVE of the DC construct is 0.849, and its square root is approximately 0.921, which is far higher than the maximum correlation coefficient of 0.803 (NC vs DC) with any other construct. Therefore, it can be concluded that the measurement model constructed in this study not only has high convergent validity but

also exhibits good discriminant validity, indicating that each latent variable can be accurately reflected by its corresponding observed indicators, and there is a clear boundary of distinction between them.

#### 4.2.2 Assessment of multicollinearity

The main purpose of the variable collinearity test is to determine whether there is a high degree of correlation between explanatory variables. If the correlation between variables is high, it will lead to unstable coefficient estimates in the regression model, unreliable hypothesis tests, and thus distort the regression results and reduce their credibility. This paper uses the variance inflation factor (VIF) test: the higher the VIF value, the higher the correlation between variables. Generally, a VIF value greater than 10 indicates a serious collinearity problem.

**Table 4**

*Collinear Diagnosis of Variables*

Item	VIF Value	Tolerance
TC	3.839	0.26
DP	4.418	0.226
SC	3.609	0.277
DC	3.895	0.257
NC	4.076	0.245

The VIF value is an indicator for measuring the severity of collinearity, and its value range is from 1 to infinity. A VIF value greater than 10 is usually considered a sign of a collinearity problem, while a value between 1 and 5 is considered acceptable. Tolerance is the reciprocal of VIF, and its value range is from 0 to 1. The lower the value, the more serious the collinearity problem. As can be seen from Table 4.4, the VIF values of all variables are higher than 3.8. Among them, the VIF value of DP is the highest, which is 4.418, and the corresponding tolerance is 0.226. The VIF value of SC is 3.609, and the tolerance is 0.277; the VIF value of DC is 3.895, and the tolerance is 0.257; the VIF value of NC is 4.076, and the tolerance is 0.245; the VIF value of TC is 3.839, and the tolerance is 0.260. The VIF values of all variables do not exceed 5, indicating that there is no collinearity problem among the variables.

### 4.3 Descriptive data analysis

The control variables of this paper cover dimensions such as the industry status, development speed, scale, R&D investment proportion, market share, and digital investment proportion of enterprises. Table 4.5 reports the statistical data of the control variables.

**Table 5**

*Descriptive statistics for control variables*

Indicator	Category	Frequency	Percent	Valid Percent	Cumulative Percent
The status of enterprise technology	Leading	140	36.1	36.1	36.1
	Follower	234	60.3	60.3	96.4
	Backward	14	3.6	3.6	100
The speed of technological development	Fast	104	26.8	26.8	26.8
	Medium	238	61.3	61.3	88.1
	Slow	46	11.9	11.9	100
	<100	179	46.1	46.1	46.1
Number of enterprise employees (persons)	100 - 500	124	32	32	78.1
	500 - 2000	44	11.3	11.3	89.4
	>2000	41	10.6	10.6	100
	<5%	171	44.1	44.1	44.1
Proportion of R&D personnel	5% - 15%	131	33.8	33.8	77.8
	15% - 30%	67	17.3	17.3	95.1
	>30%	19	4.9	4.9	100
	<1k	153	39.4	39.4	39.4
Annual sales of enterprises (10,000 yuan)	1k - 5k	121	31.2	31.2	70.6
	5k - 10k	77	19.8	19.8	90.5
	>10k	37	9.5	9.5	100
Proportion of R&D investment	<1%	99	25.5	25.5	25.5
	1% - 5%	158	40.7	40.7	66.2
	5% - 10%	97	25	25	91.2
	>10%	34	8.8	8.8	100

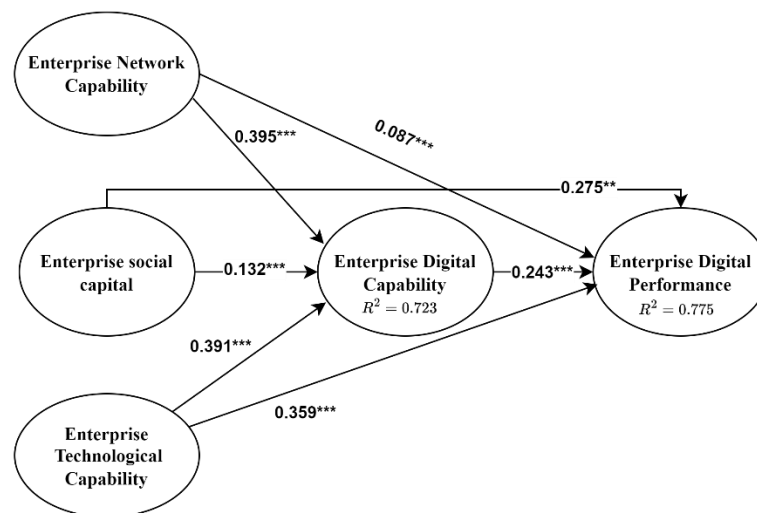
The descriptive statistical results show that most enterprises are followers in terms of industry status (60.3%), the development speed is mainly at a medium level (61.3%), the enterprise scale is mostly concentrated below 100 people (46.1%), the proportion of R&D investment is generally less than 5% (44.1%), the market share is mainly less than 1k (39.4%), and the proportion of digital investment is concentrated between 1% - 5% (40.7%).

#### 4.4 Path analysis

Path analysis consists of several key components, including variables, paths, and coefficients. Variables can be divided into exogenous variables (independent variables) and endogenous variables (dependent variables), with the former influencing the latter. Paths represent the relationships between these variables, and the arrows and values on the arrows indicate the direction and strength of the influence.

**Figure 2**

*Results of Path Analysis*



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

Coefficients are obtained through statistical estimation methods, which can quantify relationships and provide in - depth understanding of the magnitude of the influence. By analyzing these components, researchers can comprehensively understand how different factors interact and affect the observed results.

**Table 6**

*Model regression coefficients*

X	→	Y	Non-normalized path coefficients	SE	z (CR value)	p	Normalized path coefficients
NC	→	DC	0.411	0.028	14.638	0.000	0.395
SC	→	DC	0.145	0.029	5.067	0.000	0.132
TC	→	DC	0.412	0.025	16.290	0.000	0.391

NC	→	DP	0.082	0.025	3.323	0.001	0.087
DC	→	DP	0.220	0.022	9.789	0.000	0.243
SC	→	DP	0.274	0.024	11.626	0.000	0.275
TC	→	DP	0.342	0.023	15.133	0.000	0.359

Note: "→" represents the path influence relationship.

The standardized path coefficient of network capability (NC) on digital capability (DC) is 0.395, which is significant at the 0.01 level, indicating that NC has a significant positive impact on DC; the coefficient of social capital (SC) on digital capability (DC) is 0.132, significant at the 0.01 level, indicating that SC has a positive promoting effect on DC; the coefficient of technological capability (TC) on digital capability (DC) is 0.391, significant at the 0.01 level, indicating that TC has a significant positive impact on DC. The coefficient of network capability (NC) on digital performance (DP) is 0.087, significant at the 0.01 level, indicating that NC has a positive impact on DP; the coefficient of digital capability (DC) on digital performance (DP) is 0.243, significant at the 0.01 level, indicating that DC has a significant positive impact on DP; the coefficient of social capital (SC) on digital performance (DP) is 0.275, significant at the 0.01 level, confirming that SC has a positive promoting effect on DP; the coefficient of technological capability (TC) on digital performance (DP) is 0.359, significant at the 0.01 level, indicating that TC has a significant positive impact on DP. Path analysis shows that NC, DC, TC, and SC all have significant positive impacts on DP, and the influence relationships between variables are statistically significant. The results of path analysis indicate that network capabilities, digital capabilities, technological capabilities, and social capital all have significant positive impacts on digital performance, and the influence relationships between these variables are statistically significant.

#### 4.5 Mediation analysis

Mediation analysis is a statistical method that can assist researchers in understanding the complex relationships among variables. In this study, we explore the impacts of network capabilities (NC), social capital (SC), and technological capabilities (TC) on digital transformation performance (DP), and examine the role of digital capabilities (DC) as a mediating variable.

**Table 7***Results of mediation analysis*

	constant	TC	SC	NC	DC	R2	$\Delta R^2$	F-value	
D P	B	0.581* **	0.432* **	0.306* **	0.172* **			1374.0	
	S					0.75	0.75	83	
	E	0.077	0.021	0.024	0.024	9	8	p=0.00	
	t	7.587	20.231	12.634	7.265			0	
	p	0.000	0.000	0.000	0.000				
	$\beta$	-	0.454	0.307	0.183				
D C	B	0.043 **	0.412* **	0.145* **	0.411* **			1140.6	
	S					0.72	0.72	15	
	E	0.091	0.025	0.029	0.028	3	2	p=0.00	
	t	0.476	16.265	5.06	14.616			0	
	p	0.634	0.000	0.000	0.000				
	$\beta$	-	0.391	0.132	0.395				
D P	B	0.571* **	0.342* **	0.274* **	0.082* **	0.220* **		1128.7	
	S					0.77	0.77	50	
	E	0.074	0.023	0.024	0.025	0.022	5	4	p=0.00
	t	7.726	15.103	11.603	3.317	9.774		0	
	p	0.000	0.000	0.000	0.001	0.000			
	$\beta$	-	0.359	0.275	0.087	0.243			

Note: \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ ; B represents the unstandardized coefficient;  $\beta$  represents the standardized coefficient.

Table 4.7 presents the results of the mediation analysis. The following are the key statistical results obtained from the data: First, we observe that the impacts of all independent variables on DP are significant. The unstandardized coefficients of NC, SC, and TC on DP are 0.581, 0.432, and 0.306 respectively, and the P-values are all less than 0.01, indicating that these variables have a significant positive impact on DP. The standardized coefficients  $\beta$  are 0.454, 0.307, and 0.183 respectively, confirming the strength and direction of these relationships. Three models are constructed as follows:

$$\text{Model 1: } DP = 0.581 + 0.432 \times TC + 0.306 \times SC + 0.172 \times NC$$

$$\text{Model 3: } DC = 0.043 + 0.412 \times TC + 0.145 \times SC + 0.411 \times NC$$

$$\text{Model 2: } DP = 0.571 + 0.342 \times TC + 0.274 \times SC + 0.082 \times NC + 0.220 \times DC$$

**Table 8***Mediation test*

item	symbol	content	effect	95% CI		SE value	z- / t-value	p-value	conclusion
				lower limit	upper limit				
TC→DC→DP	$a \times b$	Indirect effects	0.091	0.065	0.129	0.016	5.564	0.000	Part of the intermediary
TC→DC	$a$	X→M	0.412	0.363	0.462	0.025	16.265	0.000	
DC→DP	$b$	M→Y	0.220	0.176	0.264	0.022	9.774	0.000	
TC→DP	$c'$	Direct effects	0.342	0.297	0.386	0.023	15.103	0.000	
TC→DP	$c$	Total effect	0.432	0.390	0.474	0.021	20.231	0.000	
SC→DC→DP	$a \times b$	Indirect effects	0.032	0.014	0.052	0.010	3.229	0.001	Part of the intermediary
SC→DC	$a$	X→M	0.145	0.089	0.202	0.029	5.060	0.000	
DC→DP	$b$	M→Y	0.220	0.176	0.264	0.022	9.774	0.000	
SC→DP	$c'$	Direct effects	0.274	0.228	0.320	0.024	11.603	0.000	
SC→DP	$c$	Total effect	0.306	0.258	0.353	0.024	12.634	0.000	
NC→DC→DP	$a \times b$	Indirect effects	0.090	0.065	0.133	0.017	5.374	0.000	Part of the intermediary
NC→DC	$a$	X→M	0.411	0.356	0.466	0.028	14.616	0.000	
DC→DP	$b$	M→Y	0.220	0.176	0.264	0.022	9.774	0.000	
NC→DP	$c'$	Direct effects	0.082	0.033	0.130	0.025	3.317	0.001	
NC→DP	$c$	Total effect	0.172	0.126	0.219	0.024	7.265	0.000	

The impacts of all independent variables (TC, SC, NC) on the dependent variable DP through the mediating variable DC are significant. The proportions of the indirect effects in the total effects are different, indicating that DC plays different roles in the process of different capabilities affecting DP. The proportion of the indirect effect of network capabilities (NC) on DP through DC is the highest, indicating that DC plays a more important mediating role in the impact of NC on DP. While the proportion of the indirect effect of social capital (SC) is the lowest, indicating that the mediating role of DC in the impact of SC on DP is relatively small. The total indirect effects of independent variables on DP through DC are significant and account for a certain proportion, which emphasizes the importance of considering the mediating variable when considering the impacts of these core capabilities on digital transformation performance.

#### 4.6 Findings based on research hypotheses

Path analysis reveals the direct and indirect impacts of independent variables (NC, SC, TC) on the mediating variable (DC) and the dependent variable (DP). The results show that technological capabilities (TC), social capital (SC), and network capabilities (NC) all have a significant positive impact on digital capabilities (DC), and DC significantly affects digital transformation performance (DP), indicating that DC plays a partial mediating role between independent variables and DP. The results of the mediation effect analysis show that the indirect effects of TC, SC, and NC on DP through DC are 20.959%, 10.441%, and 52.448% respectively. These proportions reveal the magnitude of the role of DC in the process of different capabilities affecting DP. Especially for NC, its impact on DP through DC exceeds half of the total effect, showing a significant mediating role of DC in the impact of NC on DP. The following is the support situation of hypotheses based on the empirical research results:

**Table 9**

*Hypothetical support*

Hypothesis	Coefficient ( $\beta/a \times b$ )	p-value	Effect Percentage (%)	Support
H1a	0.411	<0.01	-	Supported
H1b	0.172	<0.01	52.448	Supported
H2a	0.145	<0.01	10.441	Supported
H2b	0.306	<0.01	-	Supported
H3a	0.412	<0.01	20.959	Supported
H3b	0.432	<0.01	-	Supported
H4	0.22	<0.01	-	Supported
H5a	0.09	<0.01	52.448	Supported
H5b	0.032	<0.01	10.441	Supported
H5c	0.091	<0.01	20.959	Supported

#### 4.7 Qualitative results

This article adopts the semi - structured interview method and collects interview data from 15 senior enterprise managers. Combined with enterprise document materials, nearly 20,000 words of original text materials are formed. Through multiple rounds of analysis including open coding, axial coding, and selective coding, researchers transform the interview content into analyzable data, and finally form a generic coding table

covering corporate network capabilities, digital capabilities, social capital, digital transformation performance, and technological capabilities. The sufficiency of the data and the reliability of the theoretical model are ensured through information saturation testing. Finally, a comprehensive theoretical model is constructed. It is found that enterprise digital capabilities play a core role in the process of digital transformation. They are not only the direct driving force for promoting digital transformation but also connect other categories such as network capabilities, social capital, and technological capabilities. Network capabilities provide resources and support for enterprises through external partnership relationships. Social capital promotes cross - departmental cooperation by establishing trust and collaboration mechanisms. Technological capabilities provide basic support for digital capabilities through technological innovation and R&D investment. The three jointly indirectly affect digital transformation performance through digital capabilities.

## **5 CONCLUSION AND DISCUSSION**

### **5.1 Conclusion**

The discussion section of this study delves into how network capabilities, social capital, and technological capabilities indirectly influence digital transformation performance through digital capabilities. This enriches the theoretical framework of existing literature and offers new perspectives and guidance for enterprises' digital transformation practices. The research findings indicate that network capabilities, social capital, and technological capabilities not only have a significant positive direct impact on digital transformation performance but also indirectly drive performance improvement through the mediating role of digital capabilities.

Specifically, network capabilities provide resources and support to enterprises through external partnership relationships. Social capital promotes cross - departmental cooperation by establishing trust and collaboration mechanisms. Technological capabilities offer fundamental support for digital capabilities through technological innovation and R&D investment. As the core driving force, digital capabilities not only directly enhance enterprises' operational efficiency and innovation capabilities but also

integrate the effects of network capabilities, social capital, and technological capabilities, further promoting the improvement of digital transformation performance. The mediation analysis shows that digital capabilities play a partial mediating role in the influence of network capabilities, social capital, and technological capabilities on digital transformation performance, especially a remarkable mediating role in the influence of network capabilities.

## 5.2 Discussion of results

Through comprehensive analysis, this study not only verifies relevant viewpoints in existing literature but also further reveals the specific action mechanisms of these factors in digital transformation. Firstly, this study validates the significant positive impact of network capabilities on digital capabilities, which is consistent with the research of Zhou and Zhao (2020), Gölgeci and Kuivalainen (2020), Ji *et al.* (2022), and others. These studies point out that enterprises can accelerate the adoption and integration of digital technologies through cooperation with external partners. However, this study further uncovers the mechanism by which network capabilities indirectly affect digital transformation performance through digital capabilities, supplementing the discussion on the action paths of network capabilities in existing literature. This finding indicates that network capabilities not only directly influence digital capabilities but also indirectly promote the improvement of digital transformation performance by enhancing digital capabilities.

Secondly, this study confirms the positive impact of social capital on digital capabilities, which is in line with the viewpoints of Adler and Kwon (2002). They believe that social capital can promote organizational innovation and performance improvement by facilitating knowledge sharing and trust - building. However, the innovation of this study lies in revealing the path by which social capital indirectly affects digital transformation performance through digital capabilities. Compared with the research of Seo (2020), this study not only focuses on the role of social capital in promoting technological performance but also directly links it to digital transformation performance, providing a more comprehensive theoretical perspective. In addition, this study also finds that the impact of social capital is relatively weak under the mediating role of digital

capabilities, which contrasts with the research of Bagale *et al.* (2023). This difference may stem from the core position of digital capabilities in this study, indicating that in the process of digital transformation, the role of social capital is more realized through supporting digital capabilities.

Regarding technological capabilities, the results of this study are consistent with the research of Chu *et al.* (2019), who pointed out that technological capabilities have a significant positive impact on innovation performance. However, this study further reveals the mechanism by which technological capabilities indirectly affect digital transformation performance through digital capabilities, supplementing the discussion on the action paths of technological capabilities in existing literature. Compared with the research of Jeong and Chung (2023), this study not only emphasizes the synergistic effect of technological capabilities and social capital but also extends its influence to the comprehensive improvement of digital transformation performance. The research of Rodrigo - Alarcón *et al.* (2020) emphasizes that technological capabilities are crucial in digital transformation, involving not only the mastery of new technologies but also the enterprise's ability to absorb knowledge and innovate. This study further verifies that digital capabilities, as the core driving force of enterprise innovation performance, can enhance overall digital performance by integrating network and social capital. In addition, this study also finds that the direct impact of technological capabilities on digital capabilities is relatively strong, which contrasts with the research of Soellner *et al.* (2024). This difference may be attributed to the core position of digital capabilities in this study, indicating that in the process of digital transformation, the role of technological capabilities is more realized through supporting digital capabilities.

Finally, this study emphasizes the core role of digital capabilities in digital transformation, which is consistent with the viewpoints of Matt *et al.* (2015), who believe that digital capabilities are the key to enterprises' all - around transformation. However, the innovation of this study lies in revealing the mediating role of digital capabilities in the influence of network capabilities, social capital, and technological capabilities on digital transformation performance. Compared with the research of Pappas *et al.* (2018), this study not only focuses on the role of digital capabilities in optimizing business processes but also directly links it to the overall performance improvement of enterprises, providing a more comprehensive theoretical perspective. In addition, this study also finds

that the mediating role of digital capabilities in the influence of network capabilities is particularly significant, which contrasts with the research of Xu *et al.* (2022). This difference may be due to the core position of digital capabilities in this study, indicating that in the process of digital transformation, the role of network capabilities is more realized through supporting digital capabilities.

### 5.3 Practical implications

This study provides important insights for enterprise managers, guiding them on how to effectively allocate resources during the digital transformation process. The research findings suggest that enterprises should focus on building network capabilities and accelerate the adoption and integration of digital technologies through cooperation with external partners. At the same time, they should optimize the utilization of social capital, promote organizational innovation and performance improvement by facilitating knowledge sharing and trust - building. Moreover, enterprises need to enhance technological capabilities, including mastering new technologies and improving the enterprise's ability to absorb knowledge and innovate.

These findings indicate that when promoting digital transformation, enterprises should not only pay attention to enhancing technological capabilities but also attach importance to establishing and maintaining relationships with partners, as well as internal technological innovation and organizational support. By strengthening digital capabilities, enterprises can better integrate network capabilities, social capital, and technological capabilities, thereby achieving more efficient digital transformation.

This study not only enriches the theoretical framework of the digital transformation field but also provides strong theoretical support and practical guidance for enterprises' strategic formulation and resource allocation in the digital age. These findings offer new perspectives for understanding digital transformation and send a clear signal to enterprises: investing in network capabilities, social capital, and technological capabilities and strengthening digital capabilities are effective strategies to improve digital transformation performance. This provides important theoretical support and practical guidance for enterprise managers in resource allocation and strategic formulation.

## 5.4 Limitations and suggestions for future research

Although this study has achieved certain results in theory and practice, it still has some limitations. Firstly, the data collection of this study mainly relies on enterprises' self-reports, which may lead to data subjectivity and bias. Future research can consider using multiple data sources, such as field observations, interviews, and third-party data, to improve the reliability and validity of research results. Secondly, the samples of this study are mainly concentrated in specific industries, which may limit the generality of the research results. Future research can expand the sample scope to cover more industries and enterprise types to verify whether the findings of this study have broader applicability. Finally, this study mainly focuses on the indirect impacts of network capabilities, social capital, and technological capabilities on digital transformation performance. Future research can further explore the interactions among these factors and their comprehensive impacts on digital transformation performance.

Future research can be further expanded in the following directions. Firstly, it can deeply explore the specific components of digital capabilities and their manifestations in different industries and enterprises to better understand the connotation and extension of digital capabilities. Secondly, it can study the relationships between digital capabilities and other organizational capabilities (such as organizational learning capabilities and innovation capabilities) and how these capabilities jointly affect enterprises' digital transformation performance. In addition, future research can also pay attention to the dynamic changes in the digital transformation process, such as the impacts of technological updates and market environment changes on digital capabilities, and how enterprises can enhance their digital capabilities through continuous learning and adaptation. Finally, it can explore the differences in digital capabilities in different countries and regions and the impacts of cultural, policy, and other factors on digital capabilities, providing more targeted guidance for the digital transformation of global enterprises.

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### **Authors' Contribution**

All authors contributed equally to the development of this article.

### **Data availability**

All datasets relevant to this study's findings are fully available within the article.

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