The impact of digital technology application and digital capabilities in enhancing the digital export performance of Vietnamese enterprises

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Abstract: ***This paper analyzes the role of digital technology and digital capabilities in enhancing the digital export performance of Vietnamese enterprises. Quantitative research on 266 enterprises reveals that applying digital technology and developing digital capabilities significantly enhances export efficiency. Notably, the synergy between these two factors creates a more robust and positive impact on digital export performance. Based on these findings, the paper offers practical recommendations for exporting enterprises and policy suggestions for the Government and state agencies to facilitate digital export activities in Vietnam within the context of globalization.***

Keywords: *Digital technology application; digital capabilities; digital export; exporting enterprises; Vietnam.*

1. Introduction

Amidst the global economy's increasing integration and the profound impact of digital transformation, "digital export" has garnered significant attention from researchers and enterprises alike. Digital export refers to providing products and services to international markets through online platforms, enabling enterprises to access global markets more rapidly and efficiently (Elia et al., 2021; Ma et al., 2023). *Digital export performance* is defined as financial and non-financial successes achieved through using online trading platforms to access global markets.

In Vietnam, digital export has become more pressing than ever as the country deepens its integration into the global economy during the digital era of the Industrial Revolution 4.0. Both general trends and the specific circumstances of exporting enterprises reveal that digital transformation has become necessary across nearly all types of businesses and industries (Thao & Dong, 2022). The rapid proliferation of e-commerce platforms and information technology requires Vietnamese exporting enterprises to build and optimize their digital resources to expand market reach and enhance the quantity and quality of their digital export activities.

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The digital resources and capabilities essential for Vietnamese enterprises' digital export activities respond to the growing global market demands and enhance their competitive position in international markets. This study evaluates the individual impacts of digital technology applications and digital capabilities and examines their synergistic effects on digital export performance. The findings contribute to a deeper understanding of the interplay between these factors, offering management implications for Vietnamese enterprises in shaping their export strategies in the digital age and policy solutions for the government and regulatory agencies to manage and promote digital exports.

2. Theoretical framework

2.1. Basic concepts

According to the Resource-Based Theory (Barney, 1991), enterprises can achieve and sustain competitive advantages by possessing and leveraging unique, valuable, and inimitable resources. In the digital context, an enterprise's digital resources refer to the assets and capabilities it owns to develop and optimize business operations in a digital environment. These resources include information technology, software systems, data, and employees' skills in utilizing and managing digital technologies (Elia et al., 2021). The essence of digital resources lies in owning advanced technologies and the ability to employ, integrate, and optimize these resources to create additional value for the enterprise.

Digital technology is a collection of technologies that utilize digital data to collect, store, process, and transmit information. It is the foundation of the Industrial Revolution 4.0 and includes technologies such as artificial intelligence (AI), Big Data, blockchain, cloud computing, the Internet of Things (IoT), and automation. Digital technology enables enterprises to automate production and management processes, optimizing operational efficiency while improving product quality, reducing costs and time, enhancing labor productivity, and minimizing errors (Huy, 2023; Zhang et al., 2024).

An enterprise's digital capability is its ability to adopt, implement, and leverage digital technologies to enhance business performance, creating value and competitive advantages. Digital capabilities encompass more than just using digital devices in production and business operations. They also include the ability to extract and utilize information, communicate and collaborate in digital environments, ensure digital and cybersecurity, and foster the development and innovation of digital capabilities for sustainable growth and development (Elia et al., 2021; Yen et al., 2023).

In the context of globalization and the rapid growth of e-commerce, digital resources play a pivotal role in an enterprise's digital export activities (Elia et al., 2021). Enterprises with robust digital resources can harness digital technologies to improve production processes, enhance product quality, and optimize distribution channels. This, in turn, boosts operational efficiency and expands access to global markets (Hoang, 2022). Furthermore, digital resources enable enterprises to collect, analyze, and utilize customer data using big data analytics and artificial intelligence (AI). This capability allows enterprises to quickly identify consumer trends and tailor their products and services to meet international market demands.

2.2. The development of the research model and hypotheses

(1) Digital technology and its applications in enterprises

Digital technology is a critical resource for implementing and promoting export activities in digital exports. Lee (2017) emphasized the indispensable role of e-commerce in enhancing sales performance and the cross-border distribution of products and services. By leveraging existing digital platforms (e.g., websites, email, social media, and e-commerce platforms), enterprises can diversify online marketing approaches and sales channels, facilitating

customer engagement, improving customer satisfaction and loyalty, acquiring new customers, and enhancing digital export performance.

Digital technology also plays a vital role in gathering and analyzing market data, improving access to and service for international customers. Big data analytics tools allow enterprises to gain deeper insights into customer behavior and preferences, enabling precise and timely business decisions. An in-depth understanding of export markets empowers enterprises to adjust their products and services to align with the specific needs of each market segment (Borghi & Mariani, 2021). Moreover, customer relationship and supply chain management systems enable exporters to interact effectively with customers and supply chain members, enhancing customer satisfaction and experience. Satisfied international customers are more likely to repurchase and recommend products, contributing to the growth of digital exports.

Supporting the positive role of digital technology application, the paper proposes the first research hypothesis as follows:

Hypothesis H1: *Applying digital technology positively impacts enterprises' digital export performance.*

(2) Digital capabilities of enterprises

Digital capabilities positively impact enterprises' digital export activities, enabling the optimization of market entry and international market penetration processes. By leveraging the ability to collect and analyze data from online platforms, enterprises can identify customer needs and global market fluctuations, allowing them to develop appropriate strategies and enhance their ability to reach and satisfy international customers.

Furthermore, digital capabilities improve supply chain management through modern technologies such as IoT and automation, helping enterprises uphold their commitments to quality and timely delivery in international markets. By applying technology to product improvements and operational processes, the ability to adapt and innovate rapidly allows enterprises to export personalized products or services that effectively meet the specific demands of individual international markets, thereby enhancing business performance (Luu, 2023).

Digital capabilities also play a crucial role in enhancing the customer experience and building loyalty among international clients (Borghi & Mariani, 2021). Online platforms enable enterprises to interact directly with customers, gather timely feedback, and proactively improve their products and services, which builds customer trust. Additionally, data security and management are critical components of digital capabilities, particularly given the increasing importance of data security in the global market. By employing encryption, multi-factor authentication, and digital risk management solutions, enterprises can protect customer data, enhance their reputation, and sustain digital export activities in the digital environment. Digital capabilities, therefore, are a core factor that helps digital exporting enterprises enhance their competitiveness, optimize performance, and build long-term relationships with international markets.

Based on the analysis above, the second research hypothesis is proposed as follows:

Hypothesis H2: *Digital capabilities have a positive impact on the digital export performance of enterprises.*

(3) Synergistic effects of digital technology and capabilities

In the context of globalization, digital export activities among Vietnamese enterprises are becoming increasingly critical. When enterprises simultaneously adopt digital technology and possess strong digital capabilities, the combination generates a synergistic effect that significantly enhances digital export performance.

By utilizing digital technology, enterprises can optimize production processes and improve product quality. Meanwhile, digital capabilities enable enterprises to assess, adjust, implement, and flexibly integrate digital technologies according to the specific characteristics of their

industries and resources. This combination boosts efficiency and enhances the ability to meet diverse market demands, overcome stringent export barriers, and strengthen competitiveness in digital export activities (Luu, 2023).

Additionally, integrating digital technology and capabilities significantly improves the effectiveness of marketing strategies and product distribution. By leveraging digital platforms such as big data, IoT, and AI alongside digital capabilities in data analysis and evaluation, enterprises can develop tailored marketing strategies, distribution networks, and e-commerce sales channels for specific customer segments, geographic regions, and territories. This approach increases orders, expands market reach, and elevates digital export performance.

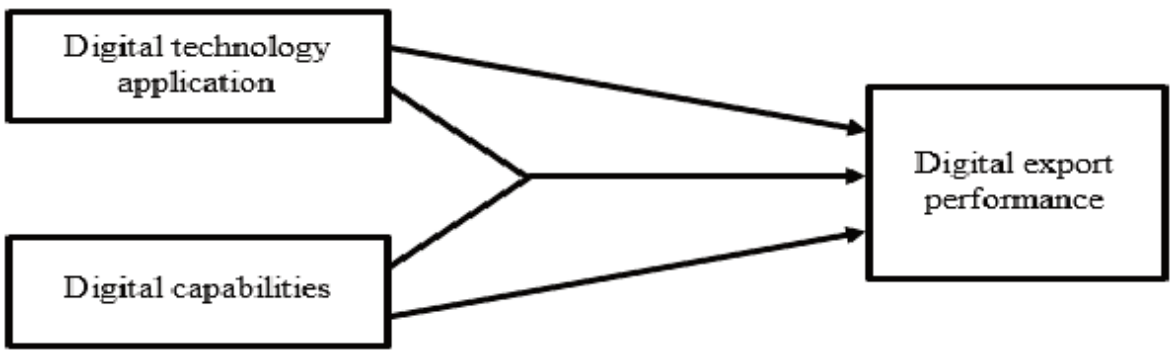
Furthermore, this synergy equips enterprises to respond swiftly to fluctuations in export markets. By employing digital technology to monitor and analyze changes in market demand and consumption trends and using digital capabilities to adjust strategies promptly, enterprises can effectively seize new export opportunities. This agility is particularly vital in the context of rapidly evolving global markets.

Based on this perspective, the study proposes the following hypothesis:

Hypothesis H3: *The combined application of digital technology and digital capabilities has a positive synergistic impact on the digital export performance of enterprises.*

Based on the theoretical analysis above, the research theoretical model is constructed as follows:

Figure 1: Theoretical research model



Source: Compiled by the authors (2024)

3. Research methodology

A comprehensive literature review was conducted to establish the theoretical foundation, research model, and hypotheses. Published studies were synthesized to clarify the relationships between digital technology applications, digital capabilities, and enterprises' digital export activities. Measurement scales were also identified to design a survey questionnaire to collect data necessary to test the proposed model and hypotheses.

The survey was distributed through email and postal mail, targeting reputable exporting enterprises listed in the annual import-export reports by the Ministry of Industry and Trade from 2016 to 2023. These enterprises are highly reputable within their industries, ensuring the representativeness and reliability of the data collected through the survey. Regarding sample size, this study examines the impact of two independent variables-digital technology application and digital capabilities-along with the interaction variable between these two factors and two control variables: enterprise age and workforce size. In total, the regression model employs five independent variables. According to Tabachnick and Fidell (2012), the minimum sample size required to test a regression model is 50 + 8 × the number of independent variables for overall model testing

and 104 + the number of independent variables for testing each predictor individually. In this study, the minimum required sample sizes are 90 and 109, respectively.

The collected questionnaires were meticulously screened to exclude enterprises engaged only in traditional exports and those that had not participated in digital exports, as well as questionnaires with missing critical information. The screening process was conducted manually and cross-verified with enterprise information to ensure accuracy. After removing invalid responses, 266 valid questionnaires were retained, forming the research sample.

With a sample size of 266 enterprises, the study meets the required criteria and ensures the sample's representativeness, supporting the analysis results' reliability. The questionnaire data were entered and compiled using Excel to check for consistency and identify anomalies. Subsequently, the data were transferred to SPSS software for statistical analysis, including reliability tests, factor analysis, and multiple regression analysis. Key characteristics of the research sample are presented in the table below, serving as the foundation for further analyses in this study (Table 1).

The sample represents most digital export enterprises in Vietnam, with private enterprises comprising the highest percentage (31.58%), followed by joint-stock companies (25.56%). Regarding export markets, most enterprises focus on non- ASEAN Asian countries (32.71%), followed by the EU and North America. Notably, the sample predominantly includes small and medium-sized enterprises (SMEs) with 10–199 employees (51.5%), while larger enterprises with 200–999 employees also account for a significant proportion (24.81%). Regarding revenue, most enterprises generate between 10 billion and 299 billion VND, indicating that this is the standard threshold within the study sample. Based on the characteristics of the enterprises in the sample, it can be observed that most are SMEs with a significant presence in digital export activities.

Table 1: Quantitative research sample characteristics

Criteria	Number	Percentage (%)	Criteria	Number	Percentage (%)
Enterprise type	266	100	Main market	266	100
State-owned	50	18.8	ASEAN	38	14.29
Joint-stock company	68	25.56	Asia (excluding ASEAN)	87	32.71
Private/LLC	84	31.58	EU (Europe)	64	24.06
Foreign-invested	30	11.28	North America	46	17.29
Others	34	12.78	Others	31	11.65
Number of employees	*266*	*100*	*Revenue (VND)*	*266*	*100*
Fewer than 10	47	17.67	Less than 10 billion	42	15.79
10–99	71	26.69	10–99 billion	58	21.8
100–199	66	24.81	100–299 billion	87	32.71
200–999	66	24.81	300–999 billion	49	18.42
1,000 or more	16	6.02	1 trillion or more	30	11.28

Source: Compiled by the authors (2024)

Table 2: Reliability test results for research variables

Variable name	Code	Cronbach's Alpha	KMO & Bartlett Test	Explained variance of first factor (%)	References
Digital technology application	DT	0.847	0.738 (p = 0.000)	68.864	Elia et al. (2021); Hoang (2022); Luu (2023); Zhang et al. (2024)
Digital application in operations	DT1				
Digital CRM application	DT2				
Digital supply chain management	DT3				
Digital decision support	DT4				
Digital capabilities	DC	0.85	0.745 (p = 0.000)	69.307	Elia et al. (2021); Luu (2023)
Digital knowledge	DC1				
Digital skills	DC2				
Digital data analytics	DC3				
Digital governance capabilities	DC4				
Digital export performance	DE	0.92	0.790 (p = 0.000)	80.809	Elia et al. (2021); Hoang (2022); Ma et al. (2023)
Digital export revenue	DE1				
Digital export profit	DE2				
Digital market share	DE3				
Digital export goals	DE4				

Source: Compiled by the authors (2024)

The scale testing results in the table show that Cronbach's Alpha values for all variables are more significant than 0.7, indicating that the scales demonstrate internal consistency and ensure the reliability of the items within each scale. Additionally, the KMO and Bartlett's tests have values greater than 0.7. They are statistically significant at the 95% confidence level, confirming that the data are suitable for exploratory factor analysis and rejecting the hypothesis of no correlation among the variables. Furthermore, the extracted factor values for the first component of each variable exceed 50%, meaning that this component explains more than 50% of the variance of the observed variables, reflecting the component's significant contribution to the scale's structure. Based on these results, the reliability and validity of the scales used in this study can be confirmed.

A regression analysis was conducted using validated scales to test the research model and hypotheses regarding the effects of digital technology applications and digital capabilities on digital exports. The regression equation includes two independent variables (current levels of digital technology application and digital capabilities), one interaction term (synergy between the two independent variables), and two control variables (firm age and workforce size):

Digital Export Performance (DEP) = $\beta_0 + \beta_1(DT) + \beta_2(DC) + \beta_3(DT*DC) + \beta_4(FA) + \beta_5(WS) + \varepsilon$

Where:

- DEP: Digital export performance
- DT: Digital technology application
- DC: Digital capabilities
- FA: Firm age
- WS: Workforce size
- ε: Error term

4. Research Results

The regression analysis results presented in Table 3 demonstrate high reliability, as evidenced by critical statistical indicators. The ANOVA and regression analyses are summarized as follows:

The ANOVA analysis shows that the regression model is statistically significant, with F = 45.971 and p-value (Sig.) = 0.000, indicating that the independent variables explain the variation in the dependent variable. The R^2 value of 0.469 and the adjusted R^2 value of 0.459 suggest that approximately 46.9% of the variance in the dependent variable is explained by the model, reflecting a good model fit.

The tolerance and Variance Inflation Factor (VIF) values were examined to assess multicollinearity. All tolerance values were more significant than 0.1, and VIF values were below 10, ranging from 1.033 to 1.138. This confirms that there is no severe multicollinearity in the model. The Durbin-Watson statistic of 1.926, close to 2, indicates no autocorrelation in the residuals. Together, these results confirm the model's suitability and the significant contribution of digital technology factors to the dependent variable.

Independent variables such as digital capabilities (DC) and digital technology application (DT) were statistically significant at $p < 0.05$, with unstandardized coefficients of 0.138 and 0.221, respectively, demonstrating their positive effects on the dependent variable. The interaction variable (DT*DC) also showed high significance ($p < 0.05$) with a coefficient of 0.639, indicating a strong interaction effect between these two factors on the outcome.

In contrast, control variables such as firm age (FA) and workforce size (WS) were not statistically significant ($p > 0.05$), suggesting that they do not play an essential role in this model.

These findings indicate that in the context of deep global economic integration, the rapid development of the digital economy, the strong application of Industrial Revolution 4.0 achievements, and changing consumer

behavior, Vietnamese enterprises' export performance is not dependent on export experience or workforce size. Instead, it is primarily determined by the application of digital technologies and enterprises' digital capabilities.

Table 3: Regression analysis results

ANOVA					
Model	Sum of Squares	df	Mean Square	F	Sig.
Regression	124.345	5	24.869	45,971	0,000
Residual	140.655	260	0.541		
Total	265	265			

Regression Coefficients						
	Unstandardized Coefficient (B)		t	Sig.	Multicollinearity	
	B	Standard Error			Tolerance	VIF
(Coefficient)	-0,198	0,139	-1,429	0,154		
DT	0,221***	0,048	4,615	0,000	0,891	1,122
DC	0,138**	0,048	2,865	0,005	0,879	1,138
DT*DC	0,639***	0,047	13,685	0,000	0,904	1,107
FA	0,015	0,035	0,423	0,672	0,968	1,033
WS	0,011	0,039	0,294	0,769	0,956	1,046

Source: Compiled by the authors (2024)

Notes:

- R = 0.685; R^2 = 0.469; Adjusted R^2 = 0.459
- Durbin-Watson = 1.926
- ***p < 0.001, **p < 0.01, *p < 0.05
- Standard Error = 0.736; F = 45.971; Sig. = 0.000.

4.1. The impact of digital technology application on enterprises' digital export performance

The regression results in Table 3 show that DT positively impacts the dependent variable DE at a 95% confidence level (B = 0.221 & p = 0.000). Thus, Hypothesis H1 is confirmed: the more vital Vietnamese enterprises implement digital technology applications, the higher their digital export performance. With the robust growth of e-commerce platforms such as Shopee and Lazada, and especially international marketplaces like Alibaba and Amazon, Vietnamese enterprises can easily access international markets, reduce operational costs, and optimize supply chains. Commonly exported products include ceramics, furniture, handicrafts, and agricultural products. The number of products enterprises sell on Amazon has increased by over 300% in the past five years. Vietnamese goods can reach over 2 billion people annually in European, North American, Australian, Japanese, and Indian markets.

Although the benefits of digital technology are clear, the current application of digital technologies in Vietnamese enterprises still needs to be improved. Most SMEs still need help accessing modern technologies due to financial and human resource constraints, primarily using essential digital technologies or tools available on e-commerce platforms. These

technologies typically focus on customer engagement and service but must fully address the need to optimize the entire supply chain or production-business infrastructure.

Only a few large enterprises with financial capacity and long-term strategies can invest deeply in digital technologies for their entire process, from production and management to distribution. For example, companies like May 10 and Minh Phu Seafood have invested in order management systems and customer data processing through e-commerce platforms, helping to improve delivery times and enhance customer experience. TH True Milk has invested in automation systems and AI to monitor and manage its international supply chain, ensuring product quality and quickly meeting the demands of foreign partners. Vinamit, a company in the agricultural food processing industry, has built a digital system to manage product quality and store product data.

4.2. The impact of digital capabilities on enterprises' digital export performance

According to the regression analysis results in Table 3, the variable DC hurts the dependent variable DE at a 95% confidence level (B = 0.138 & p = 0.005). Thus, Hypothesis H2 is confirmed: the more robust the digital capabilities of Vietnamese enterprises, the higher their digital export performance. In reality, digital capabilities go beyond simply using technology; they also include analyzing data, optimizing operational processes, and leveraging technology to increase engagement with international customers. Digital capabilities at various levels, from basic to integrated, significantly contribute to improving product quality, optimizing production processes, and adapting quickly to changing global consumer needs and behaviors. This enables enterprises to meet the stringent requirements of international markets and boost digital exports.

In practice, despite improvements, the digital capabilities of Vietnamese enterprises still need to improve in terms of knowledge and digital skills, the ability to integrate technology into production and business processes, and the level of optimization of digital tools. Digital-skilled labor in enterprises has increased by more than 200% over the past five years, but this workforce still needs to improve in quantity and proficiency. Most workers are suited to efficient basic and advanced digital skills, limiting their ability to apply digital technologies effectively and proactively. Moreover, connecting and integrating digital systems in production processes, logistics chain management, e-commerce, and cross-border sales could be more efficient, positively impacting management effectiveness and digital export capabilities. The ability to apply and integrate advanced technologies such as AI, Big Data, and IoT into product innovation processes still needs to be improved. To improve digital export performance, Vietnamese enterprises must develop comprehensive solutions to enhance their digital capabilities while addressing the current limitations to increase their competitive advantage in international markets.

4.3. Regarding the synergistic impact of digital technology and digital capabilities on digital export performance

The regression results in Table 3 show that the interaction variable DT*DC positively impacts the dependent variable DE at a 95% confidence level, with a coefficient of B = 0.639 and p = 0.000. When considered separately, the coefficient of this interaction term is much larger than the individual effects of digital technology and digital capabilities. This implies that Vietnamese enterprises that simultaneously apply digital technology and possess solid digital capabilities experience significantly higher digital export performance than those relying on just one of these factors. Thus, Hypothesis H3 is confirmed.

The current situation in Vietnamese enterprises indicates that while many have started applying digital technology in their export activities, their digital capabilities still need to be integrated or sufficiently developed. Particularly, SMEs, although having access to

technology through e-commerce platforms and basic management systems, SMEs often need more digital capabilities to harness technology's benefits fully. This gap results in digital tools being used only at a basic level, failing to achieve optimal export results. Conversely, some enterprises have solid digital capabilities but need more financial capacity to invest in advanced technologies. This leads to a need for more integration in digital processes, negatively impacting their digital export performance.

Only a few large enterprises in Vietnam have the financial capacity to develop digital technology and digital capabilities comprehensively, creating a solid synergistic effect that enhances their competitiveness in exports. These enterprises can apply advanced technologies such as artificial intelligence (AI), big data analytics, and IoT to their supply chains and production processes while developing a highly skilled workforce to optimize the export process. This enables them to respond quickly to market fluctuations, effectively analyze consumer data, and meet the stringent standards of international markets.

5. Governance and policy implication

Based on the research findings, the paper proposes several solutions for Vietnamese exporting enterprises to simultaneously apply digital technology and develop digital capabilities to optimize digital export activities. Specifically, regarding the application of digital technology, enterprises should invest in information technology infrastructure and modern software, with particular emphasis on technology systems and automated production processes, sales management software, customer relationship management (CRM), and supply chain management. Strengthening e-commerce platforms and online marketing channels will help enterprises promote products and expand their export markets. Furthermore, enterprises should focus on training and developing digital skills for employees to ensure the effective use of existing technologies.

To develop digital capabilities, Vietnamese exporting enterprises must focus on building digital capabilities at appropriate levels. First, enterprises should concentrate on developing a workforce with solid digital competencies and the ability to work professionally in a digital environment. At the same time, establishing an effective digital data management system will help enterprises optimize data storage and analysis, supporting accurate and timely decision-making. Additionally, enterprises need to enhance the development of online distribution channels to customers and maintain close connections with partners through technology platforms, strengthening their ability to proactively adapt and meet the needs of international markets.

The government and state regulatory agencies need to improve policies that support Vietnamese enterprises in enhancing their digital capabilities and applying digital technology, thereby promoting their digital export activities. First, the government should establish transparent and flexible regulations to ensure a business environment on e-commerce platforms that is both transparent and encourages innovation. This may include policies on intellectual property protection, clear tax regulations, and policies supporting safe and convenient international payment systems for enterprises. Additionally, the government should facilitate the development of digital infrastructure, particularly cross-border payment and logistics systems, to help enterprises quickly access and operate on international e-commerce platforms. Investing in international payment systems with high-security mechanisms will help Vietnamese enterprises build trust with international customers and minimize transaction risks.

Furthermore, the government should assist enterprises in training and enhancing digital capabilities, particularly for SMEs. Support programs such as digital marketing, supply chain management, and cybersecurity training will help enterprises maximize the use of e-

commerce platforms to expand their international markets. The government could also support businesses through grant programs or preferential loans to invest in technology and digital infrastructure, thereby creating favorable conditions for developing digital exports.

6. Conclusion

This paper has highlighted the crucial role of digital technology and digital capabilities in enhancing the digital export performance of Vietnamese enterprises. To achieve sustainable success in digital exports, enterprises need to develop a comprehensive strategy that focuses on improving both digital technology infrastructure and the digital skills of their workforce. In addition, the government and state agencies must implement timely policies to facilitate access to new technologies and enhance the competitiveness of enterprises. This helps Vietnamese enterprises thrive in digital export activities and contributes to the country's sustainable economic development in the context of global integration.

The research contributes to the theoretical framework of the relationship between digital technology, digital capabilities, and digital export performance. By analyzing the role and interaction of these factors, the study expands the concept of digital transformation in the context of exports. It provides a new theoretical framework for future research.

From a practical perspective, the study offers management and policy implications for enterprises and government agencies to enhance digital export performance. These recommendations help Vietnamese enterprises optimize their business activities through digital technology and guide the development of appropriate government policies. Ultimately, these efforts will improve the competitiveness of Vietnamese enterprises in the global market and foster the sustainable development of Vietnam's digital export activities.

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