RESEARCH ON THE DETERMINANTS OF E-COMMERCE DEVELOPMENT IN CONJUNCTION WITH DIGITAL TRANSFORMATION AMONG RETAIL ENTERPRISES IN HANOI, VIETNAM

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ABSTRACT

This paper explores the core determinants that shape the development of e-commerce in conjunction with digital transformation among retail enterprises in Hanoi, Vietnam. Drawing on the empirical findings, the study offers practical recommendations to accelerate e-commerce adoption in alignment with digital transformation trends within the retail sector. Data were obtained from a survey of 275 businesses across multiple districts in Hanoi and processed using SPSS software. The results indicate that five determinants exert significant influence on the advancement of e-commerce in the digital transformation context: (1) technological and digital infrastructure, (2) digital business strategy, (3) governmental support policies, (4) leadership capability, and (5) workforce competencies. The significance of this topic lies not only in its theoretical contribution but also in its ability to propose concrete solutions that promote the digital transformation process, particularly for small and medium-sized retail enterprises. The study's outcomes provide scientific and practical foundations that assist policymakers in refining supportive policy frameworks, while enabling businesses to recognize and address existing barriers, thereby enhancing their competitiveness in the digital business landscape.

Keywords: *Digital Transformation, Enterprise, E-Commerce, Hanoi, Influential Factors, Retail.*

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1. INTRODUCTION

E-commerce has become one of the most important drivers reshaping the global business landscape in the digital era. It not only transforms how firms buy, sell, and transact with customers and suppliers, but also shifts the focus from "excellent production" to "customer proximity" [1], from "seller agency" to "buyer agency" [2], and from physical goods to services, information, and knowledge [3]. This evolution reflects a new competitive paradigm, where digital technologies are no longer auxiliary tools but instead serve as the core foundation for sustainable growth and competitive advantage [4].

In parallel, the digital transformation process is considered a driving force for the expansion and development of e-commerce. Digital transformation, which is essentially the integration of information and communication technology to restructure business models [5], has brought many benefits to businesses and the economy. International practice shows that information technology helps reduce production costs [6], increase productivity in agriculture [7] and in particular, EC is increasingly becoming a strategic tool to link with sustainable development goals, through increasing transparency and facilitating equitable access to resources.

In Vietnam, e-commerce has experienced rapid growth in the past decade, particularly under the impetus of digital transformation. Decision No. 749/QĐ-TTg (June 3, 2020) approved the National Digital Transformation Program to 2025, with orientation toward 2030, which emphasizes the pivotal role of DT for enterprises, identifying the retail sector as a priority for strengthening competitiveness and contributing to national economic growth (Ministry of Planning and Investment, 2020). According to the Vietnam E-commerce Association (2020,

2021, 2022), the sector's compound annual growth rate (CAGR) averaged 30% during 2016 - 2019, rose 32% in 2020, and exceeded 20% in 2021, reaching a market size of more than USD 16 billion. By 2025, Vietnam's e-commerce market is projected to surpass USD 96 billion, ranking third in ASEAN after Indonesia and the Philippines. Although the Covid-19 pandemic caused serious disruptions, it simultaneously acted as a catalyst, compelling firms - especially in retail to shift from traditional business models to e-commerce in order to sustain operations and enhance competitiveness.

Against this backdrop, the retail sector in Hanoi - Vietnam's key consumption and economic hub - emerges as a particularly relevant field of study. While EC and DT have created substantial opportunities, retail enterprises in Hanoi still face critical challenges in adopting digital technologies effectively, including limitations in data infrastructure, managerial capacity, and online business strategy. More importantly, few empirical studies have systematically examined the determinants influencing the development of EC linked to digital transformation in this group of enterprises.

Therefore, the objective of this study is to identify and analyze the factors affecting the development of EC in the digital transformation process among retail enterprises in Hanoi. By doing so, the research contributes to the theoretical understanding of the relationship between EC and DT within the retail market context, while also providing policy and managerial implications to help enterprises strengthen competitiveness in the digital economy era.

2. LITERATURE REVIEW

Recent studies have increasingly highlighted the relationship between e-commerce (EC) and digital transformation (DT) across different economies and industries. Yang, He & Yang [8] demonstrated that EC development significantly accelerates DT in Chinese manufacturing firms, primarily through increased R&D investment, although their research does not specify which EC components drive this change. From a sustainability perspective, Oláh et al. [9] identified four determinants: environmental factors, packaging, transparency, and consumer - retailer relationships, showing that sustainable EC enhances long-term competitiveness. At the macro level, Bădircea et al. [10] found that education, labor market status, Internet banking, and mobile use significantly affect EC development in the EU-27, though demographic and legal variables were not fully considered. Earlier work by Kalinić, Ranković and Kalinić [11] stressed that EC growth in Serbia depends heavily on infrastructure and legal frameworks, while Wang and Liu [12] highlighted infrastructure, urbanization, and living standards as major drivers in China between 2000 and 2012.

In the Vietnamese context, several studies provide additional insights. Nguyen D.T-L and Thanh T-D [13] found that government support and human resources directly influence DT adoption among SMEs in the Mekong Delta, though the limited sample size reduces generalizability. Si [14] examined EC in retail firms in Da Nang and concluded that technology, perceived usefulness, trust, social influence, and perceived risk, particularly the latter, shape EC adoption. Meanwhile, Van [15] synthesized international literature and identified economic, technological, experiential, customer-related, and environmental dimensions but did not empirically test them. At the firm level, Luu T.T.M, Dinh B.H., Pham B.C. [16] showed that EC adoption among SMEs in Ho Chi Minh City is shaped by external conditions (infrastructure and legal environment), internal organizational features, and leadership factors, with external factors being the most influential.

Taken together, these studies reveal that while EC consistently emerges as an important driver of DT and business competitiveness, research remains fragmented. Many studies focus on narrow geographical regions, use small samples, or examine only selected groups of variables. Additionally, very few studies investigate EC development specifically within the retail sector of transitional economies such as Vietnam. These gaps underscore the need to explore the factors influencing EC development in retail enterprises in Hanoi, where digital transformation represents both a challenge and a key opportunity for economic modernization.

3. THEORETICAL FRAMEWROK AND RESEARCH DESIGN

3.1. Theoretical framework

To explain the factors influencing EC development in the context of digital transformation, this study draws on three theoretical foundations. Institutional Theory provides a lens for understanding how political, legal, and social pressures shape organizational behavior. It suggests that firms adapt to regulatory frameworks and external expectations to maintain legitimacy and ensure long-term survival. Dynamic Capabilities Theory complements this by conceptualizing digital transformation as a continuous

process requiring organizations to reconfigure resources, absorb new knowledge, and respond flexibly to technological change. Meanwhile, the Resource-Based View emphasizes the strategic importance of internal assets, such as IT capability, human capital, innovation, and managerial competence - as sources of sustainable competitive advantage. Together, these theories offer a comprehensive foundation for analyzing how external pressures, internal resources, and adaptive capabilities jointly influence e-commerce development in retail enterprises.

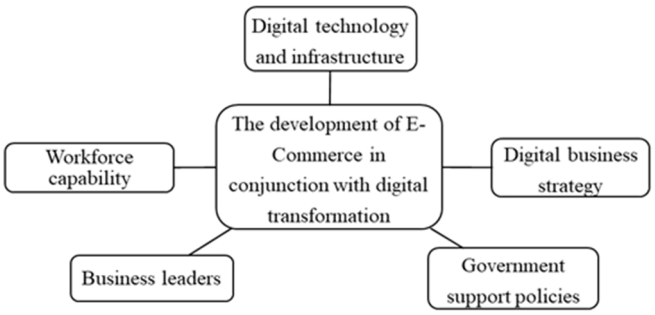

Figure 1. Proposed research model

3.2. Research design

• Identify the crowd: Retail businesses in Hanoi. These businesses have the need to develop EC associated with digital transformation to improve business efficiency and position in the market.

• Identify the sample frame: According to the results of the General Department of Taxation, as of July 19, 2024, there are 938,475 businesses operating nationwide. In addition, according to Dan Tri Newspaper, the number of businesses in Hanoi is more than 406,200 units (as of December 22, 2024).

• Determining sample size: Based on the formula for calculating the size of the sample proposed by Hair et al. (2006), the sample size must be at least five times the number of variables in the factor analysis: N = 5 * m. The research model includes 26 observed variables; therefore, the minimum sample size used for the research is 27 * 5 = 135. However, to increase reliability as well as to eliminate data that is not valuable for the research, the team collected up to 300 survey forms. Of these, 275 were suitable, and the group used these forms for analysis using SPSS software.

• Sampling method: The official research data was collected using a convenience sampling method from retail businesses in Hanoi.

• Sampling approach: To ensure the desired sample size, the group's sampling approach was indirect via the Internet (the official questionnaire was designed via the Google Form application). Based on the judgmental (non-probability) sampling method to select people who meet the requirements of the target audience for the survey by sending the survey link via the businesses' Gmail and asking for help from the instructor.

Table 1. Quantitative questionnaire

Variables	Original	Adapt
1. Digital technology and infrustructure [17] *Factors influencing electronic commerce adoption in developing countries: The case of Tanzania*	1. I believe that there are sufficient technology resources (e.g., software, computers, information) to implement e-commerce. 2. I believe that many organizations are well computerized with LAN and WAN (Internet connection) for e-commerce support. 3. I believe that the country's Internet penetration is good for e-commerce support. 4. I believe that many organizations have sufficient business resources (e.g., financial, payment processes) to support e-commerce. 5. I believe that many people have sufficient experience with network based applications (e.g., email, Web browsing, word processing, spreadsheet processing).	1. I believe that retail businesses have sufficient technological resources (e.g. software, equipment, information systems) to develop e-commerce associated with digital transformation. 2. I believe that retail businesses have been equipped with stable network systems and Internet connections to support e-commerce activities. 3. I believe that the current level of Internet popularity and quality creates favorable conditions for the development of e-commerce in the retail industry. 4. I believe that retail businesses have sufficient business resources (e.g. finance, digital payment systems, operational processes) to develop e-commerce. 5. I believe that employees in retail businesses have sufficient experience using digital applications and platforms (e.g. email, sales management systems, online payment software).

Table 1. Quantitative questionnaire (continue)

Variables	Original	Adapt
2. Digital business strategy [18] *Identifying factors affecting digital transformation intention in micro and small-sized enterprises: empirical evidence from Vietnam*	1. The digital transformation goal is mentioned in the business strategy of the enterprise. 2. The enterprise has deployed the use of a database system. 3. The enterprise's strategy aims to change the operating model. 4. The enterprise aims to optimize customer experience on a digital platform	1. The goal of developing e-commerce associated with digital transformation is integrated into the business strategy of retail enterprises. 2. Retail enterprises have deployed and exploited database systems to support e-commerce activities associated with digital transformation. 3. The business strategy of retail enterprises is oriented towards changing the operating model towards digitalization. 4. Retail enterprises focus on optimizing customer experience through e-commerce platforms and digital technology.
3. Government support policies [17] *Factors influencing electronic commerce adoption in developing countries: The case of Tanzania*	1. I believe that the government has taken action (e.g., training, publicity on mass media) to promote e-commerce. 2. I believe that policy initiatives for telecommunication competition promote e commerce. 3. I believe that the government incentives and subsidies (e.g., zero tax to electronic products) facilitate e-commerce. 4. I believe that the government's support for science (scholarship for science studies, research and development in science field) promotes e-commerce.	1. I believe that government programs and policies (e.g., training, communication) contribute to promoting digital transformation and e-commerce development in retail businesses. 2. I believe that government policies on telecommunications infrastructure and digital technology will facilitate the development of e-commerce in the retail industry. 3. I believe that government incentives and financial support (e.g., tax exemptions, technology support) help retail businesses provide e-commerce applications. 4. I believe that government support in research, development and technological innovation will provide retail businesses with effective e-commerce implementation linked to digital transformation.
4. Business leaders [19] *Sustainability and Organizational Performance in South Korea: The Effect of Digital Leadership on Digital Culture and Employees' Digital Capabilities*	1. A digital leader raises awareness of the technologies that can be used to improve organizational processes. 2. A digital leader determines the ethical behaviors required for informatics practices together with all its stakeholders. 3. A digital leader plays an informative role to reduce resistance to innovations brought by information technologies. 4. A digital leader shares his/her own experiences about technological possibilities that help his/her colleagues to learn about the organization's structure. 5. In order to increase participation in the corporate vision, a digital leader guides the employees of the institution regarding the technological tools that can be used.	1. Business leaders raise employees' awareness of digital technologies that can be applied to improve e-commerce operations. 2. Business leaders guide appropriate principles and behaviors in applying digital technologies to business operations. 3. Business leaders act as communicators, helping to reduce employee resistance to innovations related to digital transformation and e-commerce. 4. Business leaders share their experiences and understanding of digital technologies, thereby supporting employees to grasp the organization's processes and structures. 5. To promote consensus with the e-commerce development vision, Business leaders guide employees to use appropriate digital tools and platforms.
5. Workforce capability [19] *Sustainability and Organizational Performance in South Korea: The Effect of Digital Leadership on Digital Culture and Employees' Digital Capabilities*	1. We offer different training (courses, literature, coaching) to improve the digital expertise of our team members. 2. Digital skills are an important selection criterion in recruiting new team members. 3. Our team members use all digital services and products we offer. 4. Our team has the necessary skills to further digitalize our company. 5. We actively discuss our digital projects within our company, including failures and best practices.	1. Retail businesses often organize training programs (courses, documents, training) to improve digital capacity for employees to serve e-commerce activities. 2. Digital skills are considered an important criterion in the process of recruiting new employees for retail businesses. 3. Employees in retail businesses are able to effectively use e-commerce tools and platforms deployed by the business. 4. The staff of retail businesses possess the necessary skills to promote digital transformation and e-commerce development. 5. Employees in retail businesses regularly exchange and share practical experiences on digital projects, including lessons from failures and best practices.

Table 1. Quantitative questionnaire (continue)

Variables	Original	Adapt
6. The development of E-Commerce in conjunction with digital transformation [20] *Post-adoption variations in usage and value of e-business by organizations: cross-country evidence from the retail industry*	1. Businesses are increasingly using e-commerce in sales activities 2. Businesses are increasingly using e-commerce in marketing activities 3. Businesses are increasingly using e-commerce in customer support services 4. Businesses are increasingly using e-commerce for administrative procedures	1. Retail businesses are increasingly promoting the application of e-commerce in sales activities to meet the trend of digital transformation (e.g., ordering, payment, etc.). 2. Retail businesses are increasingly using e-commerce in marketing activities associated with digital transformation to effectively reach customers. 3. E-commerce is strongly exploited by retail businesses in providing customer support and care services in the context of digital transformation. 4. Administrative procedures and internal management at retail businesses are increasingly digitized through e-commerce platforms.

(Source: Author's own synthesis)

4. RESEARCH RESULTS

After conducting the survey at the enterprises, the authors collected 300 survey responses. After eliminating 25 invalid survey responses, the authors collected 275 valid responses and conducted data analysis, with the subjects being accountants, chief accountants, directors, and deputy directors at retail enterprises in Hanoi.

4.1. Reliability Test

The reliability coefficient was assessed using Cronbach's Alpha, with 275 valid samples collected.

According to Tho and Trang [21], *"The reliability of a scale is evaluated through Cronbach's Alpha. This method should be employed prior to conducting exploratory factor analysis (EFA) to eliminate inappropriate variables, as these may generate spurious factors".*

Nunnally [22] suggested that *"a good scale should have a Cronbach's Alpha of 0.7 or higher."* Similarly, Hair et al. [23] argued that *"a scale ensuring unidimensionality and reliability should reach a Cronbach's Alpha threshold of 0.7 or above. However, in exploratory research, a threshold of 0.6 can still be acceptable. The higher the Cronbach's Alpha, the more reliable the scale".*

The criteria applied in assessing scale reliability include: eliminating observed variables with item-total correlation coefficients below 0.3; and accepting scales with Cronbach's Alpha greater than 0.6, with higher values indicating stronger internal consistency [24]. *Alpha values above 0.8 indicate a highly reliable scale; between 0.7 and 0.8 are acceptable; and values from 0.6 upwards can still be used in cases where the research concept is novel or applied in a new research context* [22].

The specific reliability test results are as Table 2.

Table 2. Cronbach's Alpha of the variables in the scale measuring the development of EC in conjunction with digital transformation

Observed variables	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
"Digital technology and infrustructure" scale: Cronbach's Alpha = 0.848				
DT1	11.85	14.361	0.680	0.812
DT2	11.90	15.004	0.646	0.821
DT3	11.80	14.372	0.650	0.819
DT4	11.88	14.583	0.644	0.821
DT5	11.85	14.079	0.669	0.815
"Digital business strategy" scale: Cronbach's Alpha = 0.764				
BS1	9.05	7.191	0.573	0.711
BS2	9.14	7.319	0.585	0.705
BS3	9.09	7.394	0.569	0.714
BS4	9.08	7.259	0.550	0.724
"Government support policies" scale: Cronbach's Alpha = 0.809				
GS1	9.04	8.108	0.614	0.766
GS2	9.05	8.019	0.622	0.762
GS3	9.11	7.889	0.633	0.757
GS4	8.98	7.970	0.632	0.757
"Business leaders" scale: Cronbach's Alpha = 0.839				
BL1	12.29	14.205	0.590	0.821
BL2	12.32	12.591	0.690	0.794
BL3	12.31	13.376	0.662	0.801
BL4	12.24	14.017	0.630	0.811
BL5	12.23	13.551	0.644	0.806

"Workforce capability" scale: Cronbach's Alpha = 0.836				
WC1	12.35	13.367	0.653	0.799
WC2	12.27	13.898	0.609	0.811
WC3	12.27	13.484	0.638	0.803
WC4	12.26	13.002	0.689	0.789
WC5	12.28	13.974	0.598	0.814
"The development of E-Commerce in conjunction with digital transformation" scale: Cronbach's Alpha = 0.832				
DE1	9.16	8.714	0.651	0.791
DE2	9.20	8.304	0.671	0.782
DE3	9.18	8.475	0.669	0.783
DE4	9.17	8.777	0.648	0.793

(Source: Processed results from SPSS 22.0)

The scale was preliminarily evaluated and screened using the Cronbach's Alpha reliability assessment method. The results showed that all variables in the scale had Cronbach's Alpha coefficients greater than 0.6; specifically, the Cronbach's Alpha coefficients of the variables ranged from 0.7 to 0.8, indicating that the reliability of the scale was assessed at a good level. In addition, the total item correlation coefficients were all greater than 0.3. This proves that the observed variables have a positive impact on the reliability of the scale.

4.2. Exploratory Factor Analysis – EFA

The analysis shows that five factors were extracted based on Eigenvalues greater than 1. These five factors provide the best summary of the 23 observed variables. The cumulative variance explained (Rotation Sums of Squared Loadings) was 61.919%, more than 50%,

Table 3. Total Variance Explained for Independent Variables

Total Variance Explained									
Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	3.387	14.728	14.728	3.387	14.728	14.728	3.136	13.636	13.636
2	3.169	13.779	28.507	3.169	13.779	28.507	3.068	13.340	26.976
3	2.886	12.548	41.054	2.886	12.548	41.054	3.053	13.275	40.251
4	2.551	11.092	52.146	2.551	11.092	52.146	2.588	11.252	51.503
5	2.248	9.773	61.919	2.248	9.773	61.919	2.396	10.415	61.919
6	0.727	3.162	65.081						
7	0.698	3.034	68.115						
8	0.654	2.841	70.956						
9	0.621	2.701	73.657						
10	0.590	2.566	76.223						
11	0.559	2.429	78.652						
12	0.526	2.286	80.938						
13	0.519	2.256	83.194						
14	0.496	2.155	85.348						
15	0.476	2.068	87.417						
16	0.443	1.928	89.344						
17	0.393	1.709	91.054						
18	0.386	1.679	92.733						
19	0.367	1.597	94.330						
20	0.358	1.557	95.887						
21	0.329	1.430	97.317						
22	0.315	1.369	98.686						
23	0.302	1.314	100.000						
Extraction Method: Principal Component Analysis.									

(Source: Processed results from SPSS 22.0)

indicating that the five extracted factors account for 61.919% of the total variance of the dataset, thereby confirming the adequacy of the EFA model.

The rotated pattern matrix of factor loadings for the extracted components is presented in the Table 4.

Table 4. Rotated Pattern Matrix

Rotated Component Matrixa					
	Component				
	1	2	3	4	5
DT1	0.804				
DT5	0.800				
DT4	0.784				
DT3	0.778				
DT2	0.775				
BL2		0.815			
BL3		0.795			
BL5		0.785			
BL4		0.768			
BL1		0.730			
WC4			0.810		
WC1			0.789		
WC3			0.776		
WC2			0.753		
WC5			0.750		
GS4				0.803	
GS3				0.799	
GS2				0.789	
GS1				0.787	
BS2					0.774
BS1					0.766
BS3					0.765
BS4					0.756
Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization.					
a. Rotation converged in 5 iterations.					

(Source: Processed results from SPSS 22.0)

The results of the rotation matrix show that there are 23 variables divided into 5 factors, all variables have Factor Loading coefficients greater than 0.5 and there are no bad variables. This proves that the number of surveys has very good statistical significance. Thus, the EFA exploratory factor analysis for independent variables was performed once, 23 observed variables converged and differentiated into 5 factors.

Table 5. Table of total extracted variance values of dependent variable

Total Variance Explained						
Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	2.658	66.450	66.450	2.658	66.450	66.450
2	0.466	11.658	78.108			
3	0.463	11.570	89.678			
4	0.413	10.322	100.000			
Extraction Method: Principal Component Analysis.						

(Source: Processed results from SPSS 22.0)

The analysis results show that the 5 original observed variables are grouped into 1 group. There is a factor extracted at Eigenvalue = 2.658 > 1 and its total extracted variance is 66.450% (>50%). This factor explains 66.450% of the data variation of the 6 observed variables participating in EFA. This shows that the extracted factor explains 62.495% of the variation of the survey data, so it can be affirmed that the data is suitable for factor analysis.

Table 6. Factor matrix with Promax rotation

	Component
	1
DE2	0.823
DE3	0.822
DE1	0.809
DE4	0.807
Extraction Method: Principal Component Analysis.	
a. 1 components extracted.	

New variable:

F_DE: DE1,DE2,DE3,DE4

F_BS: BS1,BS2,BS3,BS4

F_WC: WC1,WC2,WC3,WC4,WC5

F_GS: GS1,GS2,GS3,GS4

F_BL: BL1,BL2,BL3,BL4,BL5

F_DT: DT1,DT2,DT3,DT4,DT5

(Source: Processed results from SPSS 22.0)

The results of the rotation matrix show that all 5 initially observed variables have Factor Loading

coefficients greater than 0.5 and there are no bad variables. Thus, the EFA exploratory factor analysis for the independent variables was performed once.

In summary, after testing with a sample size of 275 using SPSS software, the scales identified in the theoretical research model all meet the standards, no scale components need to be removed. Therefore, the proposed factors in the model have not changed, while maintaining the connotation of the concepts. The official research model is no different from the proposed model. Based on this result, we proceed to perform confirmatory factor analysis CFA.

4.3. Pearson's Correlation

Pearson correlation coefficient is a statistical test that measures the statistical relationship or association between dependent variables and continuous variables.

Andy Field [25] argues that although it is possible to assess the linear relationship between two variables through the Pearson correlation coefficient. However, we need to test the hypothesis that this correlation coefficient is statistically significant or not. The test result is that if the sig is less than 0.05, the pair of variables is linearly correlated with each other; if the sig is greater than 0.05, the pair of variables is not linearly correlated (assuming a significance level of 5% = 0.05).

Once we have determined that two variables are linearly correlated (sig is less than 0.05), we will consider the strength/weakness of this correlation through the absolute value of r. According to Andy Field [25]:

|r| < 0.1: very weak correlation

|r| < 0.3: weak correlation

|r| < 0.5: moderate correlation

|r| ≥ 0.5: strong correlation

Table 7. Pearson correlation matrix between independent and dependent variables

		F_DE	F_BS	F_WC	F_GS	F_BL	F_DT
F_DE	Pearson Correlation	1	0.213**	0.474**	0.247**	0.413**	0.462**
	Sig. (2-tailed)		0.000	0.000	0.000	0.000	0.000
	N	275	275	275	275	275	275
F_BS	Pearson Correlation	0.213**	1	-0.056	-0.031	-0.072	-0.079
	Sig. (2-tailed)	0.000		0.351	0.608	0.233	0.191
	N	275	275	275	275	275	275
F_WC	Pearson Correlation	0.0474**	-0.056	1	-0.006	0.057	0.031
	Sig. (2-tailed)	0.000	0.351		0.927	0.345	0.613
	N	275	275	275	275	275	275
F_GS	Pearson Correlation	0.247**	-0.031	-0.006	1	-0.058	0.046
	Sig. (2-tailed)	0.000	0.608	0.927		0.340	0.452
	N	275	275	275	275	275	275
F_BL	Pearson Correlation	0.413**	-0.072	0.057	-0.058	1	0.006
	Sig. (2-tailed)	0.000	0.233	0.345	0.340		0.919
	N	275	275	275	275	275	275
F_DT	Pearson Correlation	0.462**	-0.079	0.031	0.046	0.006	1
	Sig. (2-tailed)	0.000	0.191	0.613	0.452	0.919	
	N	275	275	275	275	275	275

(Source: Processed results from SPSS 22.0)

Comparison of the correlation between the dependent variable F_DE and the independent variables F_BS, F_WC, F_GS, F_BL, F_DT. From the table, the following conclusions can be drawn:

- The Sig values of the dependent variable with respect to the independent variables are all smaller than 0.05. Therefore, the correlation coefficients r between the variables are statistically significant.

- The Pearson Correlation - correlation coefficient r, with independent variables marked **, indicates that the correlation between the dependent variable and the independent variables is significant at the 99% confidence level (corresponding to a significance level of 1% = 0.01).

- The correlation coefficients **r** between the dependent and independent variables are as follows: F_DE with F_BS |r| = 0.213, with F_WC |r| = 0.474, with F_GS |r| = 0.247, with F_BL |r| = 0.413, and with F_DT |r| = 0.462. Based on the analysis results, the correlation between the dependent variable F_DE and the independent variables F_WC, F_BL, and F_DT is at a moderate level, whereas F_BS and F_GS show a weak correlation with the dependent variable.

4.4. Regression Analysis

Through the table above, we can see that the coefficient R = 0.856 shows that the relationship between

the variables in the model is closely correlated. The regression results report of the model shows the value of $R^2 = 0.732$. This indicates that the model's suitability is 72.7%, or in other words, 72.7% of the variation in the dependent variable is explained by 5 factors in the model. The adjusted R^2 value reflects the model's suitability more accurately than the whole. We have an adjusted R^2 value of 0.727 (or 72.7%), the remaining 27.3% is due to other variables outside the model and random errors that the study has not mentioned.

Table 8. Regression Model Summary Table

Model Summary[b]					
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	0.856[a]	0.732	0.727	0.49568	1.756

ı. Predictors: (Constant), F_DT, F_BL, F_WC, F_GS, F_BS

ı). Dependent Variable: F_DE

(Source: Processed results from SPSS 22.0)

The results of this table also provide the Durbin-Watson value to evaluate the phenomenon of first-order serial autocorrelation. The DW value = 1.756, in the range of 1.5 to 2.5, so the result does not violate the first-order serial autocorrelation assumption [26], with the F test having sig. = 0.000 (< 0.05), meaning that there is a linear regression model between the dependent variable and 5 influencing factors.

Table 9. Results of table Coefficients[a]

Coefficients[a]								
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	-3.015	0.236		-12.788	0.000		
	F_BS	0.343	0.035	0.313	9.859	0.000	0.985	1.015
	F_WC	0.479	0.033	0.455	14.375	0.000	0.993	1.007
	F_GS	0.272	0.033	0.262	8.290	0.000	0.994	1.007
	F_BL	0.444	0.033	0.422	13.290	0.000	0.988	1.012
	F_DT	0.466	0.032	0.458	14.455	0.000	0.991	1.009

a. Dependent Variable: F_DE

(Source: Processed results from SPSS 22.0)

According to Hair et al. [23], "a VIF threshold of 10 or higher indicates severe multicollinearity". Similarly, with regard to the VIF coefficient, Nguyen Dinh Tho [27] asserts that "if VIF > 2, caution is required, as multicollinearity may occur and distort the regression estimates." Examining the results in the table, it can be observed that all VIF values of the independent variables are less than 2, indicating that multicollinearity is not present.

The significance values (Sig.) of the independent variables are all smaller than 0.05. Therefore, these variables are statistically significant and have an impact on the dependent variable F_DE. Since all independent variables carry positive coefficients, their influence on the dependent variable is in the same (positive) direction.

The standardized regression coefficients (Beta) of the independent variables are also positive, confirming that each independent variable exerts a positive influence on the dependent variable. Based on the magnitude of the Beta coefficients, the level of impact of each independent variable on the dependent variable can be ranked in ascending order as follows: F_GS (0.262) < F_BS (0.313) < F_BL (0.422) < F_WC (0.455) < F_DT (0.458).

From the regression coefficients, the standardized regression equation can be formulated as follows:

$$\mathbf{F\_DE = 0.458 * F\_DT + 0.455 * F\_WC + 0.422 * F\_BL + 0.313 * F\_BS + 0.262 * F\_GS + \varepsilon}$$

5. CONCLUSION AND RECOMMENDATIONS

In the context of rapid digital economic growth and the strong influence of the Fourth Industrial Revolution, the findings of this study reaffirm that digital transformation is no longer optional but a strategic imperative for retail businesses. The empirical results show that all five factors in the proposed model exert a positive and statistically significant influence on the development of EC integrated with digital transformation in Hanoi-based retail enterprises. This outcome is generally consistent with prior studies but also offers several noteworthy contributions.

First, the strong impact of digital technology and infrastructure aligns with the conclusions of Wang and Liu [12] and Kalinić, et al. [11], who emphasized that infrastructure remains the foundational driver of EC adoption in developing economies. However, this study extends previous literature by confirming that technological readiness continues to be the dominant predictor even in a major urban center like Hanoi, where digital access is relatively high, indicating that infrastructure quality remains uneven across firms and continues to influence digital adoption capacities.

Second, the significant role of digital business strategy echoes findings from Zhu and Kraemer [28] and Yang, et al. [8], who highlighted that firms with clearer digital orientations tend to adopt e-commerce and undergo digital transformation more effectively. The current study reinforces this argument within the retail sector and provides new evidence that strategic alignment between digital transformation goals and business processes is a decisive factor in sustaining competitiveness.

Third, leadership capacity emerges as a strong predictor, consistent with insights from Luu, et al. [16] and Nambisan, et al. [29], which view leadership as a catalyst for organizational readiness and capability building. The present findings confirm this and further reveal that leadership commitment remains essential for retail enterprises - most of which are SMEs with limited resources, by directly shaping investment decisions and influencing staff adoption of new technologies.

Fourth, workforce capacity is shown to significantly affect the development of EC–DT integration, supporting the arguments of Nguyen and Thanh [13], who found human resources to be one of the central determinants of digital adoption in Vietnamese SMEs. This study adds nuance by highlighting that the retail sector, due to its customer-facing nature, is particularly sensitive to employee digital skills, thus requiring continuous training and upskilling.

Finally, the relatively weaker influence of government support policies contrasts with several previous studies, such as Nguyen and Thanh [13] that identified government intervention as the strongest driver of digital transformation in SMEs. This divergence represents a meaningful contribution: in the context of Hanoi's retail sector, institutional support is perceived as necessary but not decisive. The findings suggest that while policies create enabling conditions, enterprises rely more heavily on internal strategic and technological readiness to adopt EC effectively. This may reflect the increasing maturity of digital adoption in urban markets, where external support plays a complementary rather than leading role.

In the context of the economy being increasingly deeply affected by the rapid development of digital technology, retail businesses are facing an urgent need to innovate their business models, in which e-commerce combined with digital transformation becomes one of the strategic directions to improve competitiveness, optimize operations and expand the market. However, this process also poses many challenges related to organizational factors, human resources and technical infrastructure. Therefore, retail businesses as well as the government need to take practical actions to respond to this development process.

- For retail enterprises:

Retail enterprises should prioritize investment in digital technology and infrastructure as a foundation for sustainable e-commerce development. Upgrading data management systems and implementing advanced tools such as AI, Big Data, and IoT can optimize operations while providing personalized customer experiences. For instance, deploying AI-driven CRM systems allows firms to analyse customer behavior, generate tailored product recommendations, and increase both conversion rates and loyalty.

Another key priority is developing the digital competence of the workforce. Retail businesses need to focus on improving digital skills and technological knowledge for their staff. Specifically, it is necessary to regularly organize training courses and professional training on technology applications in retail, e-commerce, data analysis, and online operations management. In addition, businesses should also develop a sustainable digital human resource development policy, encourage employees to study long-term and proactively adapt to technological changes in the digital environment.

Finally, enterprises should adopt long-term digital business strategies that integrate multi-channel sales models. An omnichannel approach, seamlessly connecting physical stores, EC websites, and mobile applications enhances customer satisfaction by providing a unified shopping experience. Embedding such strategies within a broader data-driven framework also enables businesses to tailor customer care programs and ensure that all activities are managed under one integrated digital system.

- For government and policymakers:

From the policy perspective, the government plays a pivotal role in creating an enabling environment for e-commerce and digital transformation. The government needs to continue to improve the legal framework related to e-commerce and digital technology, and develop specific support programs such as tax incentives, preferential loans, or support for digital human resource training. The government should also develop platforms

connecting businesses with technology experts, consulting organizations, or innovation investment funds to promote the digital transformation process to take place more quickly and effectively in the retail business community.

Moreover, support for SMEs is essential. Tailored programs such as preferential credit packages, subsidized access to digital platforms, and national digital skills training initiatives can help overcome the resource limitations that SMEs often face. Establishing digital advisory centers or online consultancy platforms would also provide smaller firms with practical, low-cost access to technology solutions.

At a national scale, investment in digital infrastructure, including cloud computing, logistics networks, and cashless payment systems remains a strategic necessity. For example, developing world-class data centers and smart logistics systems would lower operational costs, shorten delivery times, and improve service quality, creating a stronger foundation for e-commerce expansion.

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