THE IMPACT OF DIGITAL TRANSFORMATION ON THE BUSINESS PERFORMANCE OF RETAIL ENTERPRISES

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Abstract

This study examines the effects of digital transformation on the financial performance of Vietnamese retail businesses using quantitative methods. Data from 190 businesses in large cities with high population densities and robust socioeconomic development are analyzed in this study. Google Forms was used to gather the data, which was then arranged in a spreadsheet, cleaned in Excel, and examined using Statistical Package for the Social Sciences software. Cloud computing (CC), the Internet of Things (IoT), big data (BD), social media (SM), artificial intelligence (AI), and blockchain technology (BT) are the six independent variables that make up the research model, drawing on prior studies on digital transformation and firm performance (Mubarak et al., 2019; Kwarteng et al., 2023). All six variables have a positive impact on retail businesses' business performance, according to regression analysis. Among these technologies, CC demonstrates the strongest impact on business performance, followed by the IoT and SM, whereas BD analytics and BT show relatively moderate effects, and AI exhibits the weakest influence. The findings provide valuable insights for businesses seeking to better understand the benefits of digital transformation. The results inform the discussion and offer practical recommendations for the effective implementation of digital transformation in Vietnamese retail enterprises, thereby supporting firms in strengthening their market position and enhancing integration into global supply chains.

Keywords: Digital Transformation, Retail Enterprises, Business Performance

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1. INTRODUCTION

Organizations, especially those in the retail sector, are now forced to undergo digital transformation; it is no longer an option. It is crucial to the survival and expansion of these businesses. Digital transformation creates new opportunities and enhances user experiences through web platforms and mobile apps. Marketing, advertising, and inventory management are just a few of the business operations that can be optimized by cutting costs and improving employee productivity. At the same time, it expands sales channels and provides access to global markets. Information security and data management have become major issues, and in today's cutthroat marketplace, being able to swiftly adapt to changes is crucial for survival. In the retail industry, digital transformation essentially refers to the use of digital technology to shift the traditional supply chain and product-focused business model to one that is customer-centric. This process is not just a fad; it is an essential tactic for retail companies looking to strengthen their bonds with customers, increase engagement, and meet the demands of a constantly shifting business landscape. Since technology is a force for change, digital transformation is crucial for fostering client relationships and guaranteeing convenient access to business information (Jeza & Lekhanya, 2022) and improving information transparency and internal governance mechanisms (Oanh et al., 2025).

In Vietnam, the retail sector is regarded as one of the most alluring and promising industries. The nation's economy is growing as well. Businesses are focusing on developing diverse and expansive supply chain networks. It is anticipated that the retail sector in Vietnam will continue to make significant strides in the years to come. But at the moment, the majority of Vietnamese retail businesses are only rudimentarily ready for the digital era. The main causes include things like inadequate funding for high-tech applications, difficulties changing company policies and practices, a shortage of skilled workers with knowledge of digital technology, or inadequate digital infrastructure — challenges similar to those identified in other developing economies where weak digital readiness and limited competencies hinder transformation (Al-Hmesat et al., 2025; Al Frijat & Al-Hajaia, 2025).

The impact of digital transformation on corporate performance has been the subject of an expanding body of domestic and international scientific research, which takes into consideration both the opportunities and challenges that this process presents. Many studies have been conducted in an attempt to provide managers with the best guidance and to allow businesses to quickly adapt and use technology to gain a competitive advantage and maximize profits. There have been mixed results from studies on the true effectiveness of digital transformation for businesses, particularly in the retail industry. Although some studies (Mubarak et al., 2019; Nhi et al., 2023) emphasize the importance of digital transformation for business performance, others (Jardak & Ben Hamad, 2022; Nga et al., 2023) contend that, because of its complexity and high costs, implementing digital technology may have negligible or adverse effects on business performance. Additionally, research on the digital transformation of Vietnamese retail businesses is still lacking. To improve the digital transformation process of Vietnam's retail firms, which is already lagging behind and lacking significant advancements, more research on this topic is therefore necessary.

Despite the growing body of literature on digital transformation, empirical evidence on its impact on business performance remains inconclusive, particularly in emerging economies. Existing studies often focus on single digital technologies or examine digital transformation at an aggregate level, providing limited insights into the heterogeneous effects of different digital technologies. Moreover, empirical research on digital transformation in the retail sector in Vietnam is still scarce. To address these gaps, this study examines the direct effects of six core digital transformation technologies on the business performance of retail enterprises in Vietnam. By adopting a resource-based perspective, this study contributes to the literature by providing context-specific empirical evidence and a disaggregated analysis of digital transformation technologies in line with recent calls for strategy-oriented digital transformation research in emerging markets (Le & Tran, 2026).

The paper is structured as follows. Section 1 introduces the research background, identifies the research gaps, and outlines the objectives and contributions of the study. Section 2 reviews the relevant literature and develops the research hypotheses, along with the theoretical foundation and conceptual framework. Section 3 describes the research model, data collection process, and research methodology employed. Section 4 presents the empirical results and discusses the main findings. Section 5 provides the discussion of results and managerial recommendations derived from the empirical analysis. Section 6 presents the conclusion, summarizing the main findings, implications, limitations, and directions for future research.

2. LITERATURE REVIEW AND HYPOTHESES DEVELOPMENT

2.1. Literature review

Sagar (2024) thoroughly examined the literature on digital transformation in sales, citing successful retailers such as Amazon, Starbucks, Walmart, and Zara as real-world examples. As these examples demonstrate, retailers employ a range of strategies to integrate physical stores with online sales channels. By putting an emphasis on innovation and the customer experience, these retailers are revolutionizing the e-commerce industry. Amazon leverages data analytics and mobile technology to create individualized customer experiences; Starbucks has effectively implemented digital solutions to improve customer experience and streamline business operations; Walmart combines physical stores with online channels to optimize supply chains and inventory management; and Zara illustrates how digital transformation transforms traditional retail by showing the shift from traditional business models to flexible technology and supply chains.

From a resource-based view (RBV) perspective, these digital technologies can be interpreted as strategic resources that are valuable and difficult to imitate, thereby enabling firms to enhance performance through superior customer experience and operational integration (Barney, 1991; Vial, 2019).

Jardak and Ben Hamad (2022) examined the impact of digital transformation on Swedish listed companies' operational efficiency. From 2015 to 2018, data were collected from 23 businesses listed on the Swedish Stock Exchange. Digital maturity has a positive impact on Tobin's Q but a negative impact on return on assets (ROA) and return on equity (ROE), according to the regression results. Accordingly, companies undergoing digital transformation may experience short-term financial challenges but are likely to improve their market valuation and operational effectiveness in the long run. This finding suggests that the performance effects of digital transformation may depend on firms' ability to reconfigure internal resources and capabilities over time, rather than producing immediate financial gains.

Nga et al. (2023) investigated the impact of digital transformation on the business performance of Vietnamese private enterprises using feasible generalized least squares regression with data from 100 listed firms during 2018–2022. The findings revealed that digital transformation exerts a negative effect on business performance, with heterogeneous impacts across different components. The authors argue that high initial investment costs and limited digital readiness may obscure short-term performance outcomes, although digital transformation remains a crucial long-term strategic orientation. These mixed results indicate that digital transformation alone does not automatically improve performance unless firms possess complementary organizational and managerial capabilities.

This heterogeneity in empirical findings is consistent with the argument of Teng et al. (2022), who emphasize that the performance outcomes of digital transformation depend not only on technology adoption itself but also on firms' digital capabilities, implementation maturity, and complementary organizational resources.

Nhi et al. (2023) examined the impact of digital transformation on the business performance of Vietnamese enterprises in the new context using ordinary least squares regression. The results indicate that asset size, revenue growth rate, and digital transformation positively affect ROA, while fixed asset investment, inflation, and COVID-19 negatively influence firm performance. The study emphasizes that firms must adopt digital technologies to meet changing customer demands and competitive pressures.

Nhan (2022) explored the application of digital technologies in Vietnamese retail enterprises and identified major digital transformation trends under Industry 4.0. The study highlights both opportunities and challenges faced by retail firms, particularly in the post-COVID-19 context. Vietnam's young population and increasing purchasing power provide favorable conditions for digital adoption, although traditional shopping habits and technological constraints remain significant barriers.

Shankar (2018) analyzed the relationship between the level of digitization and financial performance across firms in different industries. Using data from 482 Russian companies between 2017 and 2019, the results show that a higher digitization index positively affects business performance, though the magnitude varies by industry, firm age, and size. These findings reinforce the argument that digital transformation contributes to performance improvement when firms effectively leverage digital resources within their specific industry contexts.

Dung and Anh (2021) assessed the current status of digital transformation in Vietnamese retail enterprises using secondary data from the General Statistics Office and the Ministry of Planning and Investment. The study shows that traditional retail dominated prior to COVID-19, while online channels expanded rapidly afterward. The authors propose several policy and managerial recommendations to accelerate digital transformation in retail businesses and emphasize the importance of institutional and technological support mechanisms similar to those highlighted in recent emerging-market studies (Al-Hmesat et al., 2025).

Huong (2020) analyzed the role of big data (BD) in enhancing labor productivity and operational efficiency in retail firms. The study argues that BD analytics enables retailers to reduce costs, better forecast demand, optimize product offerings, and support faster decision-making. Real-time customer demand tracking is identified as a key benefit of BD adoption.

Mubarak et al. (2019) examined the effects of Industry 4.0 technologies, including interoperability, BD, cyber-physical systems (CPS), and Internet of Things (IoT), on the performance of Pakistani small and medium-sized enterprises (SMEs). The results indicate that interoperability, CPS, and BD positively influence business performance, while IoT shows a limited impact. This study provides important empirical support for conceptualizing digital transformation technologies as performance-enhancing resources within SMEs.

Şahin and Topal (2018) investigated the impact of information technology (IT) on the operational efficiency of Turkish supply chain firms using structural equation modeling (SEM) and artificial neural network methods. Based on data from 203 ISO 1000 companies, the study finds strong positive relationships between IT usage, information quality, and business performance. The authors emphasize that effective IT utilization is essential for accelerating digital transformation and improving firm outcomes, consistent with more recent evidence linking digital capability development to performance gains (Le & Tran, 2026).

2.2. Hypotheses development

Although all digital transformation technologies are expected to enhance business performance, their impacts may differ due to variations in maturity, implementation complexity, cost, and compatibility with firm resources. Technologies such as cloud computing (CC) and IoT are generally easier to adopt and integrate, enabling faster performance gains. In contrast, more advanced technologies like artificial intelligence (AI) and blockchain technology

(BT) require higher investment, stronger data capabilities, and supportive environments, which may constrain their short-term effects, especially in emerging economies. Therefore, while all six technologies are hypothesized to positively influence business performance, their relative effects are likely to vary depending on resource alignment and implementation conditions.

According to Mell and Grance (2011), CC is a service model that enables users to easily access shared computer resources, including servers, networks, storage, apps, and services, from any location at any time, provided that there is a network connection. Users of cloud computing can easily add or remove resources without help from the service provider. The importance of cloud computing in retail businesses has been acknowledged by Ali and Haseebuddin (2015) as a means of reducing expenses, focusing on and positioning products in the market, segmenting the product market, and more successfully connecting with and maintaining customer relationships. Given this, the research proposes the following theory:

H1: Cloud computing (CC) improves retail businesses' operational efficiency.

The IoT is a network of physical objects connected to the Internet and equipped with sensors, software, or other technologies to increase productivity and efficiency by sharing and providing data and information based on people's needs and objectives. This technology is widely used in the retail industry to monitor locations, control inventory, and frequently update order statuses — all of which improve the in-store shopping experience for customers. Ashton (2009) and Quyet (2021) are two authors who have studied the relationship between IoT and business success. Therefore, the following hypothesis is proposed by the study:

H2: Retail businesses' business performance is positively impacted by the Internet of Things (IoT).

The term "big data" refers to large and complex datasets that are too large or complex to be handled by standard software tools in terms of collection, organization, processing, storing, and sharing. Retail businesses can gain a better understanding of customer preferences, purchasing patterns, and demographic information by utilizing BD analytics. Retailers can use this information to predict future customer demand, personalize customer experiences, and establish fair prices for goods and services (Quyet, 2021). BD helps retailers make a greater profit, according to Huong (2020). Thus, the study proposes this hypothesis:

H3: The business performance of retail companies is positively impacted by big data (BD).

Social media (SM) platforms help people communicate, connect with each other, and share information. Social media is a good way for businesses and customers to exchange information these days. In addition to making it easier for consumers to find the products they require, it assists brands in finding and connecting with new consumers. Social media has a big influence on the market development of retail businesses (Kagondu, 2018). Among the seven digital technologies that Quyet (2021) studied that were found to affect the performance of retail businesses, SM was the most significant. Thus, the research proposes the following theory:

H4: Social media (SM) enhances the operational effectiveness of retail companies.

Software, hardware, algorithms, and systems that increase the intelligence of products, services, and machinery are all included in AI. Shankar (2018) claims that AI is revolutionizing business operations and helping retailers in a variety of ways, such as better customer demand prediction and supply chain optimization. Trang (2022) asserts that the application of AI in retail operations reduces costs by increasing sales, profit, and business efficiency, optimizing inventories, lowering labor costs, and reaching users at a lower cost. Thus, the research proposes this hypothesis:

H5: Retail businesses' business performance is positively impacted by artificial intelligence (AI).

BT stores and transfers data using interconnected data blocks that form a chain. This technology makes it simple for retail businesses to track provenance, stop counterfeiting and trade fraud, manage customer data efficiently, and enhance payment processes. According to Sharma (2017), this technology transforms product tracking systems and retail fraud prevention. BT can boost traditional retail's operational effectiveness, as Yin and Wang (2023) have shown. Additionally, they promoted the use of BT in innovative retail formats. The study puts forth the following theory in light of this:

H6: Blockchain technology (BT) has a positive effect on retail businesses' business performance.

2.3. Theoretical foundation and conceptual framework

The theoretical foundation of this study is grounded in the RBV, which explains firm performance differences based on the possession and effective deployment of heterogeneous resources that are valuable, rare, inimitable, and non-substitutable (Barney, 1991; Barney et al., 2011). In the digital context, prior research has extended RBV by conceptualizing digital technologies and IT capabilities as strategic resources that can enhance operational efficiency, decision-making quality, and competitive advantage when they are effectively integrated into organizational processes (Bharadwaj, 2000; Wade & Hulland, 2004).

Digital transformation refers to the adoption and integration of digital technologies to fundamentally reshape business processes and value creation mechanisms (Vial, 2019; Verhoef et al., 2021). Rather than representing a single homogeneous construct, digital transformation encompasses a set of distinct technologies that differ in terms of technological maturity, implementation complexity, and resource requirements. Consequently, the performance effects of digital transformation are expected to vary across technologies, depending on their alignment with firm-specific resources and capabilities. This view is consistent with the RBV, which emphasizes that technologies generate competitive advantage only when they are effectively

integrated with internal resources and organizational capabilities (Barney, 1991; Le & Tran, 2026).

Business performance in this study is conceptualized as a multidimensional construct capturing firms perceived financial and operational outcomes. The use of perceptual performance measures is well established in management and information systems research and has been shown to correlate with objective indicators, particularly in contexts where objective financial data are difficult to obtain (Dess & Robinson, 1984; Venkatraman & Ramanujam, 1986; Richard et al., 2009). From an RBV perspective, improvements in business performance arise when digital technologies enable firms to deploy resources more efficiently and effectively than competitors.

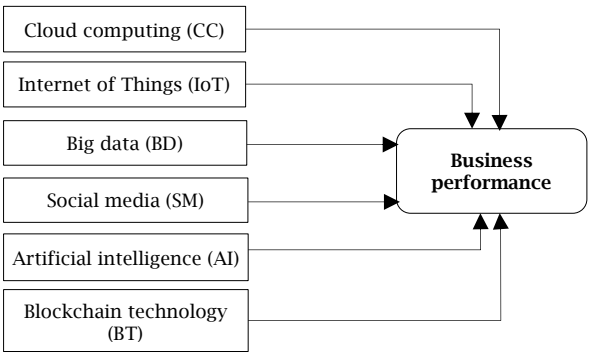
Based on this theoretical foundation, the conceptual framework of this study models six core digital transformation technologies — CC, the IoT, BD analytics, AI, SM, and BT — as distinct strategic resources that directly influence business performance. While all six technologies are expected to exert positive effects, their relative impact may differ due to variations in technological maturity, implementation costs, and contextual constraints. This framework provides the theoretical basis for the research model and hypotheses presented in the following section.

3. RESEARCH MODEL

3.1. Research model

Based on the research model proposed by Mubarak et al. (2019) and the presumptions, this work proposes a research model to assess the impact of digital transformation on the business performance of retail firms. The following is the suggested research model:

Figure 1. Proposed research model



Source: Authors' elaboration.

The proposed research model integrates six essential information technology components to examine the impact of digital transformation on the business performance of retail enterprises. These components include CC, the IoT, BD, SM, BT, and AI. All six technologies are specified as independent variables in the model. Each construct is operationalized using multiple measurement items assessed on a five-point Likert scale, consistent with prior empirical studies.

3.2. Method research

The questionnaire was developed based on a comprehensive review of prior empirical studies on digital transformation and firm performance. Measurement items for digital transformation technologies were adapted from validated survey-based research that examines specific digital technologies in organizational and retail contexts (Teng et al., 2022; Le & Tran, 2026; Ali & Haseebuddin, 2015). These studies provide theoretical and empirical foundations for selecting core digital technologies and for formulating questionnaire items reflecting firms' adoption and utilization of such technologies. Business performance was measured using perceptual indicators, which have been widely employed in prior studies when objective financial data are unavailable or difficult to access, particularly in emerging economies (Teng et al., 2022). This approach helps ensure content validity while maintaining contextual relevance to Vietnamese retail enterprises.

In this study, cluster sampling is used. Simple random sampling is used to choose samples of retail businesses in cities categorized by population within each cluster. Direct questionnaires are answered by department heads or senior executives in retail establishments.

Based on the 5:1 ratio, a minimum sample size of *5 x 30 = 150* would be needed for a questionnaire with 30 items on a 5-point Likert scale (Hair et al., 1998). Therefore, the absolute minimum number of samples needed for the investigation is 150. A sufficient sample size was ensured by analyzing all 190 of the valid questionnaires that were sent.

Data were collected using a structured online questionnaire created with Google Forms, which helped reduce time and cost while minimizing potential data collection bias. The survey link was distributed via email and popular messaging platforms such as Facebook Messenger and Zalo, and responses were downloaded for subsequent analysis.

The questionnaire was developed by adapting validated measurement scales from prior empirical studies. All items were measured using a five-point Likert scale ranging from 1 ("strongly disagree") to 5 ("strongly agree"). The instrument included items measuring six digital transformation technologies and perceptual measures of business performance, with minor wording adjustments to ensure contextual relevance to Vietnamese retail firms.

Participation in the survey was voluntary, and respondents were informed of the academic purpose of the study. No personally identifiable information was collected, and all responses were analyzed in aggregated form to ensure anonymity and impartiality, in line with ethical standards for research involving human participants.

After data cleaning and coding, the survey responses were imported from Google Forms into Statistical Package for the Social Sciences version 20 for Windows for analysis. All constructs were measured using multi-item five-point Likert scales adapted from prior empirical studies, with business performance operationalized through respondents' perceptual assessments of financial and operational outcomes relative to competitors.

Data analysis followed a structured sequence. First, reliability was assessed using Cronbach's alpha. Second, exploratory factor analysis (EFA) was conducted to evaluate construct validity, supported by the Kaiser-Meyer-Olkin (KMO) measure and Bartlett's test of sphericity. Third, correlation analysis was used to examine relationships among variables. Finally, multiple regression analysis was applied to test the proposed hypotheses, with variance inflation factor (VIF) values used to assess potential multicollinearity.

While this study adopts a quantitative survey-based approach with multiple regression analysis, alternative methods such as SEM, multi-criteria decision-making techniques (e.g., analytic hierarchy process), or longitudinal and mixed-methods designs could be employed in future research to provide deeper insights into the dynamic effects of digital transformation.

4. RESULTS OF DATA ANALYSIS

4.1. Descriptive statistics of the sample

Among the 190 businesses surveyed, 186, or 97.9%, are classified as SMEs, while four, or 2.1% of the total, are large organizations. This shows that the majority of the participating businesses are SMEs. Out of them, 22 (11.6%) work in electronics and technology; 16 (8.4%) work in home goods and furniture; 36 (18.9%) work in supermarkets and convenience stores; 47 (24.7%) work in food and beverage; 50 (26.3%) work in fashion and cosmetics; 9 (4.7%) work in pharmaceuticals and medical products; and 10 (5.3%) work in other industries.

Furthermore, of the 190 respondents, 130 are employees (68.4%), 50 are department managers (26.3%), and 10 are company executives (5.3%). Additionally, 36 businesses (18.9%) out of the total sample have been in business for less than two years, 68 for two to five years (35.8%), and 86 for more than five years (45.3%). This suggests that businesses that have been around for more than five years — particularly those in the fashion and cosmetics sectors — are the ones most impacted by the digital transformation of their operations. During this time, businesses can practice using technology and develop a competent management system to effectively oversee operations.

4.2. Cronbach's alpha reliability analysis

Based on Hair et al. (1998), variables that have a Cronbach's alpha coefficient of more than 0.6 and a corrected item–total correlation of more than 0.3 are considered suitable for further examination. The Cronbach's alpha analysis used in this study verified the measurement scales' reliability, showing that all items had item-total correlation coefficients above 0.3 and that all scales had alpha values above the 0.6 threshold. These findings imply that the scales used are appropriate for additional statistical processes and are internally consistent.

Table 1. Summary of Cronbach's alpha analysis results

No.	*Group of factors*	*Symbol*	*Scale*	*Cronbach's alpha*	*No. of Items*
1	*Cloud computing*	*CC*	CC1, CC2, CC3, CC4	0.797	4
2	*Internet of Things*	*IoT*	IoT1, IoT2, IoT3, IoT4	0.795	4
3	*Big data*	*BD*	BD1, BD2, BD3, BD4, BD5	0.827	5
4	*Social media*	*SM*	SM1, SM2, SM3, SM4	0.767	4
5	*Artificial intelligence*	*AI*	AI1, AI2, AI3, AI4, AI5	0.833	5
6	*Blockchain technology*	*BT*	BT1, BT2, BT3, BT4	0.799	4
7	*Business performance*	*BP*	BP1, BP2, BP3, BP4, BP5	0.795	4

Source: Authors' elaboration.

4.3. Exploratory factor analysis

Hair et al. (1998) state that a factor loading of at least 0.3 is regarded as the minimum threshold for statistical significance, that values above 0.4 point to practical importance, and that values above 0.5 indicate strong explanatory power. This criterion was used to guarantee construct validity during the EFA process by removing observed variables with factor loadings less than 0.5. Furthermore, in accordance with Hoang and Ngoc (2008) guidelines, the appropriateness of EFA is assessed based on three essential criteria: 1) the KMO measure of sampling adequacy must be between 0.5 and 1.0; 2) the results of Bartlett's test of sphericity must be statistically significant (p-value < 0.05); 3) the total variance explained by the extracted factors must be greater than 50%, demonstrating that the underlying constructs account for a sufficient percentage of the variability in the data.

According to Table 2, the data set's KMO value is 0.779, indicating adequate sampling, and the results of Bartlett's test of sphericity show statistical significance (Sig. = 0.000 < 0.05), indicating that the correlations between the variables are sufficiently strong for EFA. Furthermore, all of the items that were kept show factor loadings higher than 0.5, indicating that they are closely related to their respective factors and thus make a significant contribution to the construct structure.

Table 2. Kaiser-Meyer-Olkin and Bartlett's test results for independent variables

KMO measure of sampling adequacy		0.779
Bartlett's test of sphericity	Approx. Chi-square	2403.542
	df	325
	Sig.	0.000

Source: Analysis of survey data.

Overall, 62.479% of the variance is explained, according to the results in Table 3. This supports the suitability of the exploratory factors by showing that the observed variables account for 62.479% of the variance in the components within the research model. Six factors are selected from a set of 24 observable variables based on the factor rotation matrix. Since the sixth factor's eigenvalue of 1.435 is greater than the cutoff of 1, its extraction meets all requirements.

Table 3. Total variance explained

Component	Initial eigenvalues			Extraction sums of squared loadings	
	Total	% of variance	Cumulative %	Total	% of variance
1	6.368	26.535	26.535	6.368	26.535
2	2.044	8.515	35.049	2.044	8.515
3	1.903	7.929	42.978	1.903	7.929
4	1.758	7.323	50.301	1.758	7.323
5	1.487	6.196	56.498	1.487	6.196
6	1.435	5.981	62.479	1.435	5.981
7	0.843	3.514	65.992		

Source: Analysis of survey data.

4.4. Correlation analysis

Following the EFA, the average values for each factor will be ascertained for the correlation analysis. The results of the correlation analysis are shown in Table 4.

Table 4. Correlation analysis results

Variables		BP	CC	IoT	BD	SM	AI	BT
BP	Pearson correlation	1						
	Sig. (2-tailed)							
	N	190						
CC	Pearson correlation	0.631**	1					
	Sig. (2-tailed)	0.000						
	N	190	190					
IoT	Pearson correlation	0.575**	0.312**	1				
	Sig. (2-tailed)	0.000	0.000					
	N	190	190	190				
BD	Pearson correlation	0.509**	0.368**	0.316**	1			
	Sig. (2-tailed)	0.000	0.000	0.000				
	N	190	190	190	190			
SM	Pearson correlation	0.515**	0.278**	0.363**	0.224**	1		
	Sig. (2-tailed)	0.000	0.000	0.000	0.002			
	N	190	190	190	190	190		
AI	Pearson correlation	0.508**	0.348**	0.274**	0.333**	0.308**	1	
	Sig. (2-tailed)	0.000	0.000	0.000	0.000	0.000		
	N	190	190	190	190	190	190	
BT	Pearson correlation	0.529**	0.389**	0.298**	0.259**	0.338**	0.329**	1**
	Sig. (2-tailed)	0.000	0.000	0.000	0.000	0.000	0.000	
	N	190	190	190	190	190	190	190

*Note: ** Correlation is significant at the 0.01 level (2-tailed).*
Source: Analysis of survey data.

Each independent variable and the dependent variable have a strong correlation, as shown by the correlation analysis results in Table 4. The independent variables are considered statistically significant when their correlation coefficients (Sig.) are less than 0.05. Consequently, the data can be subjected to regression analysis.

4.5. Regression analysis

The significance level (Sig.) of the F-test is $0.000 < 0.05$, according to the analysis of variance results, which are displayed in Table 5. This implies that the linear regression model that was built is suitable for the entire dataset.

Table 5. Analysis of variance test results

Model	Sum of squares	df	Mean square	F	Sig.
Regression	63.409	6	10.568	71.753	0.000[b]
Residual	26.953	183	0.147		
Total	90.362	189			

Note: b. Predictors: (Constant), Cloud computing (CC), Internet of Things (IoT), Big data (BD), Social media (SM), Artificial intelligence (AI), and Blockchain technology (BT).

Table 6. Regression analysis results

Model	Unstandardized coefficients		Standardized coefficients	t	Sig.	Collinearity statistics	
	B	Std. error	Beta			Tolerance	VIF
(Constant)	-0.412	0.207		-1.989	0.048		
CC	0.309	0.047	0.313	6.624	0.000	0.728	1.374
IoT	0.242	0.043	0.260	5.670	0.000	0.773	1.293
BD	0.167	0.044	0.174	3.808	0.000	0.784	1.276
SM	0.178	0.043	0.189	4.140	0.000	0.780	1.282
AI	0.145	0.043	0.156	3.384	0.001	0.770	1.298
BT	0.160	0.044	0.169	3.633	0.000	0.755	1.324

Source: Analysis of survey data.

All of the independent variables have a significance level (Sig.) of less than 0.05, according to the regression analysis results shown in Table 6. This implies that there is a statistically significant relationship between each independent variable and the dependent variable. Beyond statistical significance, the magnitude of the estimated coefficients indicates meaningful differences in the practical impact of individual digital transformation technologies. *CC* exhibits the strongest effect on business performance ($\beta = 0.309$, $p < 0.01$), suggesting that improvements in cloud-based capabilities are associated with substantial performance gains. The *IoT* and *SM* also demonstrate moderate effects, reflecting their role in enhancing operational efficiency and customer engagement. In contrast, *AI* shows a positive but relatively modest effect ($\beta = 0.145$, $p < 0.05$), indicating that while *AI* contributes to performance improvements, its short-term practical impact remains limited compared to more mature and readily deployable technologies. The following is the regression equation derived from the analysis:

$$BP = -0.42 + 0.313 \times CC + 0.260 \times IoT + 0.174 \times BD + 0.189 \times SM + 0.156 \times AI + 0.169 \times BT \quad (1)$$

where:

- *CC* represents cloud computing;
- *IoT* represents the Internet of Things;
- *BD* represents big data;
- *SM* represents social media;
- *AI* represents artificial intelligence;
- *BT* represents blockchain technology;
- *BP* represents business performance.

Furthermore, as indicated in Table 6, all factors' VIF values are less than 10. This shows that the model does not have multicollinearity, which guarantees the validity of the regression results and that the predictors are not overly correlated.

Table 7. Model summary

Model	*R*	*R-squared*	*Adjusted R-squared*	*Std. error of the estimate*	*Durbin-Watson*
1	0.838[a]	0.702	0.692	0.38378	2.140

Note: a. Predictors: (Constant), BT, AI, SM, BD, IoT, CC.
Source: Analysis of survey data.

According to the findings in Table 7, the adjusted R-squared value is 0.692. Accordingly, 69.2% of the variability in the dependent variable can be explained by the six independent variables that are part of the research model. Random error and variables not included in the model account for the remaining 30.8% of the variability.

5. DISCUSSION OF RESULTS AND RECOMMENDATIONS

5.1. Discussion of research results

From a theoretical perspective, the findings support the RBV, suggesting that digital transformation technologies constitute strategic resources that enhance firm performance when they are valuable and effectively deployed. However, the empirical results indicate that these technologies differ in their performance impact due to variations in implementation complexity and alignment with firm-specific resources.

Every independent variable in the research model has a positive impact on the dependent variable, per the results of the data analysis. Consequently, it can be claimed that every research hypothesis has merit. Nevertheless, the magnitude of the effects varies across technologies. CC is the most significant of these. Ali and Haseebuddin's (2015) study is in agreement with this result, but it is not in agreement with the research of Nhi et al. (2023). The dominant effect of CC reflects its scalability and relatively low implementation barriers, enabling firms to achieve performance gains more rapidly.

Recently, companies have benefited from the IoT and BD through enhanced customer loyalty, higher sales volume, and better inventory management. The results of this inquiry corroborate this trend and are consistent with research by Huong (2020) and Mubarak et al. (2019). This suggests that IoT is particularly effective in the retail sector, where operational efficiency and customer experience are critical.

The influence of the SM on specific consumer groups and business choices is increasing. Because of this, managers are using SM analytics to obtain valuable data about their clients. Its relatively strong effect can be explained by its accessibility and low cost of adoption for retail firms.

The results of the study are in line with Shankar (2018) and Trang (2022). But for Vietnamese retail businesses, AI systems continue to be a roadblock to digital transformation due to their high upfront costs and data requirements. These constraints explain why AI exhibits the weakest performance effect despite being statistically significant.

The findings of the study concur with those of Yin and Wang (2023) and Sharma (2017). Nevertheless, BT is still relatively new in Vietnam, particularly in the retail industry. Regulatory uncertainty and scalability issues limit its short-term contribution to business performance.

Overall, the findings indicate that while digital transformation positively influences business performance, its effects vary depending on the feasibility and contextual fit of each technology in an emerging economy.

5.2. Recommendations

One crucial factor influencing how well businesses operate is digital transformation. Thus, in order to improve resources and gain a competitive edge in complex markets, businesses require targeted strategies (Prihandono et al., 2024). However, because every company has a unique organizational structure, it is challenging to suggest a general

strategy for accelerating digital transformation efforts. Based on the empirical results, recommendations should focus on technologies with the strongest observed performance effects.

Managers must first evaluate and choose the best technology, provider, and transformation model based on risk constraints, corporate strategy, costs, investment, and financial capacity. Given its dominant impact, CC should be prioritized as a foundational technology. If companies want to get the most out of CC, they need to revamp their IT infrastructure, ensure that cloud operations are software-based, build cloud security, cultivate a tech culture, and invest in talent development.

Second, managers must set clear business goals for IoT deployment, such as improving customer experience, increasing operational effectiveness, inventory control, and supply chain optimization. The strong empirical effect of IoT suggests that firms should focus on applications directly linked to operational efficiency and customer interaction.

For more advanced technologies such as AI and BT, firms should adopt a gradual and cautious approach, considering high costs, data requirements, and regulatory uncertainty. Pilot projects and partnerships with technology providers can help reduce risks and improve learning outcomes.

6. CONCLUSION

This study examines the impact of digital transformation technologies on the business performance of retail enterprises in an emerging economy. The empirical results indicate that all six technologies — cloud computing, the IoT, social media, big data analytics, blockchain technology, and AI — have a positive and statistically significant effect on business performance. However, their impacts differ in magnitude. Cloud computing exerts the strongest influence, followed by the IoT and social media, while big data analytics and blockchain technology show moderate effects. AI demonstrates the weakest impact, reflecting higher implementation complexity and resource constraints in the Vietnamese retail context.

The findings support the RBV by showing that digital technologies enhance firm performance when they are effectively aligned with organizational resources and capabilities. From a practical perspective, the results suggest that retail managers should prioritize strategic investments in foundational digital technologies, particularly cloud computing and IoT, rather than adopting digital solutions in a fragmented manner. Policymakers may also facilitate digital transformation by improving digital infrastructure and supporting digital skills development.

Despite its contributions, this study has limitations related to its cross-sectional design, context-specific sample, and reliance on perceptual performance measures. Future research may employ longitudinal designs, objective performance indicators, or alternative analytical approaches to further explore the performance effects of digital transformation.

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