DOI: https://doi.org/10.62985/j.huit_ojs.vol26.no3E.490

ENHANCING THE OPERATIONAL EFFICIENCY OF THE FOOD RETAIL SUPPLY CHAIN: THE ROLE OF DIGITAL TRANSFORMATION

Nguyen Xuan Quyet[1,*], Ho Thi Ha Vy[1], Do Pham Cong Thang[1], Tran Minh Thu[1], Tran Anh Quan[2], Tran Nhat Hoang[1]

[1]*Ho Chi Minh City University of Industry and Trade*

[2]*University of Economics Ho Chi Minh City*

[*]Email: *quyetnx@huit.edu.vn*

Received: 20 March 2026; Revised: 18 April 2026; Accepted: 9 May 2026

ABSTRACT

Using a mixed-methods approach, this study assesses the impact of digital transformation on the operational efficiency of the food retail supply chain in Ho Chi Minh City, Vietnam. This research was conducted using data collected from 136 food retail enterprises in Ho Chi Minh City, Vietnam. The research results show that digital transformation is becoming a trend and impacting food retail enterprises, posing challenges for competitiveness. Empirical analysis indicates that digital transformation factors, including digital transformation strategy, digital technology investment, digital transformation human resources, product characteristics, supply chain organization, and legal policies, all significantly influence the operational efficiency of the food retail supply chain. Based on the empirical research results, the authors proposed managerial implications and practical solutions to improve the efficiency of the food retail supply chain for food enterprises. This study provides valuable results for food enterprises and managers in developing strategies and policies to promote digital transformation and achieve effective performance.

Keywords: Food, business performance, retail supply chain, digital transformation.

1. INTRODUCTION

Across global economies, digital transformation is widely recognized as a key driver of productivity growth, innovation, and strategic restructuring. Today, businesses are constantly innovating to improve the efficiency of food retail by applying digital transformation such as AI, Big Data, and IoT in a positive way to change the way a business operates, organizes, and manages [1]. In this context, digital transformation not only supports businesses in optimizing operational efficiency but also contributes to improving the ability to make many decisions, especially in the field of supply chains and services, the integration of digital technologies into activities such as inventory management, demand forecasting, and transportation enable the ability to enhance stakeholder coordination, improve information transparency and improve real-time response [2].

The Garcia-Garcia et al. (2025) study has shown that the adoption of artificial intelligence (AI), big data analytics, blockchain, and the Internet of Things (IoT) can help optimize operations, enhance food industry supply chain visibility, and improve return on investment [3]. Besides, Suali et al. (2024) explored, the role of digital platforms in restructuring the e-commerce food supply chain, particularly its ability to improve process agility and resource

efficiency during major disruptions [4]. Ramazanov et al. (2021) demonstrated that digital transformation of traditional retail channels (small grocery stores, "nanostores") has changed in operations and strategic effectiveness when applying digitalization to this distribution channel, addressing issues such as channel selection, trade credit, and digital ordering [5].

The Prime Minister of Vietnam (2020) has issued Decision No. 749/QD-TTg, approving the National Digital Transformation Program to 2025, with a vision to 2030, which aims to increase the digital economy's contribute to 20% of GDP by 2025 and 30% GDP by 2030. Digital transformation in businesses is considered an important solution to improve competitiveness and promote the digital economy [6]. The Politburo of Vietnam (2024) also issued Resolution No. 57-NQ/TW, dated 22-12-2024, on breakthroughs in scientific and technological development, innovation, and national digital transformation. Continuing to consider national digital transformation as one of the most important breakthroughs, the main driving force for the rapid development of modern production forces, perfecting production relations, innovating national governance methods, socio-economic development, preventing the risk of lagging behind, etc bringing the country to breakthrough development and prosperity in the new era [7].

The Department of Enterprise Development, Ministry of Planning and Investment of Vietnam (2024), reports that Kearney's Global Retail Development Index (GRDI) ranking in 2023 has recorded a change in Vietnam's position in the retail industry, with Vietnam ranking 34th out of 44 countries, down the ranking from 6th place in 2017 to 9th place in 2021 and now 34th [8]. Luu et al. further highlight that strong competition among retail businesses in general and food retailers in particular in the Vietnamese market has created challenges and motivated businesses to implement technological innovation and digital transformation strategies to increase operational efficiency and reduce supply chain costs [9].

An overview of findings from international research shows that digital transformation is not merely a supporting tool but has become a key factor determining the performance of the food retail supply chain. For the context of Ho Chi Minh City, where traditional retail channels still occupy an important position, the application of these lessons learned requires appropriate adjustments to optimize digital transformation productivity. On that basis, this study focuses on analyzing the current situation and proposing solutions to improve the efficiency of the food retail supply chain in Ho Chi Minh City, with a focus on the key role of digital transformation in improving productivity and optimizing operations.

2. THEORETICAL BACKGROUND & LITERATURE REVIEW

2.1. Theoretical basis

- *The Wheel of Retailing (WOR) theory,* initially proposed by McNair (1958) and further developed by Hollander (1960), posits that developed the WOR theory, which states that "New retailers enter the market as operators with low positions, low profits, and low prices (entry-stage). "They gradually increase their service and cost (upgrade phase), maturing into high-cost, high-priced retailers (vulnerable phase), making them vulnerable to new, low-cost entrants [10, 11]. Male et al. (2011), also argue that "The Retail Circle: A cyclical theory in which new retailers enter the market at low cost/low margins, gradually enhance services and prices (upgrades), and eventually become vulnerable to new competitors offering lower prices [12].

- *The Digital Transformation Theory (DTT)*, Mergel et al. (2019) suggest that digital transformation is a holistic approach that takes organizations from simple digitalization efforts to changes in the culture, management, processes, and development of the entire organization. The result is a theoretical framework that outlines three prerequisites for digital transformation: 1) cost reduction in the decision-making process to buy or build yourself; 2)

flexible procurement policies with consensus from contractors and budget allocation from policymakers; and 3) people-centered design and development, including agile leadership and cultural change [13]. More specifically, Reinartz et al. (2022) argue that digital transformation in the retail industry is a shift from a traditional business model to the application of modern digital transformation technology that focuses more on the service experience of consumers [14]. For the food retail industry, digital transformation plays a central role in improving the operational efficiency of businesses and organizations, helping businesses optimize supply chain management, reduce waste, comply with legal policies and improve consumer experience.

- *Food Supply Chain Theory,* according to Mentzer et al. (2001), a supply chain is seen as a collection of three or more entities consisting of organizations or individuals and directly involved in the flow of products, services, finance, and information from supply to customers [15]. Lankauskiene et al. (2022), argue that the evolution of short food supply chain theory and practice in the context of three mindset innovations related to food production and distribution systems, supply chain efficiency includes: (1) The diversity of services and products provided by farmers; (2) Digital transformation strategy and human resources to adapt to flexible change; (3) Increase the existing consumer community; (4) Provide not only contact information but also detailed descriptions and illustrations of the product; (5) Creating a community of consumers, a culture is promoted [16].

In conclusion, digital transformation is the basis for food retail supply chains to enhance service, value, and business efficiency.

2.2. Theoretical background/Literature review

Based on theories related to digital transformation and food retail supply chains, the authors conducted a literature review and proposed research hypotheses, including:

+ *Hypothesis H1: Digital transformation strategy (DTS),* which has an impact on supply chain operational efficiency, is proposed from the research results from [3, 4]. Male's research (2011) points out that "Retailers need to implement change strategies and apply digital technology in management activities to effectively renovate and integrate more closely between supply chains and value chains in building retail chain systems [12]. The Digital Transformation Strategy (DTS) hypothesis is determined to have 04 research scales, including: Enterprises with a digital transformation strategy (DTS1); Enterprises with digital transformation policies and roadmaps (DTS2); Leaders with a commitment to digital transformation (DTS3); Digital transformation capabilities of businesses (DTS4).

+ *Hypothesis H2: Digital technology investment (DTI),* which has an impact on supply chain operational efficiency, is proposed from the research results results from [3, 4]. Wang's (2025) research results indicate that "The digitalization of the supply chain can enhance the competitiveness of enterprises, improve the competitiveness of enterprises [17]. The Digital Technology Investment (DTI) hypothesis is determined to have 04 research scales, including: Infrastructure for digital transformation (DTI1); Data system for digital transformation (DTI2); Information security during digital transformation (DTI3); Budget for digital transformation (DTI4).

+ *Hypothesis H3: Digital transformation human resources (DTW),* which has an impact on supply chain operational efficiency, is proposed from the research results from [3, 4]. The results of Gong's study (2025), the digitalization of the retail supply chain is influenced by factors such as customer risk tolerance, the extent of customer losses, and the effectiveness of the investment in security. Human resources that accept change and have knowledge of digital transformation affect the operational efficiency of the food retail chain [18]. The Digital Transformation Human Resource (DTW) hypothesis is determined to have 04 research scales,

including: Professional qualifications for digital transformation (DTW1); Competency level for digital transformation (DTW2); Understanding digital transformation (DTW3); The spirit of change and adaptation to digital transformation (DTW4).

+ *Hypothesis H4: Product characteristics (PFCs),* which have an impact on supply chain operational efficiency, are proposed from the research results from [17,18]. The results of Zhang's (2026), the digital twin model provides a data-driven framework for shelf life management based on product information, supporting targeted interventions to reduce food loss in the supply chain. At the same time, market demand and customer reviews will drive product diversity [19]. The Product Characteristics Hypothesis (PFC) is determined to have 04 research scales, including: Product Design Characteristics (PFC1); Market demand for the product (PFC2); The level of consumer evaluation of the product (PFC3); Variety of products (PFC4).

+ *Hypothesis H5: Supply chain organization (SCS),* which has an impact on supply chain operational efficiency, is proposed from the research results from [18, 20]. The research results of Mai and Nguyen (2021), Bhardwaj and Agrawal (2020), the performance of the supply chain depends heavily on the organization of the chain of operations, from the production process, supply, service, control to the organization of supply chain logistics [20, 21]. The Supply Chain Organization (SCS) hypothesis is determined to have 04 research scales including: Supply chain input organization (SCS1); In-chain production organization (SCS2); Chain distribution organization (SCS3); Chain Service Organization (SCS4).

+ *Hypothesis H6: Digital transformation policies (DTL),* which have an impact on supply chain operational efficiency, are proposed from the research results from [4, 5]. The research results of Gong (2025) and Luu et al. (2025), digital transformation has a significant positive impact on supply chain operational efficiency. This impact is manifested both directly and indirectly, with digitalization policies and initiatives strengthening the strength and transparency of supply chains, thereby improving supply chain resilience to difficulties [18, 22]. The Digital Transformation Policy (DTL) hypothesis is determined to have 04 research scales, including: Digital Transformation Trends (DTL1); National policy on digital transformation (DTL2); Digital transformation policy of enterprises (DTL3); Digital Transformation Guide of Enterprises (DTL4).

In addition, according to research by Muzamil et al. (2025), Bhardwaj and Agrawal (2020), "Supply chain operational efficiency (SSCP) is evaluated through business results, market scalability, cost reduction, and stable operations [21, 23].

2.3. Research model

Based on the results of theoretical research and expert interviews, the authors propose a research model on improving the operational efficiency of the food retail supply chain in Ho Chi Minh City, with a research framework including digital transformation factors including: Digital Transformation Strategy (DTS); Digital Technology Investment (DTI); Digital transformation human resources (DTW); Digital Transformation Policy (DTL); Product Characteristics (PFC); and Supply Chain Organization (SCS) (Figure 1).

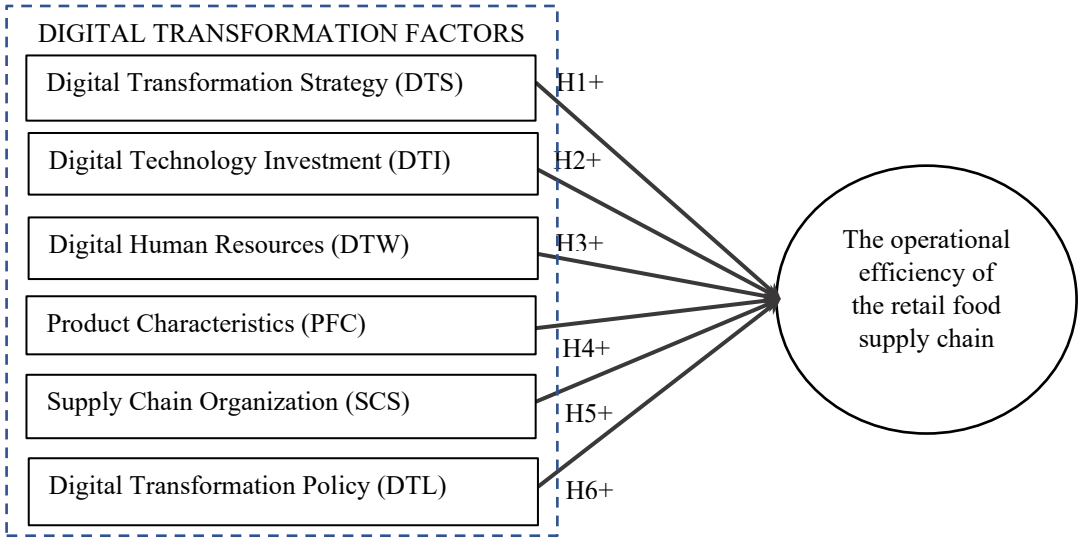

Figure 1. Proposed research model

Source: Study Authors, 2026

3. RESEARCH METHODOLOGY

Using a market system, policy, organizational and institutional research approach for the study, the authors used a mixed research method. The qualitative method is used to study the current situation and collect secondary information and data including relevant domestic and foreign studies, published reports, interviews with 10 experts who are managers and related researchers, using questionnaires to identify and standardize scales and screening questions, build official surveys for research, with objectivity and reliability.

The quantitative research method used to synthesize and analyze primary data is compiled from the survey results with a conveniently distributed sample from enterprises with food retail supply chains in Ho Chi Minh City, ensuring the sample size based on the guidelines proposed Hair et al. (2010), the sample size for exploratory factor analysis (EFA) and linear structure model analysis is at least 50 observations, with an acceptable rate of 05 observations/01 variable. The formula for calculating the sample size is N = 5x (N is the number of observations/survey sheets, x is the number of measurement variables/questions), the critical sample size requirement must be 100 respondents [24]. The authors developed a set of 24 questions, with a ratio of 5:1, the appropriate sample size for EFA analysis was 24 x 5 = 120. The authors collected 136 valid questionnaires (out of 145 samples emitted) to carry out the evaluation, 09 invalid samples due to insufficient authenticity of the evaluation data should be discarded, ensuring the reliability of the research analysis steps.

The collected data will be encoded and cleaned, and then analyzed using statistical methods, comparison, description, scale verification using Cronbach's Alpha confidence coefficient, EFA discovery factor analysis, linear regression analysis, and ANOVA testing [25]. The research and analysis tool is Excel software used for statistics and analysis by SPSS 26.0 software.

4. RESULTS & DISCUSSION

4.1. The current situation of digital transformation of food retailers at businesses in Ho Chi Minh City, Vietnam

A report by the Department of Enterprise Development - Ministry of Planning and Investment of Vietnam (2024) indicates that "Generally, in the first 6 months of 2025 total retail sales of consumer goods and services are estimated at 3,416.8 trillion VND, up 9.3% over the same period last year. Ho Chi Minh City and Hanoi, the country's two major economic hubs, continue to contribute significantly to national retail sales, with food and personal care products accounting for only 16% [8]. Luu et al. (2025) further report that in the first 6 months of 2025, retail sales of goods such as cultural - educational items, food products, garments and household goods all recorded growth of 11.5%, 9.5%, 6.1% and 5.5%, respectively. In some localities, retail sales have seen remarkable growth such as Quang Ninh (10%), Hai Phong and Da Nang (8.2%), Ho Chi Minh City (7.9%) ... The localities that recorded outstanding growth in accommodation and catering service revenue were Da Nang (18.5%), Ho Chi Minh City (16.9%), Hanoi (13%) [9]. Thus, Ho Chi Minh City is can be considered a locality with relatively strong growth in retail sales.

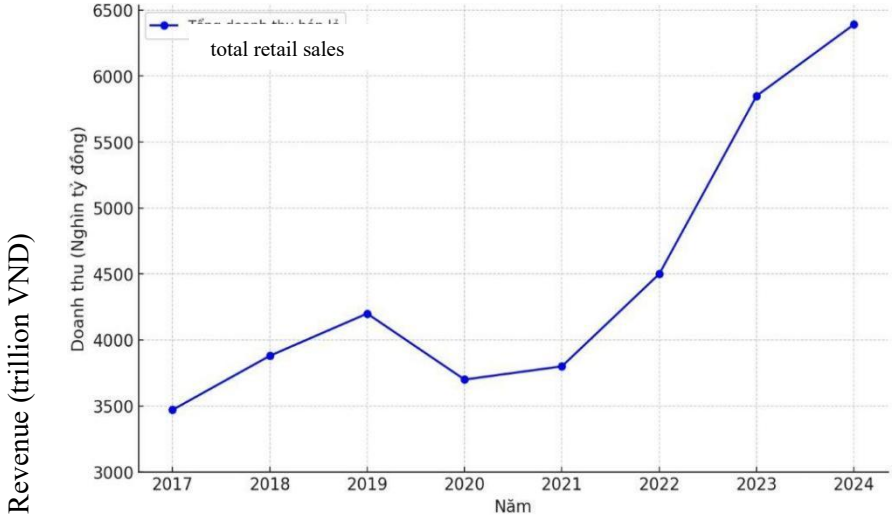

Figure 2. Retail sales of consumer goods and services in Vietnam [9]

Also, according to the research results of Luu et al. (2025), the digital transformation readiness of businesses in the retail industry is relatively high in terms of financial management, accounting, planning, legal, and human resources. However, the linkage between participants in the Vietnamese retail market is still not good, which is a big challenge in the digital transformation process. In addition, cybersecurity is a risk-tolerant sector, especially in the retail sector [9]. This shows that the digital transformation of Vietnamese retail businesses in general, and Ho Chi Minh City in particular, continues to face many limitations and challenges.

In conclusion, food retail supply chain businesses in Ho Chi Minh City have the opportunity to develop breakthroughs, and at the same time face pressure to change their brand development strategy by applying and implementing digital transformation towards improving the efficiency of food supply chain operations, but there are still many limitations and challenges due to the trend the direction of continuous technological change.

4.2. Results of the analysis of the role of digital transformation on the operational efficiency of the food retail supply chain in Ho Chi Minh City

4.2.1. Cronbach's Alpha Test Results

Based on the criteria proposed by Dinh (2011), the variables observed in the same factor seeking to ensure reliability must exhibit a correlation coefficient of 0.3 or more with the sum

variable. If this coefficient is less than 0.3, it will reduce the reliability of the whole group. In Table 1, all variables have a total variable correlation coefficient greater than 0.3 and most of them are above 0.5; All observed variables are accepted and will be used in subsequent factor analysis. The standard for the scale is satisfactory when Cronbach's Alpha > 0.6 [26]. With 136 official samples, with 06 criteria and 24 scales of the questionnaire of variables that meet the reliability requirements, the coefficient of all Cronbach's Alpha scales > 0.6, which is a good measurement (Table 1).

Table 1. Reliability testing of scales

Observed Variable	Total Inter-item Correlation Coefficient	Cronbach's Alpha if Variable Excluded	Cronbach's Alpha for Entire Scale
Digital Transformation Strategy (DTS)	0.802	0.865	0.889
Digital Technology Investment (DTI)	0.823	0.828	
Digital Transformation Human Resources (DTW)	0.810	0.802	
Product Characteristics (PFC)	0.838	0.830	
Supply Chain Organization (SCS)	0.809	0.855	
Digital Transformation Policy (DTL)	0.803	0.882	

Source: Study Authors, 2026

As a result of the Cronbach's Alpha test, the Cronbach's Alpha coefficient of the whole scale is 0.889 > 0.6 is within the good measurement level, the total correlation coefficient of the variables measuring this factor is > 0.3, the suitability and reliability of the observed variables in the analysis and research of the next steps.

4.2.2. Results of EFA Exploratory Factor Analysis

+ *KMO and Bartlett's Test,* KMO coefficient = 0.861 (0.5 < KMO < 1). The Chi-Square statistics of Bartlett's test have a value of 3455.204 with a significance level of Sig. = 0.000, indicating that the observed variables are correlated with each other. The results of the EFA analysis showed that the total variance extracted reached 77.439% (> 50%), showing that these 24 observed variables, 6 factors extracted factors explained 77.439% of the variation in the data, which is an acceptable result and proves that grouping the factors together is appropriate. The stop points when extracting the factor is at the 7th factor with a specific value of 2,306 > 1, indicating that the results of the factor analysis are appropriate. The observed variables have a satisfactory factor load coefficient > 0.5. None of the observed variables had a simultaneous load factor on both factors, so the scale had convergent validity [26] (Table 2).

Table 2. KMO and Bartlett's Test

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		0,863
Bartlett's Test of Sphericity	Approx. Chi-Square	33187.471
	df	276
	Sig.	0.000

Source: Study Authors, 2026

The Kaiser-Meyer-Olkin test showed good sample suitability (KMO = 0.861). The Bartlett spherical test was statistically significant (Chi-Square = 3455.204, df = 276, Sig. = 0.000), showing that the observed variables were correlated.

Table 3. Variance explained by influencing factors

Factor	Variance Extraction			Total variance extracted			The total cumulative variance was extracted		
	Total	Variance Percent	Cumulative Percent	Total	Variance Percent	Cumulative Percent	Total	Variance Percent	Cumulative Percent
1	7.559	23.621	23.621	7.559	23.621	23.621	7.374	23.043	23.043
2	4.967	15.521	39.142	4.967	15.521	39.142	4.628	14.463	37.507
3	3.808	11.901	51.043	3.808	11.901	51.043	3.867	12.084	49.591
4	3.144	9.826	60.869	3.144	9.826	60.869	3.191	9.973	59.563
5	2.997	9.365	70.234	2.997	9.365	70.234	3.177	9.929	69.492
6	2.306	7.205	77.439	2.306	7.205	77.439	2.543	7.947	77.439
7	0.568	1.776	79.215						
8	0.488	1.527	80.742						
9	0.455	1.423	82.164						
10	0.420	1.311	83.476						
11	0.406	1.269	84.745						
12	0.394	1.233	85.977						
13	0.382	1.194	87.172						
14	0.341	1.186	88.238						
15	0.334	1.075	89.283						
16	0.330	1.061	90.314						
17	0.314	1.054	91.061						
18	0.302	1.002	91.312						
19	0.298	1.091	92.981						
20	0.284	1.028	94.408						
21	0.238	0.989	95.797						
22	0.215	0.952	97.974						
23	0.201	0.912	98.840						
24	0.167	0.871	100.000						
Extraction method: Principal component analysis.									

Source: Study Authors, 2026

+ *Check for method changes and miscompatibility*, the observed variables are extracted into 24 factors at eigenvalue = 2,306 (>1). The results of the factor analysis were reasonable,

the total variance extracted reached 77.439% (>50%) and the variability of the data was the result. The acceptance variables are extracted into factors at the same time [26] (Table 3).

Hoang and Chu (2008) indicate that the VIF variance amplification coefficient < 2 shows that no multi-linear phenomenon occurs and there is no strong correlation between independent variables [25].

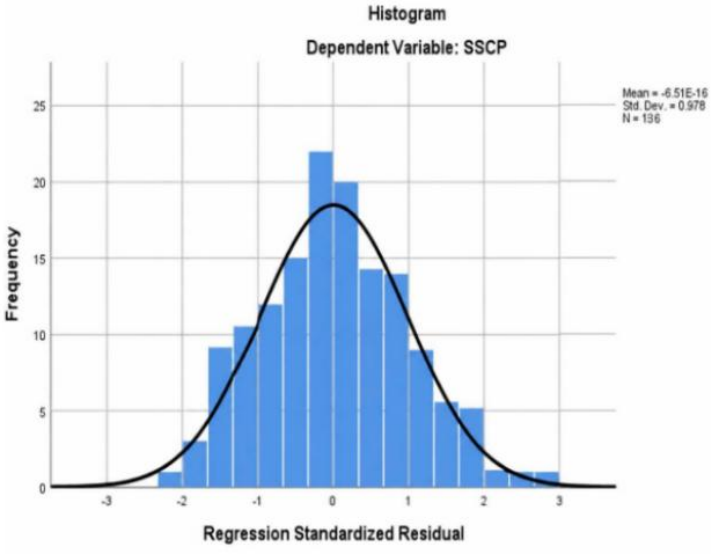

Figure 3. Testing assumptions about the distribution of residuals and autocorrelated residuals

Source: Study Authors, 2026

As shown in Figure 3, the residuals exhibit an approximately bell-shaped distribution. The mean of the residuals is 6.51×10^{-16}, which is negligible and close to zero, while the standard deviation is approximately 1. These results indicate that the standardized residuals satisfy the assumption of normality.

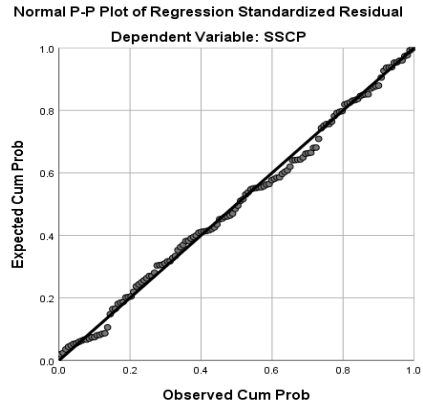

Figure 4. Residual correlation analysis graph

Source: Study Authors, 2026

The graph of the normalized residual values converges randomly along the value line = 0, so we conclude that there is no self-correlation between the residual. The results of the EFA discovery factor analysis ensure reliability [26]

4.2.3. Linear Regression Analysis

Linear regression analysis shows that there is no multicollinearity. Multilinear statistics with the VIF (Variance Amplification Coefficient) of the independent variables in the model are all less than 2, proving that there is no multicollinearity (Table 4). As a result, all variables have statistically significant Sig values = 0.000 (< 0.05). Thus, there are 06 factors affecting the application of digital transformation to improve the operational efficiency of the food retail supply chain at enterprises in Ho Chi Minh City according to the standardized regression coefficient (Beta) [26].

Table 4. Linear regression test

Model		Coefficients are not standardized		Standard coefficient	Coefficient (t)	Sig	Multicollinearity statistics	
		Coefficient (B)	Standard deviation	Beta coefficient			Tolerance	Variance Inflation Factor
1	(Constant)	0.058	0.293		0.198	0.000		
	DTS	0.018	0.031	0.420	11.578	0.000	0.976	1.024
	DTI	0.046	0.034	0.247	7.369	0.000	0.966	1.035
	DTW	0.006	0.033	0.206	6.181	0.000	0.967	1.034
	PFC	0.034	0.034	0.235	5.994	0.000	0.948	1.054
	SCS	0.026	0.035	0.326	12.753	0.000	0.969	1.032
	DTL	0.908	0.034	0.430	16.957	0.000	0.975	1.026

Source: Study Authors, 2026

From the above results, we have a linear equation that shows the influencing factors (DTS, DTI, DTW, PFC, SCS, DTL) to Y - impact on improving the operational efficiency of the food retail supply chain at enterprises in Ho Chi Minh City, Vietnam, as follows:

$$\mathbf{Y = 0.420DTS + 0.247DTI + 0.206DTW + 0.235PFC + 0.326SCS + 0.430DTL + \varepsilon\_KQ}$$

Therefore, the linear regression model constructed based on the Y equation does not violate the assumptions required in residual. Consequently, the hypotheses are accepted with a statistical significance of 5% and the relationship between each factor and Y – The performance of the food retail supply chain at enterprises in Ho Chi Minh City, Vietnam, is a proportional relationship.

5. DISCUSSION AND POLICY IMPLICATIONS

Based on the research findings on the current situation and the discussion of the analysis of digital transformation factors affecting the operational efficiency of the retail supply chain in Ho Chi Minh City. Governance implications to improve the operational efficiency of the food retail supply chain at enterprises in Ho Chi Minh City, Vietnam are proposed, including:

5.1. Managers and businesses need to concretize policies and develop digital transformation strategies for food retail supply chain operations in Ho Chi Minh City

The results of the study show that Ho Chi Minh City, the largest economic center in Vietnam, has established strategic guidelines and policies to promote economic development, the development of retail chains in general and food in particular is of great interest. At the same time, digital transformation is also a nation policy in Vietnam, supported by government agencies and the Ho Chi Minh City goverment. In this context, improving the operational efficiency of the food supply chain is essential for the city to captitalize on potential market opportunities, enhance competitiveness, and move toward sustainable development [6, 7, 8].

The results of the empirical research analysis also show that the Digital Transformation Policy (DTL) factor has the strongest impact with β6=0.430 and the Digital Transformation Strategy (DTS) factor with β1=0.420, the second strongest impact on the operational efficiency of the food retail supply chain (Table 4). Consistent with the research hypothesis. Therefore, managers and businesses need to concretize policies and develop digital transformation strategies for the operation of the food retail supply chain in Ho Chi Minh City, such as: 1) Develop a digital transformation strategy to enhance the operational efficiency of the food retail supply chain; 2) Develop policies to support digital transformation for businesses managing food retail supply chains; 3) Specifically, the digital transformation action program for food retail supply chain management businesses... On that basis, the group of proposed solutions should be implemented synchronously in the direction of prioritizing the development of internal institutional frameworks and long-term strategies. First of all, businesses need to build a methodical digital transformation roadmap, closely linking business strategies and digitalization strategies, and establish a periodic monitoring and evaluation mechanism to ensure consistency in implementation. Enterprises need to have a clear decentralization of responsibilities between departments in the supply chain, combined with preferential policies and support from industry associations and state management agencies to encourage the application of digitalization in the entire process from procurement, logistics services... manage the entire retail supply chain operations.

5.2. Increase investment in digital transformation to improve the operational efficiency of the food retail supply chain

The results of the study indicate that retail food supply chain enterprises in Ho Chi Minh City have significant opportunities for growth, supported by promising market potential and favorable growth rates. But it is also under highly competitive pressure, limited investment capacity, while the connectivity is not high [8, 9]. The results of the empirical study analysis also indicate that the Product Characteristics factor (PFC), with β4=0.235, and the Digital Technology Investment factor (DTI) with β2=0.247 have the fifth and fourth influence on the performance of the retail food supply chain. consistent with the research hypothesis. Therefore, businesses need to increase investment in digital transformation to improve the operational efficiency of the food retail supply chain, specific solutions include: 1) Increase investment in digital technology, aiming for high integration between platforms such as enterprise management systems (ERP), customer relationship management (CRM) and operational tracking systems (WMS, TMS) to increase visibility and coordination in the retail supply chain; 2) Investing in technology to improve operational efficiency, on the one hand, helping to implement the digital transformation of the retail supply chain with inherently diverse and complex product characteristics, requiring modern and effective management. Thereby, helping food retail supply chain businesses improve their competitiveness and boldly transform digitally to enhance the operational efficiency of the food retail supply chain in Ho Chi Minh City.

5.3. Restructuring the organization and training of human resources for digital transformation to improve the operational efficiency of the food retail supply chain

Inheriting studies and reports on the current state of digital transformation of food retail supply chain enterprises, it shows that the digital transformation human resource factor of businesses in general is limited in both quantity and quality, while due to the trend, the requirements are very high [8, 9, 22]. The results of the empirical research analysis also show that the Supply Chain Organization (SCS) factor has β5=0.326 and the Digital Transformation Human Resource factor has β3=0.206, which is consistent with the research hypothesis. Therefore, enterprises need to study organizational restructuring and training human resources for digital transformation to improve the operational efficiency of the food retail supply chain.

Specific solutions include: 1) Improving the supply chain organization in the direction of leaning and flexible, combining the effective exploitation of product characteristics to build a digitalization strategy suitable for each group of fresh and processed food products that will create a sustainable competitive advantage; 2) Strengthen the training of digital management teams and improve digital capacity for employees; 3) Have a policy to attract talents in the field of technology and supply chain management. The group of proposed solutions needs to be implemented with the participation of technology units, experts and organizations and businesses with experience in sharing practical success to improve the operational efficiency of the food retail supply chain in Ho Chi Minh City, Vietnam.

6. CONCLUSION

This study uses empirical research to evaluate the impact of digital transformation factors on the operational efficiency of the food retail supply chain in Ho Chi Minh City, Vietnam. Specifically, the study has developed and validated a comprehensive set of scales for the core structure of six components representing digital transformation, ensuring strict both theoretical and empirical research. Based on a validated data system, scale and research model, with a new analysis framework proposed from the results of a survey of food retail supply chain managers in the study area. The results of the study have proposed management implications to strengthen digital transformation to improve the operational efficiency of the food retail supply chain Ho Chi Minh City, Vietnam. At the same time, it helps managers and planners to strengthen policies by developing theories in terms of the digital economy and national policymaking. The research results not only affirm the multi-dimensional role of digital transformation in the retail supply chain but also emphasize that businesses need to prioritize building appropriate strategies, opening up new research directions with a more specific analysis of technology and resources to improve operational efficiency in a sustainable way.

REFERENCES

[1] P. Parviainen *et al.,* "Tackling the digitalization challenge: How to benefit from digitalization in practice," *International Journal of Information Systems and Project Management*, vol. 5, no. 1, pp. 63–77, 2017, doi: https://doi.org/10.12821/ijispm050104

[2] T. L. Huang, "Digital transformation and business performance in China," *Asia Pacific Management Review*, vol. 30, no. 4, pp. 1–12, Art. no. 100400, 2025, doi: https://doi.org/10.1016/j.apmrv.2025.100400

[3] G. Garcia-Garcia, H. Trollman, C. Parra-Lopez, C. Carmona-Torres, S. Jagtap, Y. Luo, and A. Soofastaei, "Digitizing the palate: Exploring opportunities for digital transformation in the food industry," in *Advanced Analytics for Industry 4.0*, A. Soofastaei, Ed., 1st ed. Boca Raton, FL, USA: CRC Press, 2025, pp. 205–232, doi: 10.1201/9781003186823-6

[4] A. S. Suali, J. S. Srai, and N. Tsolakis, "The role of digital platforms in e-commerce food supply chain resilience under exogenous disruptions," *Supply Chain Management: An International Journal*, vol. 29, no. 3, pp. 573–601, 2024, doi: https://doi.org/10.1108/SCM-02-2023-0064

[5] I. A. Ramazanov *et al.,* "Retail transformation under the influence of digitalisation and technology development in the context of globalisation," *Journal of Open Innovation: Technology, Market, and Complexity*, vol. 7, no. 1, Art. no. 49, 2021, doi: https://doi.org/10.3390/joitmc7010049

[6] Prime Minister of Vietnam, "Decision No. 749/QD-TTg: Approving the National Digital Transformation Program to 2025, with orientations toward 2030," *LuatVietNam,* Jun. 3, 2020. [Online]. Available: https://english.luatvietnam.vn/decision-no-749-qd-ttg-on-approving-the-national-digital-transformation-program-until-2025-with-a-vision-184241-doc1.html

[7] Political Bureau, "Resolution No. 57-NQ/TW dated December 22, 2024 on breakthroughs in the development of science, technology, innovation, and national digital transformation", *LuatVietnam*, Dec. 22, 2024. [Online]. Available: https://english.luatvietnam.vn/resolutionno57-nq-twdateddecember222024ofthepoliticalbureauonbreakthroughsinthedevelopmentofscience technologyinnovationandna-381835-doc1.html

[8] Department of Enterprise Development, Ministry of Planning and Investment of Vietnam, *Annual Report on Digital Transformation of Vietnamese Enterprises in 2023: Promoting Digital Transformation and Green Transformation*, 2024. https://blog.slimcrm.vn/sites/default/files/2024/04/ebooks/bao-cao-thuong-nien-cds_final.pdf

[9] Q. D. Luu *et al.,* "Digital Transformation of Retail Businesses in Vietnam," *Communist Review*, 2025. [Online]. Available: https://www.tapchicongsan.org.vn/web/guest/nghien-cu/-/2018/1143102/chuyen-doi-so-cua-cac-doanh-nghiep-nganh-ban-le-tai-viet-nam.aspx

[10] M. P. McNair, "The Wheel of Retailing: Competitive Distribution in a Free, High Level Economy," *University of Pittsburgh Press*, pp. 1–25, 1958, doi: 10.1002/9781118785317.weom090703.

[11] S. C. Hollander, "The wheel of retailing," *Journal of Marketing*, vol. 25, pp. 37–42, 1960, doi: https://doi.org/10.1177/002224296002500106

[12] S. Male, J. Kelly, M. Grönqvist, L. Damodaran, and W. Olphert, *Supply Chain Management for Refurbishment: Lessons from High Street Retailing*. Emerald Publishing Limited, 2011. ISBN: 978-0-7277-3242-2, doi: 10.1680/scmrlfhsr.32422.

[13] I. Mergel, N. Edelmann, and N. Haug, "Defining digital transformation: Results from expert interviews," *Government Information Quarterly*, vol. 36, no. 4, Art. no. 101385, 2019, doi: https://doi.org/10.1016/j.giq.2019.06.002

[14] W. Reinartz, N. Wiegand, and M. Imschloss, "The impact of digital transformation on the retailing value chain," *International Journal of Research in Marketing*, vol. 36, no. 3, pp. 350–366, 2019, doi: https://doi.org/10.1016/j.ijresmar.2018.12.002

[15] J. T. Mentzer *et al.,* "Defining supply chain management," *Journal of Business Logistics*, vol. 22, no. 2, 2001, doi: https://doi.org/10.1002/j.2158-1592.2001.tb00001.x

[16] R. Lankauskiene, D. Vidickiene, and Z. Gedminaite-Raudone, "Evolution of short food supply chain theory and practice: Two-sided networks and platforms," *Energies*, vol. 15, no. 3, Art. no. 1137, 2022, doi: https://doi.org/10.3390/en15031137

[17] Z. Wang, L. Gao, and W. Wang, "The impact of supply chain digitization and logistics efficiency on the competitiveness of industrial enterprises," *International Review of Economics & Finance*, vol. 97, Art. no. 103759, pp. 1–10, 2025, doi: https://doi.org/10.1016/j.iref.2024.103759

[18] S. Gong, "Digital transformation of supply chain management in retail and e-commerce," *International Journal of Retail & Distribution Management*, vol. 53, no. 2, pp. 1–19, 2025, doi: https://doi.org/10.1108/IJRDM-02-2023-0076

[19] Y. Zhang *et al.,* "A digital twin–driven dynamic shelf life approach for mitigating food loss across fruit supply chains," *Journal of Stored Products Research*, vol. 117, no. 5, Art. no. 103016, pp. 1–15, 2026, doi: https://doi.org/10.1016/j.jspr.2026.103016

[20] T. D. Mai and T. V. A. Nguyen, "Digital transformation, retail industry, COVID-19, consumer preferences, current situation, solutions," *Journal of Science Hanoi Open University*, vol. 84, no. 10, pp. 1–9, 2021. [Online]. Available: https://jshou.edu.vn/houjs/article/view/97/106

[21] M. Bhardwaj and R. Agrawal, "Operational efficiency of perishable product supply chain using Petri net technique," *Proceedings of the International Conference on Industrial Engineering and Operations Management*, Dubai, UAE, pp. 2126–2133, 2020.

[22] P. Li, Y. Chen, and X. Guo, "Digital transformation and supply chain resilience," *International Review of Economics & Finance*, vol. 99, Art. no. 104033, pp. 1–17, 2025, doi: https://doi.org/10.1016/j.iref.2025.104033

[23] A. Z. A. Muzamil *et al.,* "Enabling retail food supply chain viability and resilience in pandemic disruptions by digitalization – A conceptual perspective," *International Journal of Industrial Engineering and Operations Management*, vol. 7, no. 2, pp. 175–203, 2025, doi: https://doi.org/10.1108/IJIEOM-07-2024-0040

[24] J. F. Hair, W. C. Black, B. J. Babin, and R. E. Anderson, *Multivariate Data Analysis*, 7th ed. Upper Saddle River, NJ, USA: Pearson, 2010. [Online]. Available: https://www.drnishikantjha.com/papersCollection/Multivariate%20Data%20Analysis.pdf

[25] A. Alili and D. Krstev, "Using SPSS for research and data analysis," Knowledge International Journal, vol. 32, no. 3, pp. 363–368, Jul. 2019, doi: 10.35120/kij3203363a.

[26] H. P. Dinh, "Quantitative Research Methods & Practical Research in Development Economics – Agriculture," Ho Chi Minh, Vietnam: Phuong Dong Publishing House, 2011.