

Article

The Factors Affecting Digital Transformation in Vietnam Logistics Enterprises

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Abstract: In the context of the industrial revolution 4.0 that is firmly taking place globally, the digital transformation process is considered a revolution that changes the operating and business model. In Vietnam, logistics is one of eight areas that need to be prioritized in the national conversion program to 2025, the orientation towards 2030 by the Prime Minister under Decision No. 749/QĐ-TTg. Digital transformation is an essential solution that helps businesses improve their competitiveness, increase labor productivity, sustainably develop businesses, and integrate with the global economy. This study analyzes the influencing factors of digital transformation and the situation in Vietnam's logistics enterprises. This paper used a qualitative research method carried out through direct interviews with 20 digital transformation experts in the field of logistics about the current situation, adjusting models and scales, and discussing research results. Quantitative research was conducted online through 258 survey questionnaires of logistics enterprises in the country. The authors performed descriptive statistics, tested the scale, analyzed EFA using SPSS software, and tested the research hypotheses. Research results indicate that five factors—managers, digital transformation human resources, information technology, investment cost, and support services for digital transformation—affect the digital conversion activity in logistics enterprises. Afterward, the research team proposed solutions to promote this operation in Vietnam's logistics enterprises, contributing to implementing critical tasks of the government's digital transformation.



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Keywords: digital transformation; Vietnamese logistics enterprises; investment expenses and digital transformation services

1. Introduction

The 4.0 industrial revolution has highly changed, affecting all aspects of human life, such as in economic, political, social, and logistical areas [1–3]. According to [4,5], logistics is the supply chain service industry in delivery, transport, customs procedures, and goods. Logistics is considered one of the living backbones of the digital economy in many areas, from production, distribution, and circulation to consumer goods—supporting, connecting, and promoting the country's socio-economic development and localities. Especially after the COVID-19 pandemic, consumption habits, ways of operation, and trade exchange have all changed. E-commerce has grown enormously, leading to logistics needing to adapt to the epidemic by ensuring efficient transportation, delivery, and warehousing activities for goods circulation, serving the needs of consumption, import, and export [6].

Currently, most Vietnamese logistics enterprises predominantly operate as middlemen for foreign companies, offering a limited range of services such as customs declaration, vehicle rental, and warehousing [7]. However, as the economy grows, there is a growing need for these enterprises to transition from traditional services to digital platforms in order to expand their market penetration and capture new opportunities. Such a modification can be an effective solution for these enterprises to keep pace with the evolving business landscape and gain a competitive edge [7,8].

In Vietnam, digital transformation is understood as integrating and applying technology to enhance business and management efficiency and the competitiveness of enterprises and to create new values [1]. In [9], the digital transformation process aimed to change stagnation, create breakthroughs to improve competitiveness, reduce costs, proliferate, and achieve optimal profits for logistics businesses. To maintain activities, many of Vietnam's logistics enterprises have pushed the application of technology, e-commerce, and efficient exploitation of the operation of online logistics [7,8]. The fact requires accelerating the digital transition in logistics to overcome the problems that arose after the COVID-19 pandemic and taking advantage of the digital and industrial revolutions 4.0. In the context of the recovery and development of logistics due to the influence of the COVID-19 pandemic, the Europe and Vietnam Free Trade Agreement (EVFTA) was officially executed on 1 August 2020, opening a new door and creating motivation for Vietnam's economic development in general and the logistics business in particular [7].

On the other hand, the digital transformation process provides many benefits, such as cost-cutting, accessing customers, and managers making decisions quickly and accurately [10,11]. Therefore, the productivity and competition of the enterprise are enhanced. Thus, digital transformation is the essential trend for logistics enterprises that want to succeed in the age of 4.0. The trend became more popular after the COVID-19 pandemic, and firms had to adapt flexibly to new social conditions [4,12].

The main research questions of this article are: what factors affect the digital transformation of logistics enterprises in the current context, when Vietnam is integrating with the global economy; what is the current situation of digital transformation in Vietnamese businesses? These goals are processed by a qualitative research method through direct interviews with digital transformation experts in logistics about the current situation of digital transformation, adjusting models and scales, and discussing research results. In addition, quantitative research is also carried out using survey questionnaires of logistics enterprises. Collected data are used to build research models, test hypotheses, and evaluate factors affecting digital transformation in logistics enterprises.

The main contributions of this paper include:

- In theory: after collecting a survey of 258 logistics enterprises, a quantitative analysis method points out five factors affecting digital transformation in Vietnamese logistics enterprises, including manager roles, human resources, IT infrastructure, investment costs, and digital transformation services.
- This paper proposes a model to support businesses in recognizing critical factors in the digital transformation process, thereby giving more motivation and defining the development strategy better.
- In practical terms, the paper presents the current situation of digital transformation in Vietnamese logistics enterprises. The analysis results help managers better understand the challenges and opportunities logistics businesses face in the digital transformation process.
- From the analysis, the paper proposes four specific solutions to help enterprises execute digital transformation more efficiently and quickly, based on that improving competitiveness and increasing the ability to participate in international supply chains and meet the needs of logistics globalization in today's digital economy.

The rest of this paper is presented as follows: Section 2 provides an overview of the research, including the theoretical background, research methods, and related studies. Section 3 outlines the research model and approaches to present the research findings. The actual situation of argument transfer in logistics enterprises in Vietnam is analyzed in Section 4. Section 5 proposes several solutions to promote logistics in Vietnam. Finally, Section 6 summarizes the paper's main results and contributions.

2. Literature Review

2.1. Theoretical Background

The theoretical framework of this study is based on New Information Technologies (NIT) theory. By implementing new technologies that align with an enterprise's culture [13] and environment, NIT assists businesses in transforming their technological, production, and operational processes. NIT refers to many resources, factors, and barriers affecting the digital transformation process, as well as to advantages and disadvantages when implementing digital transformation in enterprises [14]. Adebajo et al. [15] proposed an approach to understanding change and innovation activities within an enterprise that emphasizes the importance of environmental factors and corporate culture. The approach highlights the relationship between changes and the aspects of the enterprise that remain unchanged. Furthermore, Greenwood et al. [16] analyzed digital transformation activities in enterprises, which included various levels such as social, professional, organizational, and employee-related aspects. The analysis covered planning, digitizing structures, and computerizing business operations. Ferreira et al. [17] focused on the factors influencing the adoption of new digital processes in enterprises, in which sustainability and market share growth, enterprise environment, investment capital for technology, and field of activities significantly influence the adoption of new digital processes.

In addition, the article also mentions the theories guiding the digital transformation process and the factors affecting digital transformation activities in enterprises by Molinillo and Japutra [18], including Information Systems theory (IS), Diffusion of Innovations theory (DOI), the Technology Organization Environment (TOE) framework, and Institutional theory. Nyandoro [19] believes that the Theory of Reasoned Action (TRA) is the theory to explain the factors affecting digital transformation in small and medium enterprises.

2.2. The Concept of Digital Transformation in Logistics Enterprises

Samuel et al.'s [20] digital transformation used digital technology to change business models and create opportunities, revenue, and new values. The concept of digital transformation in the enterprise involves moving from a conventional business model to a digital one. Digital conversions are the rethinking of how organizations gather people, data, and processes to create new values. Digital transformation is resetting the mindset of the data, processes, and people to create new values.

In [10], Swen and Reinhard thought that digital transformations integrate digital technology into business operations to change how business models fundamentally operate and provide new values to customers. It is a change in managing processes, procedures, and culture based on effective digital platforms and business targets. The current business industry is facing a significant challenge from the process of integration of the digital transition and the COVID-19 pandemic challenge going on globally. Transformation is an essential solution that helps businesses improve their competitiveness, increase labor productivity, make the business sustainable, and integrate with the global economy. That can be interpreted as using digital technology to create or modify business processes, cultures, and existing customer experiences to meet the requirements of market and business changes. The authors propose a five-step digital transformation process as shown in Figure 1 below.

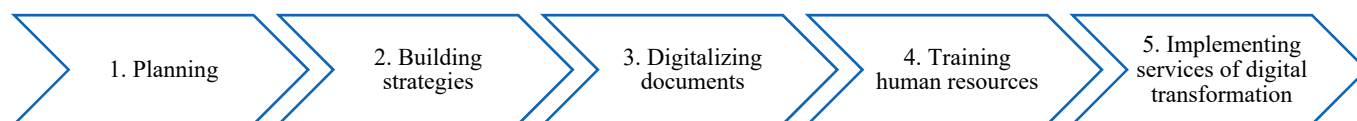


Figure 1. Process of digital transformation in business.

Muhammad and Anton [4] defined digital transformation in the logistics industry as identifying and integrating digital technology to enhance business efficiency, management capacity, and corporate governance processes. This involves incorporating digital technol-

ogy into existing processes and modifying the overall thinking, strategy, and corporate governance approach. The demand for the management of internal operations of logistics enterprises includes the management of the sales and customer database, monitoring and managing the internal work process, archiving, analyzing data, and reporting. The activities involved in chain management include: implementing and processing direct orders within the system, managing and monitoring the system, exchanging and connecting data, providing tailored services to meet each customer's individual needs, and integrating the entire software into the service chain.

For logistics providers, transforming the digital sector is the process of applying technology to optimize the production, supply, and transport of products, increase the value of the data, and decrease the customer's cost. By applying software management tools to manage software, order management software, and for warehouse management, logistics service operations can be optimized for cost while improving data management efficiency [21]. Logistics enterprises participate in the transformation process when they do the following: invest in their infrastructure; use new technology and social networks; implement software support software; and store data, technology, and data-processing activities to exchange information on electronic channels.

2.3. Digital Transformation's Role in Logistics Enterprises

Swen and Reinhard [10] explain that digital transformation in the enterprise involves digitizing information, computerizing professional activities, and transforming leadership thinking, culture, operational models, and business models. Digital transformation can help businesses improve labor productivity, save costs, reach a more extensive customer base over an extended period, make faster and more accurate decisions, enhance decision-making systems, improve competitiveness, and integrate with the global economy. There are several benefits of this change in the logistics business of an enterprise [21,22]:

- All sources should be connected to a single integrated digital logistics system to optimize inventory management, ensure efficient use of time cost, and minimize risks. Digitizing logistics helps business leaders comply with new data management standards and meet customer expectations.
- To improve efficiency in shipment control and network management, automation helps save costs and time by automating the overall movement of goods and ensuring timely access to both origin and destination. Technology applications are used to optimize resources and prepare standby solutions in case of transportation delays.
- To grow the ability to ensure timely progress, technology applications help businesses track real-time shipping data from beginning to end, fully anticipating the risk of order progress if available. Furthermore, transforming logistics into digital logistics supports optimal time management for loading and unloading transport roads, leading to optimized line schedules.
- It is easy to track the status of shipments using RFID cards and GPS sensors that connect business managers to the transport process through the final stage. Additionally, logistics managers can receive real-time location data from sensors to ensure that weather or other environmental changes do not endanger delivery.
- Precise planning is possible through upgrading digital technology to manage supply chains and logistics, resulting in more accurate and coherent outputs from the ERP system. This includes automating transaction activity, terminal planning, inventory management, and revenue forecasting.

The study of digital conversion has received interest from many researchers worldwide. Swen and Reinhard [10] highlighted three key factors affecting the success of digital transformation: new technology applications, information technology, and communication in the digital capabilities of leadership. The study team analyzed key factors for digital transformation, such as a multi-level model, from individuals and groups to organizations. The authors said that a clear long-term business strategy, manager roles, human resources, and technology are critical determinants of digitizing. In there, people are considered to

be one of the pillars that determine the failure of the transformation strategy. Meanwhile, Reis et al. [11] classified the meaning of digital conversion into three groups: technology, organization, and society. The technology group relates to using new technology, such as social media and embedded equipment. The organization group relates to applying new business models or changes to current processes. A study emphasized major challenges of digital transformation for the reform system in the area that requires strategic action in three pillars: culture and skills, information technology infrastructure, and ecosystem. Kane et al. [2] identified that managers' perceptions of digital conversion, business culture, and implementation skills affect digital transformation. Vogelsang et al. [23] demonstrated three factors that affect conversion efficiency, including an enterprise structure (managers, employees, business data, and customers); environment (corporate culture, job description, and operation field); and technology (information technology infrastructure, new technology, and security).

According to Osmundsen et al. [24], there are eight factors affecting digital transformation activities: business culture, digital conversion strategy, the national conversion platform, the availability of digital human resources, the information technology infrastructure, the flexibility of the enterprise, strategies for digitizing industrial processes, and standardized business processes. In [25], Marzenna et al. gave out factors that influence the number of changes within a business. These factors include the manager's role, corporate culture, staff participation and collaboration with partners, business and IT strategy, standardization processes, data integration, staff training, digital transformation management, information technology infrastructure, and the adoption of new technologies. Within this, manager and digital management strategy had the highest impact. Bader et al. [26] assumed that digital transformation in the business affected by the conversion manager factor affects the flexibility of the organization, and both are affected by the modulation of the regulatory strategy. The ability to lead has a major influence on a team's flexibility in the conversion of numbers, directly affecting the entire transition process in business. Muhammad and Anton [4] analyzed three factors: the ability to adapt to the enterprise, the allocation of corporate resources, and the ability to innovate and have a positive impact on implementing the digital transition when the influence is changed by changing the new technology. Nuraan and Osden [21] based their study on the three-group base analysis framework: the technology group refers to the IT infrastructure and new technology in the 4.0; a group of organizations considers the characteristics, strategies, competitiveness, and incentives of the government. The research results show that technological factors impact the number of changes in logistics firms rather than the factors and environmental factors. Others such as Eller et al. [27] focused on an assessment of the DT factors and the impact they have on an SME's performance. Results showed that information technology (IT), employee skills, and digital strategy are the key factors that positively affect digital transformation in SMEs.

In Vietnam, the study of the Ministry of Planning and Investment [9] was to indicate the nature, practice, and application of the number of enterprises. Two studies were conducted to evaluate the feasibility of transforming the number of retail businesses in Vietnam and to explore potential solutions that could address the fundamental challenge of the retail industry. The studies aimed to assess the current situation and prospects for retail businesses in Vietnam, analyzing proposed solutions to determine which ones would be beneficial to the enterprise. VCCI [8] dissects the overall landscape of solutions that has helped enterprises overcome the challenges posed by the COVID-19 pandemic. The organization has also proposed important technologies that can assist enterprises in their development during this crisis. Research results are also the original foundation contributing to orientation and change in human personnel training in the current era.

In short, studies show that concerns are concerned with the issues related to digital transformation in Vietnam. For the world's countries, the conversion of the number of logistics firms is strong and proactive, helping increase productivity and creating growth in the enterprise. In Vietnam, digital transformation is predominantly observed in large

logistics enterprises. In contrast, most small- and medium-sized enterprises are merely reactive to market changes and do not actively pursue digital transformation.

3. Research Methodologies

3.1. Proposing Research Models and Hypotheses

Based on the research conducted by Swen and Reinhard [10], Vogelsang et al. [23], Marzenna et al. [25], and the report on the current state of digital transformation in Vietnam's enterprises by VCCI [8], the authors have proposed a model to study the factors that affect digital transformation in Vietnam's logistics enterprises. Figure 2 below illustrates the proposed model.

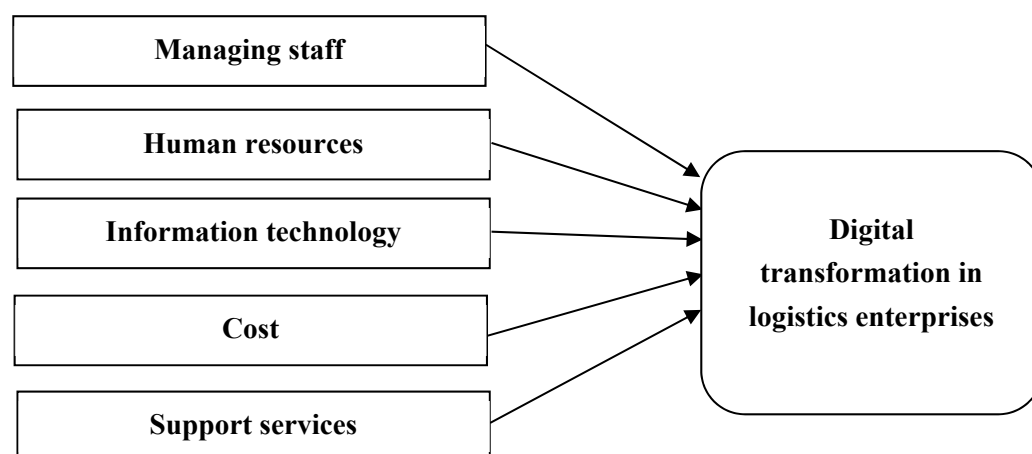


Figure 2. The research model on factors affecting digital transformation in logistics enterprises.

Digital transformation is facing challenges related to technology, people, and costs. Technology creates a new era for businesses to shift their services towards digitization and adjust their operational strategies accordingly. However, digital transformation focuses not only on intelligent technology but also on the people, mindset, and culture of the business. To achieve the set research objectives, the authors developed and tested the following research hypotheses:

Hypothesis 1 (H1). *The role of a manager has an impact on digital transformation activities in the logistics business.*

Leadership is an important factor shaping the digital transformation process. The results are reflected in the first stage of committing to whether the business has a digital transformation plan. Swen and Reinhard [10] found that leadership and organizational culture are essential in implementing digital transformation. The manager factor (age, management experience, practical awareness in technical transformation) affects the increase in the use of digital transformation services. Bader et al. [26] demonstrated that enterprise capacity is most evaluated through the manager's strategy in warehousing control, the transportation of materials and goods, ordering process management, and digital transformation, which is considered a revolution that allows businesses to carry out these logistics activities based on new technology.

Hypothesis 2 (H2). *The digital transformation of human resources impacts digital transformation activities in logistics businesses.*

Digital transformation is the transformation of human perception in the digital environment. Reis et al. [11] pointed out that organization, technology, IT skills, and gender have significantly influenced the computerization of logistics operations and, therefore, significantly impacted digital transformation. Kane et al. [2] demonstrated that when

employees are confident and proactive, able to make their own decisions, and perform tasks, they are more creative in achieving service efficiency. The value of trust positively influences the behavior of employees using technology. The right skills and competencies of employees are paramount during the transition. With the right expertise, employees can plan and execute processes smoothly and efficiently, leading to a willingness to change operational methods and apply new technology.

Hypothesis 3 (H3). *Information technology infrastructure has an impact on digital transformation activities in logistics enterprises.*

Osmundsen et al. [24] argued that information and communication technology infrastructure is critical for logistics in supporting efficient access to information and services. Logistics infrastructure includes physical infrastructure such as transport systems and infrastructures such as human resources, policy systems, rules, and procedures. To achieve effective development, management, and operation of infrastructure systems, businesses must adopt software deployment on their information technology infrastructure. This enables them to streamline operations and optimize performance, ensuring the efficient management of their infrastructure. Research by Bader et al. [26] on information technology infrastructure is a premise, a foundation to promote digital transformation and economic development. In addition, compared with traditional forms of transportation, digital transformation needs to apply a lot of technology, data storage, and analysis, which will lead to the need to ensure data security and safety for the system. Currently, digital technology has become the basis for recent innovations around the world, with new technology such as AI, cloud computing, IoT, big data, and robotics rapidly breaking down digital barriers, which are the pillars for accelerating digital transformation.

Hypothesis 4 (H4). *Investment costs have an impact on digital transformation activities in logistics enterprises.*

Digital transformation enterprises must have enough IT infrastructure to meet the needs of computerizing logistics activities with high Internet connection speeds. According to a survey by the Ministry of Planning and Investment [9], 68.3% of enterprises said that high investment and technology application costs are the most significant barriers when applying new technology. In particular, investment capital is always the top priority when solving the problem of allocating financial resources to enterprises. The cost of implementing digital transformation includes not only the expenses related to purchasing software, license fees, deployment costs, and annual maintenance fees, but also the costs of renting external technology solutions. In addition, other costs are involved, such as investment costs for system operating infrastructure, process innovation and human resource training, adapting to new technology, and the cost of building a secure system to prevent risks and ensure data security throughout the system.

Hypothesis 5 (H5). *Digital transformation services have an impact on digital transformation activities in logistics businesses.*

Successful digital transformation in the enterprise is indispensable for implementing support services [23]. Digital training support services are related to logistics chain management software, social network application deployment, e-commerce service deployment, e-payment, and online advertising. Marzenna et al. [25] argue that orders are dispersed with many different delivery locations, with which an automated sorting system can meet delivery needs and accuracy. If businesses deploy simple, discrete software to support order processing and logistics activities, they need help in the current context of economic integration. Digital transformation of the logistics industry requires equipping order management, warehouse management, and transportation management software to connect information infrastructure, provide real-time data, and look up order information anytime, anywhere.

3.2. Research Methodologies

This study is based on two groups of secondary and primary data to analyze and evaluate the current state of digital transformation at logistics enterprises. The researchers collected secondary data from various statistical reports on digital transformation activities in Vietnamese and logistics enterprises in particular.

A qualitative research method was carried out through direct interviews with 20 experts on the current situation of digital transformation in order to adjust the model and scale and to discuss the research results. Primary data were collected using a quantitative method based on a survey questionnaire on the current state of digital transformation in logistics enterprises.

In order to ensure the reliability of the research results, the researcher surveyed 280 employees working in logistics enterprises. The survey was conducted through Google Drive from March to June 2022, and questionnaire submissions were collected during this time. The total number of valid votes collected was 258 (92.14%), meeting the sample size requirement. The sample was selected according to a conventional method, based on personal relationships and considering the balance of gender, age, position, and professional work of the subject in question. The survey was developed based on the research overview and adapted to the research context in Vietnam.

Based on the collected data results, the research team carried out descriptive statistics, tested the scale, and analyzed EFA using SPSS software to make statistics and analyze the factors affecting the digital transformation situation in Vietnam's logistics enterprises.

4. Analysis of the Current Situation of Digital Transformation in Vietnam's Logistics Enterprises

4.1. Research Results

Results, Using Cronbach Alpha and EFA Scale

Table 1 presents statistics on the research factors from previous publications. Based on this, the authors conducted a survey, collected data, and performed experimental tests. The results in Table 2 show that all scales had a Cronbach Alpha > 0.6 and the Corrected Item (Total Correlation) coefficient > 0.3. Specifically, the Cronbach alpha results showed satisfactory scales of reliability. Specifically, Cronbach Alpha for the manager factor was 0.88, the digital transformation factor was 0.4, the technology factor was 0.73, the investment cost factor was 0.81, and the digital transformation support service factor was 0.67. The observed variables all had a high variable correlation coefficient—the sum (from 0.71 to 0.4 and all greater than 0.5) indicates that the observed variables all had a high contribution to the overall scale.

Table 1. Summary of the common factors in related studies.

Factors Studies	Managing Staff	Human Resources	Information Technology	Cost	Support Services
Trener et al. (2021)	+	+	+		+
McKinsey (2020)	+	+	+	+	
Clark (2019)		+	+		+
Swen and Reinhard (2020)	+		+	+	+
Reis et al. (2018)		+	+		+
Kane et al. (2018)	+	+		+	
Vogelsang et al. (2019)	+	+	+		
Osmundsen et al. (2018)	+	+	+	+	+
Marzenna et al. (2020)	+	+	+	+	+
Bader et al. (2022)	+	+		+	
Muhammad and Anton (2021)	+	+		+	+
Nuraan and Osden (2020)	+	+	+		+
VCCI (2020)	+	+	+	+	+
Ministry of Planning and Investment (2021)	+	+	+	+	+

Table 2. The EFA and Cronbach Alpha Scale results.

Factors	Average	Mean	Coefficient of Correlation of Total Variables	Weight EFA
<i>M. Managers $\alpha = 0.88$</i>				
M1. Managers' awareness of digital transformation	4.59	0.90	0.84	0.86
M2. Strategies of digital transformation	4.56	0.75	0.78	0.75
M3. Commitment to digital transformation	4.68	0.91	0.81	0.88
<i>H. Human resources for digital transformation $\alpha = 0.84$</i>				
H1. Readiness to change	4.03	0.82	0.75	0.88
H2. Understanding the digital transformation process	3.66	0.75	0.76	0.78
H3. Ability to apply new technology	3.81	0.83	0.82	0.82
H4. System operation skills	3.97	0.85	0.79	0.86
<i>T. Information technology facilities $\alpha = 0.73$</i>				
T1. Hardware and network system	3.72	0.71	0.83	0.78
T2. New digital platforms	3.54	0.83	0.81	0.75
T3. Automated pick-up truck	3.01	0.68	0.76	0.71
T4. Information security and safety	3.36	0.79	0.77	0.73
<i>C. Cost of digital transformation $\alpha = 0.81$</i>				
C1. Cost of new technology	4.52	0.86	0.83	0.87
C2. Cost of hardware and network system	4.13	0.82	0.78	0.76
C3. Cost of software deployment	4.48	0.91	0.88	0.89
C4. Cost of user training	4.19	0.84	0.81	0.83
<i>S. Digital transformation support service $\alpha = 0.76$</i>				
S1. Deploying digital transformation software	4.48	0.85	0.76	0.87
S2. Using social networks	3.25	0.90	0.71	0.76
S3. Deploying e-commerce services	3.64	0.86	0.77	0.78
S4. Online payment	3.82	0.89	0.79	0.81
S5. Online marketing	3.51	0.78	0.72	0.79

Table 3 shows Bartlett's test results between variables in the overall Sig = 0.000 (all less than 0.05), showing that the observed variables correlate. KMO coefficients are all greater than 0.5 ($0.5 < \text{KMO} = 0.875 < 1$), so it is appropriate to analyze the above EFA factors. After performing Cronbach Alpha and KMO tests, the authors analyzed the EFA discovery factor to ensure the scale's reliability. The results in Table 3 indicate that the EFA weighted value for each variable is more significant than 0.5 on the concept they measured. Therefore, the original criteria are significantly related to the extracted factor. Based on this, the results of this study suggest that the scales have measured different research concepts. Alternatively, we can conclude that the scales and variables in the study have all achieved convergence and differentiation values, indicating reliability and suitability for multiple linear regression analysis.

Table 3. Research results using KMO and Bartlett's Scale.

Kaiser–Meyer–Olkin Measure of Sampling Adequacy		0.875
Bartlett's Test of Sphericity	Approx. Chi-Square	2816.325
	Df	258
	Sig.	0.000

After EFA analysis to detect independent and dependent factors, the authors conducted regression analysis to determine the degree of impact of independent variables on the sub-variable. The regression analysis results are in Table 4 with R2 adjusted by 0.891. This value explains that with five independent variables included in the analysis affecting 89.1% of the dependent variable change, the remaining 10.9% is due to out-of-model variables and random errors.

Table 4. Results of multivariate regression.

Model	Unnormalized Regression Coefficients		Normalized Regression Coefficient β	Value t	Level of Significance (Sig.)	Multicollinearity	
	B	Sta. Error				Acceptability	VIF
(Constant)	0.284	0.128		1.239	0.016		
Managers	0.405	0.036	0.355	6.724	0.000	0.294	2.126
Human resources	0.273	0.048	0.247	5.351	0.000	0.253	2.814
IT technology facilities	0.086	0.056	0.069	2.136	0.012	0.214	2.012
Cost	−0.214	0.085	−0.205	−3.015	0.009	0.326	2.214
Support services	0.248	0.154	0.221	2.451	0.004	0.382	2.462
Adjusted R2 = 0.891, Value F = 162.574, Sig. = 0.000							
<i>Dependent variable: digital transformation activities in logistics businesses</i>							

In Table 4, the Sig. values of the variables are all less than 0.05, meaning that the variables are all statistically significant in the model. The Variance Inflation Factor (VIF) magnification factor of each small-valued factor (between 2.012 and 2.814) demonstrates that the regression model does not violate multi-linearity, meaning that independent variables are closely correlated with each other. Independent factors all influence dependent factors. Specifically, factors such as managers, human resources, technology, and support services in the model have a favorable impact on digital transformation activities because the regression coefficients B are all >0. The cost factor of digital transformation has the opposite effect on digital transformation activities. The analysis showed that the regression model matched the data and had statistically significant factors, which means that five hypotheses H1, H2, H3, H4, and H5 are accepted. The constructed regression equation takes the form:

$$DT = 0.284 + 0.405 \times M + 0.273 \times H + 0.086 \times T - 0.214 \times C + 0.248 \times S$$

The Standardized Coefficients Beta results indicate the importance of each variable independent of the dependent variable. The greater the absolute value of the normalized regression coefficient, the greater the degree of influence. Specifically, the standard regression value of the manager factor affected 35.5%, the digital transformation human resources factor affected 24.7%, the technology factor affected 6.9%, the cost factor affected 20.5%, and the digital training support service factor affected 22.1% of the digital transformation activities in the enterprise.

The research findings are consistent with the statistical results reflecting the current digital transformation in Vietnam's logistics enterprises. The main challenges businesses face today include inadequate financial capacity, limited support for digital transformation, a need for more skilled human resources, and a lack of organizational commitment. Business leaders often feel apprehensive about online platforms' safety and security, leading to reluctance to adopt new technologies. However, digital transformation requires strong leadership and unwavering commitment from management since changing operational processes and information systems can have far-reaching impacts on the entire organization and its employees. Therefore, managers need to be able to motivate and persuade their employees to ensure a successful transition.

Furthermore, digital transformation necessitates modifying work processes, requiring employees to use new technologies proficiently. Logistics companies must find and retain employees with the appropriate skills to make this transformation possible. Recent statistics [7] suggest that 53.3% of companies need more staff with professional qualifications and logistics knowledge. In comparison, 30% of enterprises have to retrain their employees, and only 6.7% of businesses are satisfied with their staff's expertise. This explains why only 16% of logistics enterprises are ready for high-level digital transformation, while more

than 50% are in phase two, with discrete and small digital transformation efforts. Around 31% of companies are still passive in reacting to market changes and have made little or no effort toward digital transformation [9].

However, small- and medium-sized enterprises (SMEs) in the logistics industry (accounting for over 89% of logistics enterprises in Vietnam [23]) face unique challenges, such as the high cost of investing in technology and implementing new information systems. Most of these enterprises have a capital of below VND 10 billion, with only 5% having a capital between VND 10 and 20 billion. The cost of transitioning to logistics solutions could range from VND 200 million to tens of billions of VND, making it a significant investment [8]. Many SMEs claim that automating their processes using foreign models and software would require a substantial initial investment. Doing it themselves would require a significant amount of time and human resources. The initial investment required is often substantial, and it can take time to recoup the investment quickly. With an appropriate IT investment strategy and financial plan, it is easier for SMEs to undertake digital transformation, particularly with support from the state and financial and credit institutions.

In addition, logistics businesses in Vietnam face a challenge in selecting appropriate digital transformation software that caters to their service activities and aligns with the current logistics operations in Vietnam. Currently, some logistics enterprises use basic applications or single solutions such as logistics and warehousing management systems, electronic data exchange, transport management, and customs declaration. However, adopting international standard software still needs to be improved [7]. Logistics businesses in Vietnam increasingly use social networks to gather information, deploy e-commerce services, accelerate online advertising, and deploy e-payment activities, reflecting a shift towards digitization in the southern region [8].

These results from Table 4 can potentially be applied to other Southeast Asian countries, such as Thailand, Indonesia, the Philippines, and Malaysia, which share similar market conditions, development levels, and logistics activity scales as Vietnam. However, it is essential to tailor the surveys to the specific characteristics of each country's logistics enterprises, as the cost of digital transformation investment and support services, as well as the level of information technology infrastructure and market demand for supply chain operations, may differ.

4.2. Analysis of the Current Situation of Digital Transformation in Vietnam's Logistics Enterprises

Currently, the logistics market of Vietnam has the participation of more than 4000 enterprises, with 89% of them being small- and medium-sized and which have capital of less than VND 10 billion; about 5% have capital of VND 10 to 20 billion, approximately 10% are joint venture enterprises, and 1% have foreign-owned enterprises provide international logistics services such as DHL, FedEx, Maersk Logistics, APL Logistics, CJ logistics, and KMTC Logistics [7]. Only 16% of enterprises integrate third-party logistics services (contract logistics) or fourth-party logistics services (distribution chain logistics). However, this high-value-added logistics service mainly belongs to foreign enterprises. Currently, only a few large enterprises can meet digital transformation conditions, such as DHL, FedEx, and leading brands such as Viettel Post and Vietnam Post.

The survey results show that only 46.90% of businesses have built a clear digital transformation strategy in line with the enterprise's business strategy and existing resources. Some businesses still need to identify appropriate technology transformation directions. Some businesses need to establish a clear strategy for the transition process. Some businesses focus on something other than investing in technology without focusing on human resource training. About 29.46% of surveyed businesses have made changes in terms of new technology investment (Figure 3). However, to run a business well, they must rely on external data experts or hire digital services to meet the maximum needs of customers.

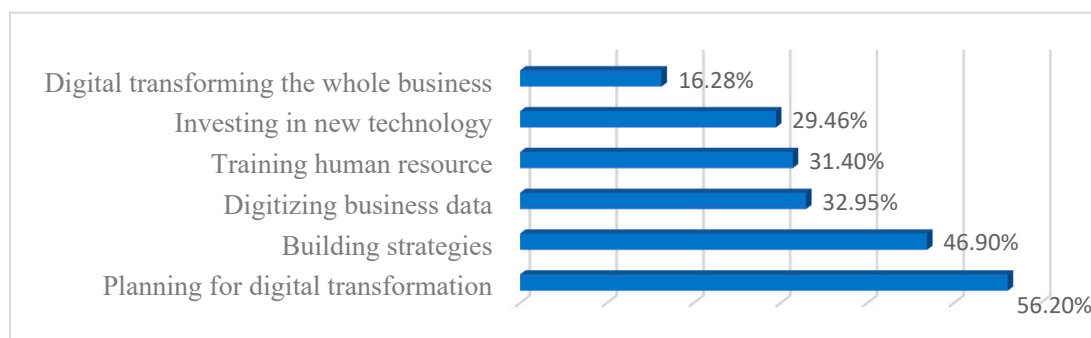


Figure 3. Steps to implement digital transformation.

4.2.1. The Level of Readiness for the Digital Transformation of the Business

Digital transformation is considered a revolution that changes the entire business. In the face of such a significant change, it means eliminating the old way of doing things and getting out of a business's comfort zone to embrace a new way of working. Technology is an essential factor, but the commitment of the head and corporate culture is the core factor in the digital transformation process. Statistical results show that only 37.21% of managers are committed to digital transformation. In addition, the digital transformation period often lasts longer than initially expected, and the cost also increases. The digital transformation process needs at least 2–5 years to bring visible efficiency to businesses. Thirty percent of information technology applications are primary, such as forwarding management systems, warehousing, electronic data exchange, transportation management, and customs declaration. International standard software has yet to be applied in Vietnam. Most businesses have stopped at digitization and electronic data storage, but need to be connected to the ability to look up data or process orders on online platforms.

The human resource willingness to apply new technology and digital transformation skills affects 80% of the success and failure of digital transformation projects (VCCI, 2020). The digital transformation process requires employees to have the skills and capacity to change accordingly and flexibly with the new business operations. Table 2 shows that only 53.10% of businesses have human resources ready for digital transformation. Only 32.56% of businesses have prepared digital transformation investment costs (Figure 4). This is the reason why many businesses do not choose digital transformation even though the working apparatus operates according to an old, cumbersome, and complex model. Digital transformation becomes more complicated when businesses do not know where to start and how to solve outstanding problems when there is no investment capital for new technology applications.

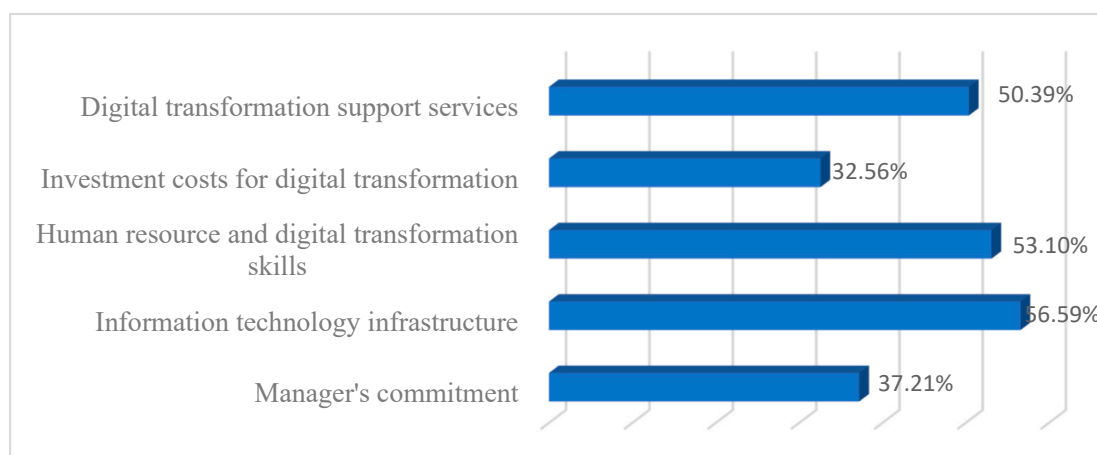


Figure 4. Degree of willingness to change to digital transformation.

4.2.2. About Managerial Commitment to Digital Transformation

Figure 5 shows that 60.02% of managers recognized the importance of digital transformation. This activity must start from manager thinking to infrastructure construction, personnel training, and technology. The primary challenge in the digital transformation process is the mindset of leaders. They must understand that digital transformation is not just about purchasing software but a long-term, continuously innovative operation. Unfortunately, only 37.60% of managers have policies to support digital transformation.

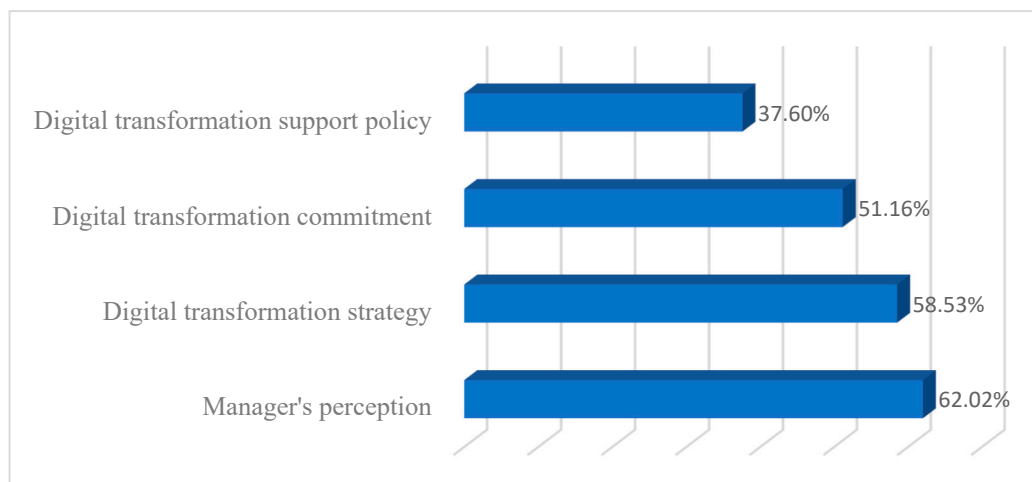


Figure 5. Managers' commitment.

Many leaders are still devoting all their time to doing business for survival, so they do not see the urgency to change their approach to business or implement digital transformation. Additionally, there needs to be more information and knowledge about digital technology, so it has not been able to offer effective deployment solutions for businesses. In fact, many leaders have an apprehensive attitude about online platforms' safety and information security capabilities, leading to slowness and insensitivity to digital transformation technology applications.

4.2.3. About Human Resources for Digital Transformation

In Figure 6, digital transformation requires high-quality human resources to master new technology, serving the implementation of digital transformation. On the national level, Vietnam needs about 90,000 human resources each year to develop the digital economy and society, while domestic digital transformation training programs still need to meet the demand.

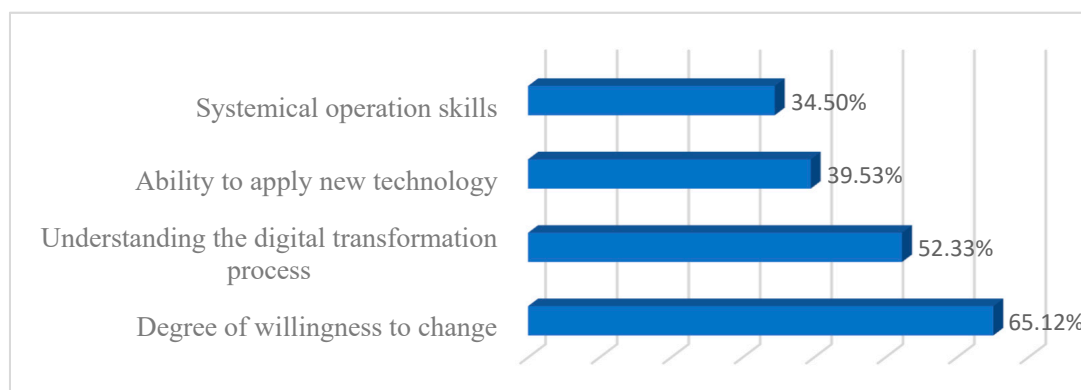


Figure 6. Human resources for digital transformation.

Statistics show that 65.12% of employees are ready to change to a new way of working, but only 34.50% have the skills to operate systems, software, and new technology.

4.2.4. About IT Sources for Digital Transformation

Figure 7 shows that technology application plays a critical role in all stages of the logistics service chain.

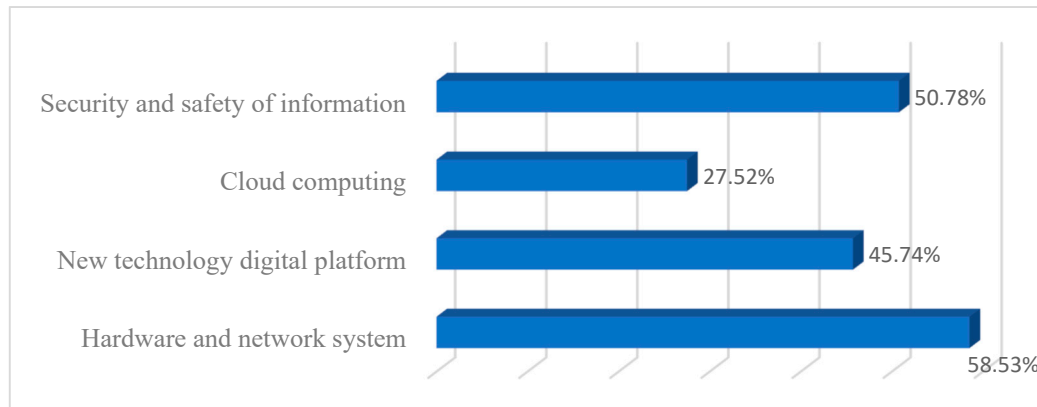


Figure 7. Infrastructure of Information Technology.

Technology will help businesses control losses and risks to optimize costs, contributing to changing the face of the industry. In total, 44.74% of enterprises said technological compatibility exists between enterprises and partners in the logistics service chain. About 58.53% of businesses are ready to invest in completing hardware and software IT infrastructure. Measures to implement information security and security have yet to be paid much attention by businesses (equivalent to 50.78%). In internal management, cloud computing is a technical tool many businesses use; this number is 27.52%, up 9.31% compared with the time before the COVID-19 epidemic.

4.2.5. About Investment Costs of Digital Transformation

Figure 8 presents investment in digital transformation as an investment to change from awareness, strategy, human resources, and infrastructure to crucial technology solutions. This digital revolution requires significant and long-term investment capital, while uncertainty about efficiency and facing many risks of failure have created great barriers for businesses, especially those with limited budget capital.

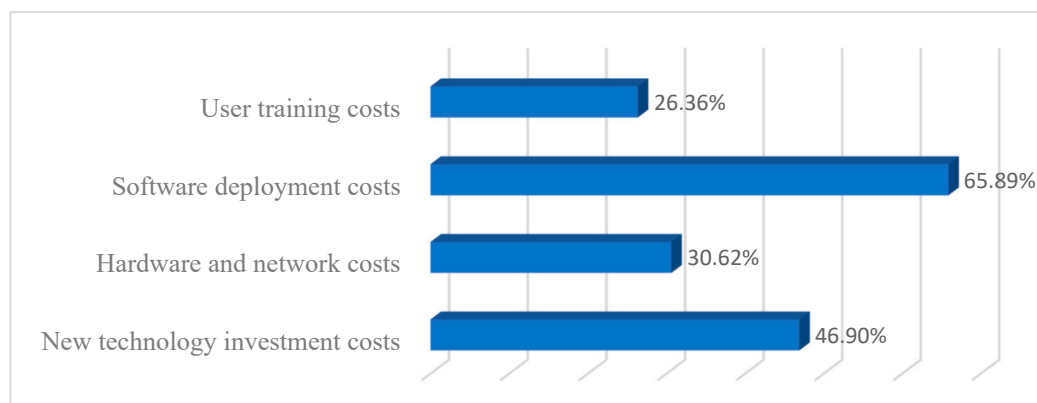


Figure 8. Investment costs of digital transformation.

That slows down the decision-making process and leaves managers needing more commitment. According to the survey results, it was found that only 65.89% of enterprises

have allocated investment costs for software deployment, while 46.90% of enterprises have invested capital for new technology. Interestingly, only 26.36% of enterprises have planned to allocate a budget for user training. Some businesses prioritize investing in short-term growth forms, such as cloud computing technology applications, instead of spending costs and human resources on digital transformation. This technology allows businesses to expand quickly without investing much capital in IT sources.

4.2.6. About Support Services for Digital Transformation

The survey results in the above table show that 66.67% of enterprises have deployed one or more software to support the logistics chain. About 30.23% of businesses have adopted electronic payment services, while the adoption rates are higher for e-commerce services (33.72%) and social networks (37.98%) (Figure 9). In contrast, online advertising has the lowest adoption rate at 25.97%. This may indicate that businesses focus more on improving their payment processes and expanding their online sales channels rather than investing in e-advertising to reach more customers. The application of digital technology, IT devices, automation lines, and automatic pickup trucks is still relatively small because this field needs more research and investment.

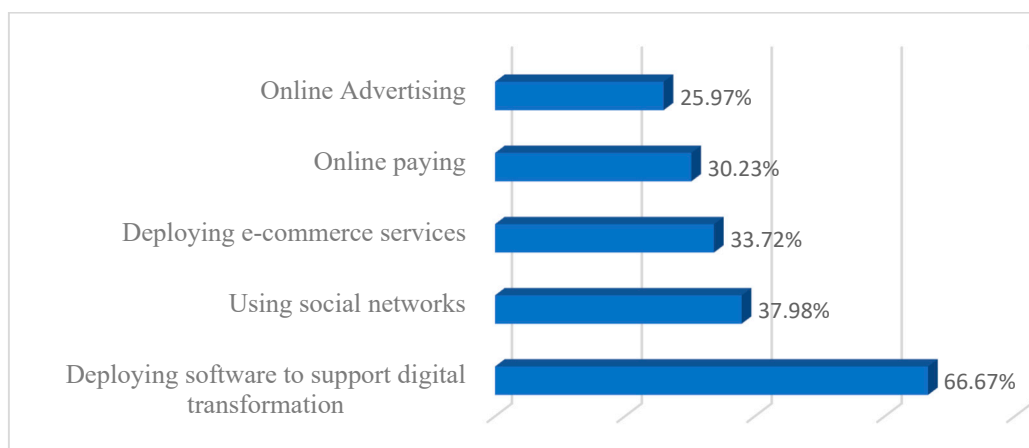


Figure 9. Services supporting digital transformation.

In addition to mandatory applications such as Manifest customs declaration software on the national one-stop system or truck positioning management software, the number of businesses currently using information technology solutions to manage transportation, vehicles, and warehouses only accounts for 10%.

Statistical results show that 53.1% have an application of a warehouse management system, 46.90% have a transportation management application, and 41.86% use barcode technology (Figure 10). Although 99% of transport vehicles have cruise monitoring equipment, 100% of enterprises declare customs. Only large enterprises such as Tan Cang, Gemadept, Vinafco, U&I, TBS, Transimex, and Sotrans have enough resources to develop ERP software to achieve data synchronization between delivery, inventory management, and financial accounting departments.

Most logistics businesses have only stopped at the level of digitization, transferring operational data to electronic storage. However, they need the connection and ability to look up data and process orders on online platforms.

In summary, the most important barrier to the digitization of logistics businesses is the lack of information and lack of implementation capital and the commitment of managers. Some businesses have implemented digital transformation initiatives without a proper roadmap in place. They have attempted to make numerous changes simultaneously, while needing more human resources and digital transformation skills. In addition, there may be a need to enhance the security of their information technology infrastructure and establish secure access protocols for technology solutions, to ensure the safety of data and

information. The roadmap and digital transformation plan may also need to be clarified or defined. The analysis results show some awareness and digitalization trends in logistics businesses with barriers to remove today.

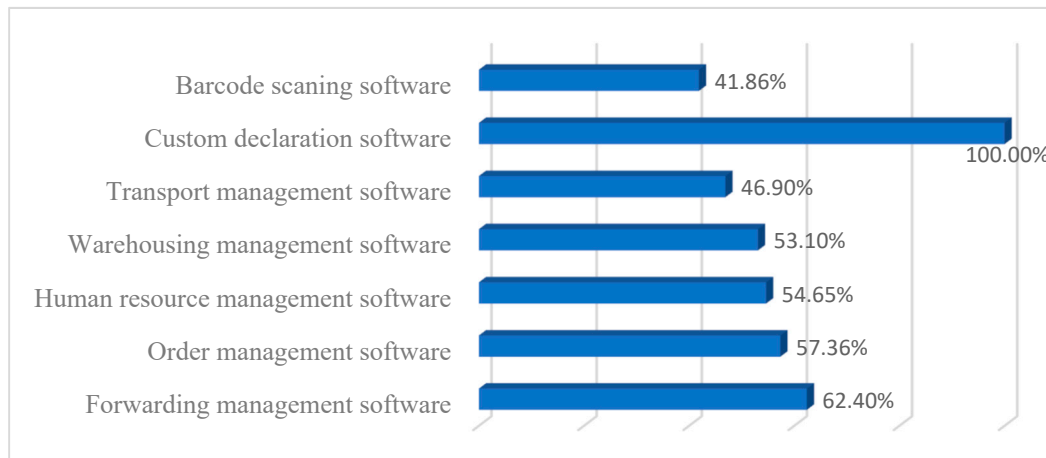


Figure 10. Software being deployed in companies.

5. Discussion and Implications for Promoting Digital Transformation in Vietnam's Logistics Enterprises

Digital transformation in the logistics industry has been a critical issue that businesses are interested in because of its impact on changing the model and efficiency of logistics service business. Enterprises need a lean and flexible argument transfer framework based on the common argument transfer framework. The modification roadmap will correspond to the different needs and sizes of organizations and outputs at each business. In addition, the choice of practical solutions or technology models to apply digital transformation at enterprises must be based on cost, deployment ability, complexity, efficiency, and system security. First of all, it is necessary to have policies to encourage digital transformation, support loans, and preferential interest rates for digital transformation enterprises. Thus, logistics enterprises can buy solutions or rent solutions from software providers when they need more financial capacity. Some proposed solutions to promote digital transformation in logistics businesses are as follows:

Raising managers' awareness—Digital transformation is not a revolution of technology, but a revolution to change people's perception of the application of new technology to digitize and automate business activities. Digital transformation in each enterprise will greatly impact the business strategy and form of operation, forcing managers to have timely awareness and take early action for digital transformation in their businesses. Managers need to have a long-term vision to build an effective digital business strategy, create initial experiences, and integrate those experiences into the development strategy process to help businesses participate in the broader supply chain, bringing greater economic efficiency.

Digital transformation skills training for human resources—Digital transformation requires high-quality human resources to master new technology, serving the implementation of digital transformation. To keep pace with industrialized countries, enterprises must have a plan to train high-quality human resources in the logistics service industry. This will help meet the demand for digital transformation experts and accelerate the training program for logistics professionals with the necessary skills to apply and implement logistics management and supply chain practices. The human resource development strategy must be important in the long-term development strategy. To enhance the quality of existing human resources within the enterprise, it is essential to implement solutions such as training programs, knowledge updates, skill development, and professional proficiency. In addition, it is crucial to prioritize recruitment and have strategies in place to supplement the enterprise with high-quality human resources for digital transformation activities.

Improve IT infrastructure and accelerate the application of new technology—Logistics enterprises need to have the essential IT infrastructure to develop logistics service business on digital platforms. Specifically, enterprises need to (1) retrofit and upgrade hardware and network systems to meet the needs of digital transformation; (2) improve the business's website and update information regularly on the website; (3) conduct computerization of closed cycle delivery activities for logistics activities.

Choose the exemplary digital transformation service—The mission of digital transformation is to apply IT and new technology to computerize the logistics chain to help businesses operate effectively. Businesses must be aware that implementing digital transformation services is an inevitable trend that must be applied at all stages of the service supply chain. In this process, businesses can aim to cooperate with software enterprises to deploy specialized applications, thereby making the most of the efficiency of each application. When implementing digital transformation, businesses must ensure a synchronous transformation by building a digital platform for the logistics service chain. This platform will help connect stakeholders in the chain, including ports, carriers, agents, forwarding enterprises, and warehouses, to share data, particularly in customs declaration and the development of logistics portals.

Based on the statistical analysis, the manager factor is considered significant in the digital transformation process of logistics enterprises in Vietnam, with a difference of only 0.12 between the highest (4.68) and lowest (4.56) average scores (detail in Figure 11). This finding is consistent with the traditional cultural values in Vietnam, where the board typically makes critical decisions for directors. Additionally, the study indicates that Vietnamese logistics enterprises face challenges related to new technology investment costs, with an average score of 4.52. While most enterprises have already implemented software applications to support transportation, warehouse management, and logistics activities, the adoption of social networks and e-commerce services still needs to be improved.

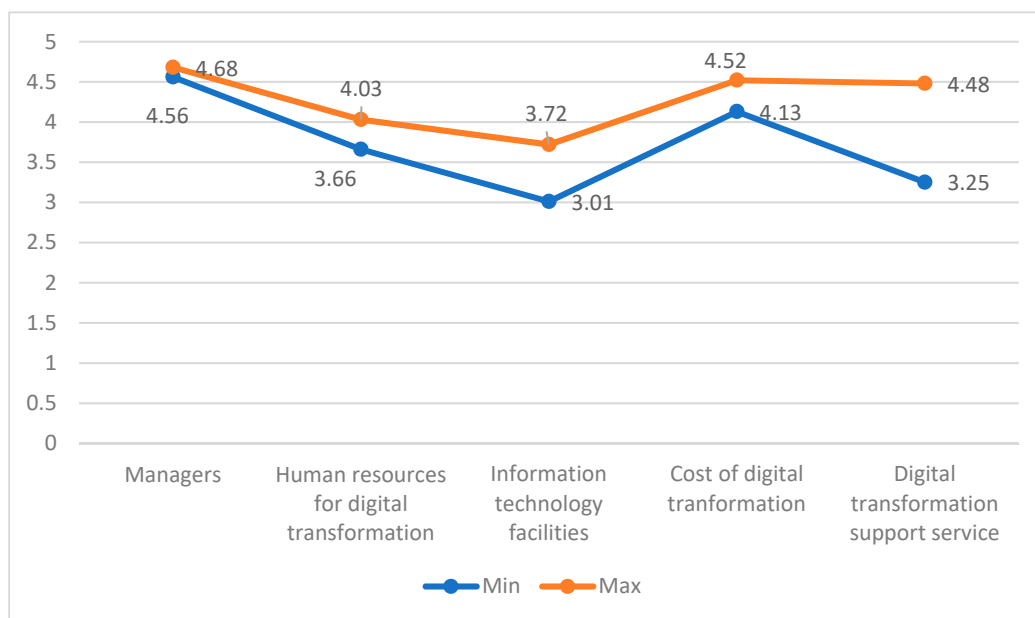


Figure 11. The average maximum and minimum values of factors affecting digital transformation activities of logistics enterprises.

6. Conclusions

In summary, digital transformation is a prominent trend in economies worldwide and in Vietnam. Digital transformation has brought many opportunities for logistics businesses in Vietnam, such as reaching more customers in all parts of the world. The purpose of digital transformation is for enterprises to participate in a general supply chain, bringing

greater economic efficiency. This research analyzes the influencing factors and the current situation of digital transformation in Vietnam's logistics enterprises. Specifically, the management factor affects 35.5%, the digital transformation human factor affects 24.7%, the technology factor affects 6.9%, the cost factor affects 20.5%, and the training support service factor affects 22.1% of the influence on digital transformation activities in logistics enterprises. The results show that the most significant barrier to digital transformation is not the technology, but the awareness of managers and the cost of implementing digital transformation. Therefore, logistics enterprises need to choose appropriate digital transformation support services, complete information technology infrastructure, train staff in digital transformation skills, and raise awareness among managers to accelerate digital transformation. In addition to their efforts, logistics businesses must have a multi-channel combination with associations and comply with government regulations for the most effective digital transformation. Some implications of the solutions proposed in this article are to improve competitiveness when integrating into the current digital economy.

Although this study utilized an intelligent method to select representative samples from the logistics industry in Vietnam to ensure the reliability and accuracy of the research results, the sample size of 285 may be considered modest when compared with the more than 4000 logistics enterprises in Vietnam. As a next step, future research efforts will focus on expanding the sample size and developing new data analysis techniques that account for local and cultural factors within the logistics industry. By doing so, the research findings can be more effectively applied to different countries.

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