International Journal of Innovative Research and Scientific Studies, 8(2) 2025, pages: 4210-4218

IJIRSS
International Journal of Innovative Research & Scientific Studies

ISSN: 2617-6548

URL: www.ijirss.com

Unpacking the enablers and barriers to digital transformation in Vietnamese logistics companies: A qualitative analysis

Phong Trong Vu[1], H. X. Nguyen[2], Quynh T. T. Pham[3], P. V. Nguyen[1*]

[1]*Faculty of Business Administration, Posts and Telecommunication Institute of Technology, Hanoi, Vietnam.*
[2]*Faculty of Accounting and Auditing, University of Finance and Marketing, Ho Chi Minh City, Vietnam.*
[3]*Department of Marketing, Posts and Telecommunication Institute of Technology, Hanoi, Vietnam.*

Corresponding author: P. V. Nguyen (*Email: phuocnv@ptit.edu.vn*)

Abstract

This study explores the enablers and barriers to digital transformation in Vietnamese logistics companies, a sector pivotal to the nation's economic growth yet lagging in digital adoption. The core theme centers on understanding how local contextual factors shape the integration of technologies like artificial intelligence, IoT, and blockchain in an emerging market. The research objectives are to identify key facilitators of digital transformation, examine obstacles impeding progress, and offer strategic recommendations for logistics firms to enhance their digital maturity. Data were collected through semi-structured interviews with 20 stakeholders, logistics managers, policymakers, and technology providers, representing firms of varying sizes and digital maturity levels, supplemented by secondary sources such as industry reports and government policies. A qualitative, exploratory approach was employed, with thematic analysis conducted using NVivo software to identify recurring patterns. Findings reveal that leadership vision, government incentives, affordable technological ecosystems, and workforce training are primary enablers, fostering organizational and technical capacity for digital adoption. Conversely, financial constraints, cultural resistance, regulatory complexities, and cybersecurity risks emerge as significant barriers, particularly pronounced due to the prevalence of small and medium enterprises and traditional practices. These insights highlight Vietnam-specific nuances, such as the reliance on cost-effective solutions and the critical role of upskilling, distinguishing this study from global trends. The research contributes to logistics scholarship by offering a localized perspective and provides practical strategies for firms and policymakers to navigate digital transformation challenges effectively.

Keywords: Cultural resistance, Digital transformation, Emerging markets, Government incentives, Vietnamese logistics, Leadership vision.

DOI: 10.53894/ijirss.v8i2.6271
Funding: This study received no specific financial support.
History: Received: 24 February 2025 / **Revised:** 26 March 2025 / **Accepted:** 28 March 2025 / **Published:** 17 April 2025

Competing Interests: The authors declare that they have no competing interests.
Authors' Contributions: All authors contributed equally to the conception and design of the study. All authors have read and agreed to the published version of the manuscript.
Transparency: The authors confirm that the manuscript is an honest, accurate, and transparent account of the study; that no vital features of the study have been omitted; and that any discrepancies from the study as planned have been explained. This study followed all ethical practices during writing.
Acknowledgments: This work was supported by Posts and Telecommunications Institute of Technology, Vietnam (PTIT) and University of Finance and Marketing.
Publisher: Innovative Research Publishing

1. Introduction

The logistics industry has experienced a transformative shift in recent years, propelled by the rapid evolution of digital technologies. Digital transformation, marked by the adoption of innovations such as artificial intelligence (AI), the Internet of Things (IoT), blockchain, and big data analytics, has redefined operational efficiencies, customer experiences, and competitive landscapes within the sector [1]. Globally, logistics firms are leveraging these technologies to optimize supply chains, improve real-time tracking, and lower operational costs. The global logistics digitalization market is projected to grow at a compound annual growth rate (CAGR) exceeding 10% from 2020 to 2027, underscoring the critical role of digital tools in enhancing efficiency and resilience [2].

In Vietnam, the logistics sector is a cornerstone of the country's rapid economic development, particularly as it solidifies its position as a manufacturing hub in Southeast Asia. Contributing approximately 16–20% to the national GDP, the industry is vital yet remains anchored in traditional practices [3]. Despite its economic importance, Vietnam lags in digital adoption compared to ASEAN peers like Thailand and Singapore, where greater investment in technological infrastructure and higher digital literacy have accelerated progress [4]. Government efforts, such as the National Digital Transformation Program launched in 2020, aim to bridge this gap by promoting technology adoption across industries, including logistics. However, implementation has been inconsistent, with many Vietnamese logistics firms struggling to shift from legacy systems to digitally enabled operations [5]. This study investigates the dynamics of digital transformation in Vietnamese logistics companies, focusing on the enablers and barriers shaping this transition.

Digital transformation presents significant opportunities for improving efficiency and competitiveness, yet its application in the Vietnamese logistics sector remains underexplored. Existing literature predominantly focuses on developed economies, leaving a gap in understanding the unique contextual factors influencing digital adoption in emerging markets like Vietnam [6]. This gap is particularly pronounced when compared to ASEAN nations such as Malaysia and Indonesia, which face similar challenges like resource constraints and regulatory complexities but have received more scholarly attention [7]. The lack of Vietnam-specific empirical evidence on the enablers and barriers to digital transformation limits the development of tailored strategies to support the sector's digital evolution. Moreover, the multifaceted nature of digital transformation necessitates a comprehensive approach to dissect its challenges. Vietnamese logistics firms grapple with issues such as limited financial resources, technological readiness, and regulatory uncertainties, yet these factors are often examined in isolation rather than within an integrated framework [8]. Without a holistic understanding of both drivers and impediments, policymakers and industry leaders risk devising ineffective solutions. This study addresses these shortcomings by systematically analyzing the enablers and barriers to digital transformation in Vietnam's logistics context, offering a localized perspective to inform strategic advancements.

This study is designed to investigate the dynamics of digital transformation within Vietnamese logistics companies by pursuing three core objectives: first, to pinpoint the primary enablers, such as technological infrastructure, organizational culture, and government support, that facilitate this process; second, to analyze the key barriers, including financial constraints, skill deficits, and resistance to change, that impede digital adoption; and third, to propose strategic recommendations that enable logistics firms to leverage these enablers and overcome obstacles for successful digital transformation. These objectives are underpinned by three guiding research questions: What are the main enablers driving digital transformation in Vietnamese logistics companies? What are the critical barriers preventing effective digital adoption in these firms? And how can logistics companies address these barriers to achieve robust digital transformation? Together, these aims and questions provide a structured framework to deliver actionable insights, enhancing the digital maturity of Vietnam's logistics sector while addressing the complexities of digitalization in this industry.

This research contributes to both academic and practical spheres. Academically, it enriches the digital transformation literature by offering empirical insights from an emerging market, addressing a notable gap in logistics scholarship. Practically, it provides Vietnamese logistics firms with a roadmap to navigate digital adoption challenges, boosting their competitiveness in a globalized market. Furthermore, the study offers evidence-based recommendations for government agencies to refine digital transformation policies, supporting the sector's growth. By linking theory and practice, this research highlights the value of context-specific strategies in driving digital innovation.

The paper is structured into five sections. Following this introduction, Section 2 reviews the literature on digital transformation in logistics, laying a theoretical foundation. Section 3 details the research methodology, including data collection and analysis methods. Section 4 presents the findings, discussing the identified enablers and barriers and their implications. Finally, Section 5 concludes with a summary of key insights, strategic recommendations, and directions for future research.

2. Literature Review

2.1. Theoretical Foundations of Digital Transformation

Digital transformation is a complex, multifaceted process that has been analyzed through various theoretical lenses. The Resource-Based View (RBV) stands out as a prominent framework, positing that a firm's competitive advantage derives from its unique resources and capabilities, such as technological assets, human capital, and managerial expertise [9]. In the context of digital transformation, RBV emphasizes the critical role of resources like IT infrastructure and leadership vision in enabling firms to adopt and leverage digital technologies effectively [10]. This perspective is particularly relevant to logistics, where digital tools can enhance operational capabilities and sustain competitive edges. Compared to alternatives like the Technology Acceptance Model (TAM), which focuses on individual adoption behaviors, or the Technology-Organization-Environment (TOE) framework, which emphasizes broader external factors, RBV is chosen for this study

because it aligns with the focus on internal organizational resources and capabilities driving digital transformation in Vietnamese logistics firms.

Complementing RBV, digital maturity models provide a structured approach to assess the stages of digital adoption, from basic digitization to fully integrated systems, offering a roadmap for firms to navigate their transformation journey [11]. These models are apt for this study as they allow for an evaluation of Vietnam's logistics sector against a progressive continuum, highlighting gaps in maturity specific to an emerging market. Additionally, the Industry 4.0 framework underscores the integration of advanced technologies like automation and IoT to create smart logistics ecosystems [12]. Together, RBV and digital maturity models provide a robust theoretical foundation, justified by their emphasis on resource utilization and staged transformation, which are central to understanding digital adoption in Vietnam's resource-constrained logistics context.

2.2. Digitalization in the Logistics Industry

The logistics sector globally has seen a surge in digitalization, driven by technologies such as artificial intelligence (AI), the Internet of Things (IoT), blockchain, big data analytics, and cloud computing. AI and IoT facilitate real-time tracking and predictive analytics, enhancing supply chain visibility and responsiveness [13]. Blockchain improves transparency and security in transactions, addressing inefficiencies in cross-border logistics, Queiroz et al. [14], while big data and cloud computing enable data-driven decision-making and scalable infrastructure [1]. These advancements yield significant benefits, including operational efficiency through automation, cost reductions via streamlined processes, and sustainability improvements through optimized resource use, such as reduced fuel consumption from route optimization [15]. In Vietnam, the government's Smart Logistics Plan 2025 aims to integrate these technologies into the sector, though its implementation remains in early stages, reflecting a slower pace compared to global trends [16].

Comparatively, ASEAN neighbors like Malaysia and Indonesia have made strides in digitalizing logistics, leveraging national policies and foreign investments to adopt IoT and blockchain more rapidly [7]. Malaysia's Digital Free Trade Zone, for instance, has accelerated e-commerce logistics, while Indonesia's focus on digital infrastructure has boosted supply chain connectivity. Vietnam, however, lags due to limited technological readiness and regulatory coherence, necessitating a localized examination of its digitalization efforts.

2.3. Enablers of Digital Transformation

Several factors enable digital transformation in logistics. Leadership commitment and vision are foundational, providing strategic direction and resource allocation essential for transformative change [17]. Investment in IT infrastructure, hardware, software, and connectivity lays the technological groundwork for adoption [18]. A digitally literate workforce, supported by training initiatives, is critical for operating and innovating with new technologies [5]. Regulatory support, such as Vietnam's National Digital Transformation Program and Smart Logistics Plan 2025, offers subsidies and guidelines to accelerate adoption, a role mirrored in regional policies like Malaysia's logistics digitalization incentives [7, 19]. Industry collaboration further enhances transformation by enabling resource and knowledge sharing, fostering a supportive ecosystem [20]. These enablers collectively create conditions for successful digitalization, though their effectiveness in Vietnam requires contextual analysis.

Table 1 provides a comprehensive regional comparison, which can strengthen your study's discussion section when highlighting Vietnam's position within ASEAN digital transformation trends. Vietnam and Indonesia face similar challenges in financial constraints and evolving regulatory frameworks, but Vietnam has a stronger government incentive structure. Singapore leads in digital infrastructure and regulatory clarity, making it a model for logistics digital transformation. Thailand and Malaysia show moderate barriers but have government-backed incentives and training programs that ease digital adoption.

Table 1.
Comparison of Enablers and Barriers in Vietnam, Indonesia, Singapore, Thailand, and Malaysia.

Factor	Vietnam	Indonesia	Singapore	Thailand	Malaysia
Enablers					
Leadership Vision	Strong driver, top-level commitment	Similar, but less emphasized	Highly strategic, driven by Smart Nation Initiative	Government and industry-led initiatives	Strong push from government and corporations
Government Incentives	Subsidies via National Program	Limited subsidies, more policy focus	Comprehensive grants and incentives for Industry 4.0 adoption	Tax incentives for digital investments	Digital Economy Blueprint provides tax breaks and subsidies
Tech Ecosystem	Affordable tools prioritized	Broader adoption of advanced tech	Advanced digital infrastructure, widespread AI and IoT use	Growing adoption, regional logistics hub	Well-established, high adoption of cloud computing and automation
Workforce Training	Critical due to literacy gaps	Moderate focus, higher baseline skills	Strong government support for upskilling	National workforce programs for digital skills	Public-private partnerships for digital training

Factor	Vietnam	Indonesia	Singapore	Thailand	Malaysia
Barriers					
Financial Constraints	High, limited alternative funding	High, offset by foreign investment	Lower concern due to strong government and corporate investment	Moderate government support helps SMEs	Moderate, incentives available, but uneven adoption
Cultural Resistance	Strong due to traditional practices	Moderate, less entrenched traditions	Low, high acceptance of technology	Moderate, traditional business structures still present	Low, digital transformation widely accepted
Regulatory Challenges	Inconsistent, evolving frameworks	Similar, but clearer guidelines are emerging	Well-defined regulations, strong data governance	Regulatory frameworks are improving but still evolving	Strong digital policies, but some bureaucratic delays
Cybersecurity Risks	Significant, growing concern	Comparable, with better mitigation	Highly secure digital landscape with strict regulations	Moderate, growing focus on cybersecurity	Moderate, focus on data protection, but some vulnerabilities

2.4. Barriers to Digital Transformation

Digital transformation faces notable obstacles. High initial investment costs deter adoption, particularly for small and medium enterprises (SMEs) prevalent in Vietnam [6]. Organizational resistance to change, driven by cultural inertia or fears of job displacement, complicates implementation [21]. Skill shortages among logistics workers in emerging markets like Vietnam exacerbate these challenges [8]. Regulatory and legal uncertainties, such as Vietnam's inconsistent frameworks for blockchain under the Smart Logistics Plan 2025, hinder progress, a contrast to more defined policies in Malaysia [7, 14]. Cybersecurity risks, including data breaches and system vulnerabilities, also loom large as digitization increases [15]. These barriers underscore the need for tailored strategies to address Vietnam's unique challenges. Figure 1 illustrates how enablers like leadership and barriers like financial constraints interact within the RBV.

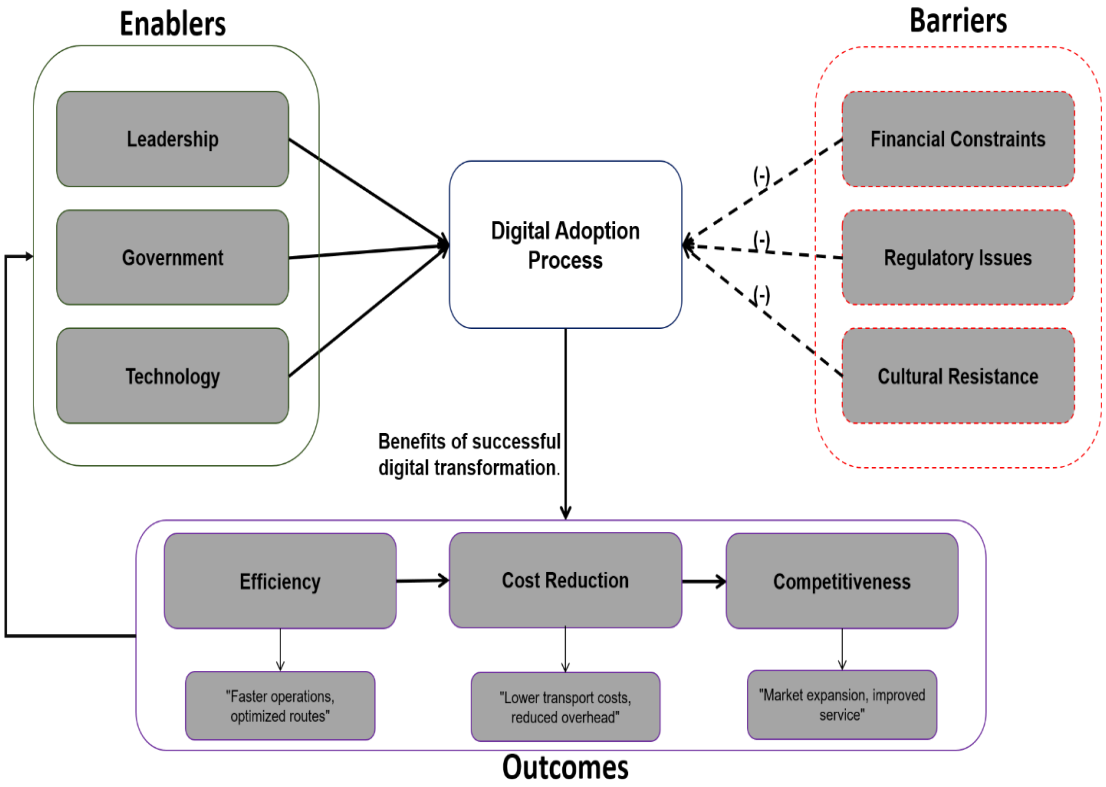

Figure 1.
Conceptual Framework of Digital Transformation in Vietnamese Logistics.

2.5. Research Gap

The literature on digital transformation in logistics is extensive but skewed toward global trends and developed economies [1, 13]. This focus leaves a gap in understanding digitalization in emerging markets like Vietnam, where economic, cultural, and infrastructural contexts differ significantly. While studies in ASEAN countries like Malaysia and

Indonesia highlight similar issues, resource constraints and regulatory gaps, Vietnam-specific empirical evidence remains scarce [6, 7]. Moreover, existing research often examines enablers and barriers separately, lacking a cohesive framework tailored to Vietnam's logistics sector. This study addresses these gaps by integrating global insights with local perspectives, offering a contextualized analysis of digital transformation in Vietnamese logistics companies.

3. Research Methodology

3.1. Research Design

This study employs a qualitative, exploratory research design to investigate the enablers and barriers to digital transformation in Vietnamese logistics companies. A qualitative approach is well-suited to this research as it allows for an in-depth exploration of complex phenomena within their natural context, particularly in an understudied market where existing knowledge is limited [22]. The exploratory nature of the design aligns with the study's aim to uncover contextual insights into the digital transformation process, offering flexibility to capture diverse stakeholder perspectives and emerging themes [23]. This approach facilitates a nuanced understanding of the interplay between enabling and impeding factors in Vietnam's logistics sector, providing a foundation for theory-building and practical application.

3.2. Data Collection Methods

Data were gathered using a combination of primary and secondary sources to ensure a comprehensive analysis. Primary data were collected through semi-structured interviews, selected for their ability to yield rich, detailed insights while allowing flexibility to probe unanticipated issues [24]. Interviews were conducted with three stakeholder groups: logistics managers, policymakers, and technology providers. Logistics managers provided operational insights, policymakers offered perspectives on regulatory frameworks, and technology providers contributed technical expertise on digital solutions. Each interview, lasting 45–60 minutes, was held either in person or via virtual platforms based on participant availability, with questions informed by the research objectives and literature review.

Secondary data were sourced from industry reports, government policies, and case studies. Reports from the Vietnam Logistics Business Association (VLBA) and international organizations like the World Bank provided macro-level context on the sector's digital progress. Government documents, including Vietnam's National Digital Transformation Program, were analyzed to understand regulatory influences. Case studies of Vietnamese logistics firms adopting digital tools complemented interview data with practical examples. This dual-method approach enriched the study by triangulating primary findings with broader industry trends and documented evidence.

3.3. Sampling Strategy

A purposive sampling strategy was utilized to select participants and firms, ensuring representation of diverse perspectives relevant to the research questions [25]. The target population comprised Vietnamese logistics companies at varying stages of digital maturity, from early adopters to those yet to initiate transformation. Inclusion criteria included company size (small, medium, and large enterprises), digital adoption status (fully digitized, partially digitized, or non-digitized), and industry role (e.g., transportation, warehousing, freight forwarding). A total of 20 participants were recruited: 10 logistics managers, 5 policymakers, and 5 technology providers, chosen for their expertise and direct involvement in digital transformation initiatives.

The sample size of 20 was deemed sufficient based on the principle of data saturation, where no new themes emerged in later interviews, aligning with qualitative research standards Guest et al. [26] suggest that 12–20 interviews often suffice for thematic saturation in exploratory studies, and this was confirmed in the analysis as recurring patterns stabilized by the 17th interview. This justification supports the adequacy of the sample for capturing the depth and breadth of insights required to address the study's objectives.

3.4. Data Analysis

Data were analyzed using thematic analysis, a method ideal for identifying, analyzing, and reporting patterns within qualitative data [27]. The process was facilitated by NVivo software, enabling systematic organization and coding. Analysis followed a six-phase approach: (1) familiarization with the data through transcription and repeated reading, (2) generation of initial codes based on recurring concepts tied to enablers and barriers, (3) searching for themes by grouping related codes, (4) reviewing themes against the dataset for coherence, (5) defining and naming themes, and (6) producing the final report. Codes were iteratively refined to reflect key enablers (e.g., leadership support, technological infrastructure) and barriers (e.g., financial constraints, cultural resistance), ensuring alignment with the research questions.

3.5. Reliability and Validity

Several strategies were employed to enhance the reliability and validity of the findings. Triangulation was achieved by integrating primary interview data with secondary sources (e.g., reports, case studies), allowing cross-verification and reducing bias [28]. Member checking was conducted by providing participants with summaries of their interview responses for confirmation or clarification, ensuring accurate representation of their views. Intercoder reliability was addressed by involving a second researcher to independently code a subset of the data, with discrepancies resolved through discussion to achieve consistency, enhancing the robustness of the thematic analysis. To mitigate researcher bias in thematic analysis, peer debriefing was employed, where findings and interpretations were reviewed by an external academic colleague familiar with qualitative methods. This process challenged assumptions and refined theme definitions, bolstering objectivity. An audit trail was maintained in NVivo, documenting the coding and analysis steps to ensure transparency and replicability. These

combined efforts strengthened the credibility and dependability of the study's results. Ethical principles were rigorously upheld throughout the research. Informed consent was obtained from all participants prior to interviews, with a clear explanation of the study's purpose, their voluntary participation, and their right to withdraw at any time without consequence. Confidentiality and anonymity were assured by removing personal identifiers from transcripts and storing data securely on a password-protected server accessible only to the research team.

4. Findings and Discussion

4.1. Overview of Interview Responses

This study's findings stem from semi-structured interviews with 20 participants, offering a diverse representation of Vietnam's logistics sector. The sample included 10 logistics managers, 5 policymakers, and 5 technology providers, spanning firms from small enterprises (<50 employees) to large corporations (>500 employees). Digital maturity varied, with 40% of firms classified as early adopters (fully or partially digitized), 35% in transition (initiating digital projects), and 25% non-digitized. Table 2 shows the interview participants; these participants' roles provided a balanced perspective, capturing operational, regulatory, and technical dimensions of digital transformation. This diversity ensures a robust foundation for understanding the contextual factors influencing digital adoption in Vietnamese logistics companies.

Table 2.
Summary of Interview Participants.

Category	Characteristic	Details
Sample Size	Total Participants	20
Participant Composition	Roles	Logistics Managers (10), Policymakers (5), Technology Providers (5)
Firm Characteristics	Size	Small (<50 employees), Medium (50–500 employees), Large (>500 employees)
	Digital Maturity	Early Adopters (40%), In Transition (35%), Non-Digitized (25%)
	Industry Roles	Transportation, Warehousing, Freight Forwarding
Interview Details	Duration	45–60 minutes
	Mode	In-person and Virtual

4.2. Identified Enablers of Digital Transformation

Thematic analysis identified four key enablers: leadership and strategic vision, government policies and incentives, technological infrastructure and ecosystem, and workforce readiness and training initiatives. Table 3 shows the key enablers of digital transformation in Vietnamese Logistics.

Leadership and Strategic Vision: Leadership emerged as a pivotal driver, with interviewees emphasizing its role in prioritizing digital initiatives. A logistics manager from a digitally mature firm stated, "Without our CEO pushing for digital tools and allocating budget, we'd still be stuck with paper-based systems." This commitment mitigated resistance and fostered innovation, aligning with global findings [17].

Government Policies and Incentives: Vietnam's National Digital Transformation Program was frequently cited as a key enabler, offering subsidies and tax incentives. Policymakers noted its role in reducing financial burdens, especially for SMEs, a finding consistent with regional trends [19].

Technological Infrastructure and Ecosystem: Affordable tools like cloud computing and IoT platforms facilitated adoption, with technology providers highlighting partnerships with vendors as critical to building a supportive ecosystem [20].

Workforce Readiness and Training Initiatives: Training programs were essential for upskilling employees, with digitally mature firms reporting significant investments in digital literacy, reinforcing their importance in Vietnam's context [5].

Table 3.
Key Enablers of Digital Transformation in Vietnamese Logistics.

Characteristic	Details
Leadership and Strategic Vision	Strong leadership commitment and clear vision driving resource allocation and digital initiatives
Government Policies and Incentives	Subsidies and tax incentives from programs like the National Digital Transformation Program reduce financial burdens
Technological Infrastructure and Ecosystem	Affordable tools (e.g., cloud computing, IoT) and partnerships with tech vendors foster adoption
Workforce Readiness and Training Initiatives	Training programs enhancing digital literacy and reducing resistance to new technologies

4.3. Identified Barriers to Digital Transformation

Four primary barriers emerged: financial constraints and investment risks, organizational culture and change resistance, regulatory and legal challenges, and technical and cybersecurity concerns. Table 4 presents the key barriers to digital transformation in Vietnamese Logistics.

Financial Constraints and Investment Risks: High initial costs were a major hurdle, particularly for SMEs. Managers noted the risk of uncertain returns deterred investment, with limited evidence of firms seeking alternative funding like government grants or foreign investments, exacerbating the barrier [6].

Organizational Culture and Change Resistance: Resistance was pronounced in firms with traditional practices, with employees fearing job losses and workflow disruptions [21]. This cultural inertia was a recurring theme across interviews.

Regulatory and Legal Challenges: Inconsistent regulations, such as unclear blockchain guidelines, delayed adoption, a challenge echoed in broader logistics contexts [14].

Technical and Cybersecurity Concerns: Cybersecurity risks, including data breaches, were significant as firms digitized, aligning with global concerns [15].

Table 4.
Key Barriers to Digital Transformation in Vietnamese Logistics.

Characteristic	Details
Financial Constraints and Investment Risks	High initial costs and perceived risks of uncertain returns deterring investment, especially for SMEs
Organizational Culture and Change Resistance	Resistance rooted in traditional practices and fears of job loss or workflow disruption
Regulatory and Legal Challenges	Inconsistent regulations and unclear guidelines (e.g., for blockchain) are delaying adoption
Technical and Cybersecurity Concerns	Risks of data breaches and system vulnerabilities as operations digitize

4.4. Comparative Analysis with Existing Literature

The findings both align with and diverge from global and regional studies, offering Vietnam-specific insights. Leadership and government support as enablers are universally recognized [17, 19]. But Vietnam's reliance on affordable technological ecosystems—prioritizing cost-effective solutions like cloud computing over cutting-edge innovations—reflects its emerging market status, differing from developed economy trends [1]. Workforce training emerged as a stronger enabler here, likely due to Vietnam's focus on bridging digital literacy gaps [5].

Financial constraints and cybersecurity risks align with global literature [6, 15]. yet their impact is amplified in Vietnam by the dominance of SMEs with limited capital. Cultural resistance, a common global barrier Vial [21], is more pronounced in Vietnam due to a preference for stability rooted in traditional practices. Regulatory challenges, while noted globally, Queiroz et al. [14] are uniquely complex in Vietnam due to rapid policy evolution outpacing implementation, contrasting with more mature frameworks elsewhere.

5. Conclusion and Recommendations

5.1. Summary of Key Findings

This study provides a comprehensive analysis of the enablers and barriers to digital transformation in Vietnamese logistics companies, shedding light on the dynamics of digital adoption in an emerging market context. Key enablers identified include leadership and strategic vision, government policies and incentives, technological infrastructure and ecosystem, and workforce readiness through training initiatives. These factors collectively enhance organizational commitment, regulatory support, and technical capacity for adopting digital technologies. Conversely, significant barriers encompass financial constraints and investment risks, organizational culture and resistance to change, regulatory and legal challenges, and technical and cybersecurity concerns. These obstacles underscore the complexities of transitioning to digital operations in Vietnam, where resource limitations, cultural preferences for traditional practices, and evolving policy frameworks play prominent roles. Together, these findings offer a nuanced, Vietnam-specific perspective on the drivers and impediments shaping digital transformation in the logistics sector.

5.2. Theoretical and Practical Implications

Theoretical Implications: This research enriches logistics and digital transformation scholarship by extending the Resource-Based View (RBV) and digital maturity frameworks to an emerging market setting [9, 11]. By identifying context-specific enablers and barriers, it refines theoretical models predominantly tested in developed economies, addressing a gap highlighted in prior reviews [6]. The emphasis on affordable technological ecosystems and workforce training as critical enablers underscores the need for localized adaptations of global theories, enhancing their applicability across diverse economic contexts.

Practical Implications: For logistics firms, the findings provide actionable insights into leveraging leadership commitment and training to drive digital adoption while addressing financial and cultural barriers. Policymakers can utilize this evidence to refine digital transformation initiatives, ensuring they tackle the sector's unique challenges. The identification of cybersecurity as a pressing concern also highlights the need for robust technical safeguards, offering a focus for technology providers partnering with logistics firms. These implications bridge academic insights with industry needs, supporting Vietnam's logistics sector in achieving greater digital maturity and competitiveness.

5.3. Recommendations for Stakeholders

5.3.1. Logistics Firms

A step-by-step digital adoption roadmap tailored to firm size is recommended:

- *Small and Medium Enterprises (SMEs)*: Begin with low-cost, scalable solutions like cloud-based inventory management systems to minimize financial strain. Gradually integrate IoT for real-time tracking as revenue grows, leveraging government subsidies where available.
- *Large Firms*: Prioritize comprehensive platforms (e.g., blockchain for supply chain transparency) after establishing a digital foundation with cloud and AI tools. Invest in leadership training to sustain a digital vision and allocate resources for employee upskilling to reduce resistance [5].

This phased approach aligns with incremental digital integration strategies, Büyüközkan and Göçer [1], ensuring feasibility across firm scales.

5.4. Policymakers and Academics

To enhance digital training programs, Vietnam should establish Public-Private Partnerships (PPPs) between government agencies, universities, and logistics firms. These partnerships could develop targeted curricula focusing on practical digital skills (e.g., IoT implementation, cybersecurity basics), subsidized by the National Digital Transformation Program. Additionally, streamline regulatory frameworks to provide clear guidelines for emerging technologies like blockchain, reducing adoption delays [14]. Expanding financial incentives, such as tax breaks for SMEs investing in digital tools, would further alleviate cost barriers, building on existing policy successes [19].

Future research should explore the long-term impacts of digital transformation on firm performance in Vietnam, extending beyond the current focus on adoption processes. Methodological advancements, such as mixed-methods approaches, could combine qualitative depth with quantitative rigor to enhance generalizability [22].

5.5. Limitations of the Study

This study has notable limitations. Its geographic focus on Vietnam may limit the applicability of findings to other emerging markets with differing economic or cultural contexts. The emphasis on logistics firms excludes other supply chain actors (e.g., manufacturers, retailers), potentially overlooking broader ecosystem influences. The qualitative design, while rich in depth, introduces subjectivity in interpreting responses, despite triangulation and member checking efforts to enhance reliability [27]. These constraints suggest caution in generalizing results beyond the study's specific scope.

5.6. Suggestions for Future Research

To extend this work, a longitudinal study tracking digital transformation trends in Vietnamese logistics over time is recommended. Such an approach would reveal how enablers and barriers evolve, providing dynamic insights into long-term adoption patterns. Additionally, quantitative validation of the identified factors using Partial Least Squares Structural Equation Modeling (PLS-SEM) or Artificial Neural Network (ANN) models could test the relationships between enablers (e.g., leadership, training) and barriers (e.g., costs, resistance) with firm performance outcomes. These advanced analytical techniques would complement the qualitative findings, offering statistical rigor and broader generalizability [24]. A cross-country comparison with ASEAN peers like Malaysia or Thailand could further contextualize Vietnam's experience, contributing to a regional understanding of digital adoption in logistics.

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