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The Impact of Digital Transformation on Financial Performance and Competitiveness of Freight Transport Enterprises in Vietnam

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ABSTRACT: Digital transformation is redefining the way the organization and management of freight transport is being handled, with the help of transport management systems, vehicle positioning and telematics, electronic documents, digital freight platforms, real-time tracking, data analytics and artificial intelligence. However, for freight transport companies in Vietnam, the key question is not whether digital technologies are being used, but whether digital investment can yield tangible financial results and competitive advantages. The research method adopted in this study is a qualitative research design with the combination of document analysis and evidence synthesis to analyze the mechanisms of digital transformation on the financial performance and competitiveness of freight transport companies in Vietnam. The evidence base covers basic research on the resource-based view and dynamic capabilities, international research on digital transformation and Logistics 4.0, recent empirical research in Vietnam, official transport statistics and national policy documents. The results reveal two interrelated value-conversion pathways. First, digital transformation can boost financial performance by cutting down on coordination and transaction costs, optimizing routes and loads, maximizing vehicle utilization, minimizing waiting time, enabling predictive maintenance, streamlining the invoice-to-cash cycle and unlocking new revenue streams through value-added services. Second, by enhancing transparency, reliability, responsiveness, customer-partner integration, service innovation, and participation in digital supply chains, digital transformation can contribute to strengthening competitiveness. These benefits are not guaranteed, but are contingent. A digitalization paradox can occur when fragmented technology investments, weak managerial skills, lack of digital skills, financial limitations, digital incompatibility among partners and poor data integration leads to rising investments and declining performance. The study recommends a Digital Capability - Operational Conversion - Firm Outcomes Framework and a roadmap for the phased transformation, starting from the process and data standardization and then moving to the advanced analytics and digital-green convergence.

I. INTRODUCTION

Freight transport is the material interface between production, distribution and consumption. Its efficiency has a direct impact on delivery times, stability of supply chains, logistics costs and companies' market access. While many services can be digitalized to a large extent in the online world, freight transport can't be fully digitalized without linking digital information flows to the physical transport of vehicles, goods, drivers, terminals, ports, warehouses, and infrastructure. Therefore, the importance of

digital transformation in transport goes beyond software and devices, it is about enabling the transformation of data into improved operational decisions.

The freight transportation market in Vietnam is still growing rapidly. In 2024, freight volume is estimated at 2,670.6 million tonnes, up 14.0% compared to the previous year, and freight traffic is estimated at 545.1 billion tonne-kilometres, up 11.8% compared to 2023, according to the General Statistics Office of Vietnam. In 2025, the volume of goods transport increased to 3,027.7 million tonnes (+14.1%), and goods transport traffic grew to 612.3 billion tonne-kilometres (+13.1%) (General Statistics Office of Vietnam, 2025, 2026). All this expansion opens up new revenue streams but imposes stress on the fleet dispatching, fuel control, load allocation, shipment tracking, document processing, receivables management and customer and partner coordination.

The policy environment also offers good impetus for this change. The National Digital Transformation Programme until 2025 (oriented towards 2030) was approved by Decision No.749/QD-TTg/2020. Resolution No. 163/NQ-CP also related logistics competitiveness to infrastructure, information technology and digital transformation (Government of Vietnam, 2022). Decision No. 2229/QD-TTg dated 9 October 2025 is the latest decision approving the Strategy for the Development of Vietnam's Logistics Services for the 2025-2035 period, looking towards the 2050 horizon. The Strategy aims for logistics value added of 5% - 7% GDP, growth rate of 12% - 15% per year, logistics costs of 12% - 15% of GDP, ranking within the top 40 countries and territories in the Logistics Performance Index and implementation of digital-transformation solutions by 80% of logistics enterprises (Prime Minister of Vietnam, 2025). It reflects the World Bank's Logistics Performance Index framework, which focuses on four key dimensions of logistics performance: infrastructure, logistics quality and competence, tracking and tracing, and timeliness (World Bank, 2023). Digital transformation is thus placed right next to competitiveness, efficiency and sustainable development.

However, it does not mean that the more digital you invest the more successful your business will be. An enterprise can do any of the following things: install positioning devices, but only for the purpose of location monitoring; install a transport management system and still dispatch vehicles by telephone and spreadsheet; create a customer portal but not connect the order data to accounting; install multiple standalone applications that increase technology investment but do not provide data integration. In these cases, individual activities have been digitized but there is no capability for digital transformation at the organizational level.

This challenge has been clearly illustrated by international studies in the field of logistics. Logistics-network complexity, resource and skill shortages, challenges with the adoption of technology, resistance to change, and data security issues are all significant challenges identified by Cichosz et al. (2020). As demonstrated by Lai et al., (2008) information-technology capability of third-party logistics providers is correlated with three dimensions of competitive advantage: cost reduction, innovative and customized services, and service-quality improvement. In addition, Bag, Gupta, and Luo (2020) demonstrate that the Logistics 4.0 capabilities will be effective if they are aligned with organizational capabilities and environmental factors.

Further evidence from Vietnam has emerged in recent years that these effects are heterogenous. Vu et al. (2024) find that by applying fixed-effects quantile regression to firm-level data in Vietnam, firms with higher financial performance have greater gains from digital transformation, while lower performing firms do not necessarily have the same gains. This finding aligns with the concept of a digitalization paradox: When complementary conditions are not present, there is a risk that technology investments can be counterproductive in terms of performance. For Vietnamese logistics companies, Nguyen et al. (2026) find that digital transformation is positively associated with the return on assets (ROA) and cost efficiency in logistics, and government support can play a reinforcing role. In Vietnamese shipping companies, Nguyen (2024) further finds that financial capability, digital skills, digital technology development, top-management support and competitive pressure are all factors that encourage digital transformation.

There are three gaps that are especially pertinent to freight transport enterprises. First, the financial results and competitiveness are analyzed separately, although they are both driven by the same mechanisms of operation. Second, many studies focus on logistics service providers in general rather than freight transport companies, which are very asset intensive, subject to payload, empty kilometres, fuel consumption, waiting time, maintenance schedules, and also to fluctuations in freight demand. Third, technology adoption as a variable is often used without clearly distinguishing between technology ownership and the ability to make technology lead to process change and business outcomes.

The study thus aims to answer the following three research questions: (RQ1) How does the financial performance of freight transport companies in Vietnam become a result of digital transformation? Therefore, this study focuses on answering the following three research questions: (RQ1) How does the financial performance of freight transport companies in Vietnam become a result of digital transformation? How does digital transformation enhance their competitiveness (RQ2)? (RQ3) What are the organizational, technological and environmental conditions that make the difference in whether digital investments are translated into financial outcomes and competitive advantage?

The study provides an Integrated Digital Capability - Operational Conversion - Firm Outcomes Framework. The framework does not see digital transformation as a collection of devices and software, but as an organizational capability that generates value when digital data and connectivity contribute to the transformation of asset use, cost management, customer

service, network coordination and service innovation. This method is suitable for a qualitative and policy-oriented study and serves as a basis for further research with quantitative data at the firm level of freight transport companies.

II. THEORETICAL BACKGROUND AND RESEARCH METHODS

2.1. Digital transformation in freight transport enterprises

According to Verhoef et al. (2021), there are three levels: digitization, digitalization, and digital transformation. In the transport sector, this is a crucial distinction. The digitisation of paper documents, the automation of dispatching, invoicing and vehicle tracking on the basis of digital data, and the restructuring of the decision-making, internal coordination, customer-partner connectivity and service creation of an enterprise on the basis of data are all digital transformation.

The four components of digital capability of freight transport enterprises discussed in this study are: (i) core operational digitalization; (ii) data and analytics; (iii) digital customer interfaces; and (iv) digitalization of the transportation ecosystem. The first is transport management systems (TMS), the second is enterprise resource planning (ERP), the third is GPS/telematics, the fourth is electronic dispatching and the fifth is electronic documentation and electronic proof of delivery. The latter encompasses data warehouses, dashboards, forecasting, route optimisation, cost analysis and predictive maintenance. The third one consists of digital quotations, service booking, shipment tracking, estimated-time-of-arrival (ETA) notifications and online feedback. The fourth encompasses API/EDI links with customers, shippers, warehouses, ports, subcontractors, freight-matching platforms and payment systems.

This classification is designed to prevent making an error in measuring digital transformation on the basis of the number of technologies acquired. Two businesses can both employ GPS, but one might employ it to merely track the location of vehicles, while the other would also utilize GPS to supplement transport orders, payloads, fuel consumption, maintenance schedules and delivery timetables to make better decisions. The value of digital transformation is in the second scenario.

Table 1. Dimensions of digital capability in freight transport enterprises

Dimension	Typical content	Expected managerial value
Operational digitalization	TMS, GPS/telematics, electronic dispatching, e-POD, e-invoicing	Improve control; reduce manual processing and errors
Data and analytics	Data warehouse, dashboards, route optimization, load forecasting, cost analytics, predictive maintenance	Improve decision quality and speed
Digital customer interface	Quotation, service booking, shipment tracking, ETA, digital reconciliation and online feedback	Increase transparency, customer experience, and retention
Ecosystem integration	API/EDI, freight-matching platforms, connections with warehouses, ports, shippers, and subcontractors	Reduce transaction friction and improve network efficiency

Source: *Compiled by the author from Verhoef et al. (2021), Cichosz et al. (2020), and Lai et al. (2008).*

2.2. Resource-based view and dynamic capabilities

The resource-based view (RBV) suggests that SCA is not based merely on what the firm has acquired and bought on the market, but on how they have the capacity to possess, combine, and exploit the resources that are valuable, rare, difficult to imitate, and difficult to substitute (Barney, 1991). Having a widely available TMS package or GPS device isn't enough to give you an edge as competitors can obtain the same technology. Advantage is when technology and historical data is joined with route knowledge, dispatching capability, process discipline, customer relationships, driver experience, analytical capability, and network-coordination competence.

This is expanded upon in dynamic-capability theory. Teece, Pisano, and Shuen (1997) highlight the capacity for integration, construction, and adaptation of skills to adapt to different situations. Digital data assist enterprises in observing the network conditions faster, analyzing demand and cost changes, redeploying vehicles, adjusting prices, and reorganizing processes in the field of freight transport. The authors of Mikalef et al. (2020) reveal that the competitive performance is influenced by the big-data analytics capability through dynamic and operational capabilities. This further supports the thesis that value is created by data only when they are transformed into capabilities for action.

The study does not make the assumption of a direct and uniform relationship between investment in technology and financial performance. Digital transformation is understood as an input competence, while financial performance and competitiveness are at the end of a conversion chain, with intermediate mechanisms and boundary conditions.

2.3. Financial performance and competitiveness

The performance of freight transport operations should be measured in four aspects, namely, cost efficiency, profitability, asset-utilization efficiency and cash-flow efficiency. Freight transport is an asset-intensive operation and profitability is driven by freight rates but also by vehicle utilisation, empty kilometres, fuel usage, waiting time, maintenance costs, coordination costs, and

the speed of receivables collection. Indicators that are relevant are cost-to-revenue ratio, operating margin, return on assets (ROA), asset turnover, revenue per vehicle, loaded-kilometre ratio, fuel cost per transport unit and days sales outstanding (DSO).

Competitiveness is the capacity of an enterprise to establish and maintain a better market position than its competitors through cost, quality, reliability, responsiveness, transparency of information, flexibility, extension of the market network, integration of customers and innovation in services. Information technology has the potential to impact on cost advantage and differentiation, as demonstrated by Porter and Millar (1985). For freight transport, both these paths are mutually complementary: The same data system can cut down on empty running at the same time as it gives customers more reliable ETA information.

Both the concepts should be differentiated as in the short run, there is no guarantee that financial performance and competitiveness will increase at the same time. A data-integration project or customer portal can lead to higher investment costs before it even makes money, but it can also help to improve customer retention, service standardization, and access to long supply chains. On the other hand, an isolated digital solution can yield cost-saving benefits that can enhance short-term profitability, but also leave a company exposed to competition if the solution can be easily replicated.

2.4. Proposed analytical framework

The study suggests that a three-layer impact chain can be used to conceptualize the impact: digital capability, operational conversion mechanisms, and financial and competitive outcomes. The conversion mechanisms that are being applied in the operations are cost optimization, utilizing assets, increasing information quality, reducing transaction time, increasing service reliability, integrating customers with partners, and developing new services.

The conditions on the firm side such as financial resources, the quality of data, process standardization, digital skills, leadership commitment, digital compatibility with customers and partners, data security, infrastructure and policy support shape this chain. The framework thus provides insight into how technology can be implemented differently in enterprises, which leads to different results. Similarly, in another Vietnamese research setting, Nguyen, Luong, and Tran (2026) demonstrate that institutional quality and support infrastructure can enhance the process of turning signals and capabilities into fundraising. The present study does not directly extrapolate the results from entrepreneurship to freight transport, but relies on this finding for supporting evidence of the general role of an enabling environment.

Table 2. Digital Capability - Operational Conversion - Firm Outcomes Framework

Analytical layer	Content	Indicators/manifestations
Digital capability	Digital operations, data and analytics, customer interface, ecosystem integration	Digital process coverage; data integration; analytics capability; API/EDI connectivity
Operational conversion	Route/load optimization, fuel control, dispatching, maintenance, documentation, ETA, reconciliation	Empty kilometres; waiting time; fuel use; processing time; on-time delivery; invoice-preparation time
Financial performance	Costs, profitability, asset utilization, cash flow	Cost/revenue; ROA; operating margin; asset turnover; DSO
Competitiveness	Price, reliability, transparency, responsiveness, differentiation, innovation	On-time delivery; retention rate; response time; share of digital services; integrated contracts
Boundary conditions	Resources, data, skills, leadership, partners, security, policy	Budget; data quality; workforce capability; system compatibility

Source: *Proposed by the author based on the RBV, dynamic-capability theory, and digital-logistics research.*

2.5. Research design and analytical procedure

The study takes a qualitative design, conceptual approach, and a focus on policy from a document analysis and evidence synthesis. It does not build its own survey and is not measuring causal relationships from primary data. This design is suitable because financial impacts are separated from competitive impacts and value creation mechanisms identified, and conditions for successful or failed digital transformation are defined.

The documentary corpus is divided into four groups. The first are basic research on the RBV, DC, IT and competitive advantage. The second includes international research on digital transformation in logistics, Logistics 4.0, big data and firm performance. The third contains empirical research conducted in Vietnam in recent years on digital transformation, financial performance and the transport/logistics industry, with a focus on studies that make clear the methodology and data sources. The fourth includes official statistics, the National Digital Transformation Programme, and Vietnam's logistics-services development strategy.

To better explain the boundary conditions in the Vietnamese context, the study also selects and presents evidence from other transport sectors to clarify mechanisms that are applicable in other fields as well, such as financial-data transparency, data-based risk management, institutions and supporting infrastructure, and digital and green transformation. This type of evidence is only passed on at the mechanism level, and is not regarded as direct evidence of freight transport businesses.

There are four stages to the analysis. First, the four digital-capability groups are infused with digital technologies and practices. Secondly, the mechanisms by which these technologies can operate directly, such as routing, loading, waiting time, maintenance, documentation, customer communication, and reconciliation, are identified. Third, operational changes are correlated with financial and competitive results. Fourth, conflicting evidence is analyzed to find the boundary conditions and the digitalization paradox.

Evidence on logistics enterprises in general is used cautiously. This does not imply that empirical coefficients estimated for logistics companies can be simply taken over for all freight-transport modes. This distinction restricts the interpretation beyond the evidence.

III. RESEARCH FINDINGS

3.1. Freight growth context and digital-transformation requirements

Data for 2024-2025 show double-digit growth in Vietnam's freight demand in both transported volume and tonne-kilometres. This creates a managerial paradox: larger scale can improve revenue, but if dispatching and management continue to depend on fragmented data, coordination costs, processing time, and operational risks can rise rapidly as well. The first economic significance of digital transformation therefore lies in enabling enterprises to process larger transaction volumes without a proportional increase in administrative and coordination costs.

Notably, the 2025-2035 Logistics Strategy does not treat digital transformation as an isolated objective. It places digitalization alongside competitiveness, cost reduction, higher value added, green transformation, and human-resource development. This policy design is consistent with the findings of the present synthesis: digitalization has economic meaning only when it changes network efficiency and service quality.

Table 3. Selected freight transport indicators in Vietnam, 2024-2025

Indicator	2024	2025	Key change
Freight volume transported	2,670.6 million tonnes	3,027.7 million tonnes	Up 14.0% in 2024 and 14.1% in 2025
Freight traffic	545.1 billion tonne-km	612.3 billion tonne-km	Up 11.8% in 2024 and 13.1% in 2025
Logistics digitalization policy	National Digital Transformation Programme continued	2025-2035 Logistics Strategy issued	Target: 80% of logistics enterprises using digital-transformation solutions by 2035

Source: *Compiled from General Statistics Office of Vietnam (2025, 2026) and Decision No. 2229/QD-TTg.*

3.2. Mechanisms affecting financial performance

3.2.1. Reducing operating and transaction costs

The most direct impact channel is cost. TMS, automated dispatching, digital maps, GPS/telematics, and route optimization can reduce unnecessary distance, waiting time, coordination calls, and deviations from plan. Electronic documents, e-POD, and e-invoicing can reduce repetitive data entry and administrative costs. However, value does not come from merely having a system; it comes from changing dispatching and control rules on the basis of data.

In road freight transport, for example, a system that only displays vehicle location creates monitoring value, whereas a system that links location with transport orders, payloads, delivery windows, fuel consumption, and driver status can support cost optimization. Similarly, document digitalization reduces paperwork only when data are reused throughout the process from transport order to acceptance and invoicing. If employees re-enter the same data at each stage, much of the expected benefit disappears.

Evidence from Nguyen et al. (2026) shows that digital transformation is positively associated with ROA and cost efficiency in a sample of Vietnamese logistics enterprises. These estimates cannot be applied mechanically to every freight carrier, but they support the mechanism through which lower operational friction and processing costs can translate into financial outcomes.

An additional financial channel is stronger risk control and lower financial leakage through data. In a study of risk management in construction procurement, Nguyen, Thai, and Tran (2025) propose digital transparency and data analytics for anomaly detection as one of three pillars for preventing financial losses. Although the research context differs from freight transport, the mechanism is transferable at the management level: when route, fuel, surcharge, maintenance, and payment data are integrated, enterprises can identify deviations earlier, improve transaction traceability, and reduce losses associated with manual controls or fragmented data.

3.2.2. Improving vehicle and asset utilization

Freight transport is highly asset intensive. Vehicles generate revenue only when they are assigned to the right load, route, and time. Empty running, loading and unloading delays, idle vehicles, and poorly timed maintenance all represent capacity losses. Real-time data and freight-matching platforms can improve visibility of spare capacity, while historical analytics can support demand forecasting and better vehicle allocation.

The financial effects of this mechanism appear in revenue per vehicle, loaded-kilometre ratio, asset turnover, and fixed cost per transport unit. This is a distinctive feature of freight transport compared with purely service-based firms: digital efficiency is reflected not only in office-labour productivity but also in the utilization of physical assets.

3.2.3. Maintenance management and asset lifecycle

Vehicle failures create two types of cost: direct repair costs and opportunity costs from interrupted operations. Digital maintenance records, sensor data, and anomaly alerts allow a gradual shift from reactive maintenance toward preventive or condition-based maintenance. This does not mean that annual maintenance expenditure must immediately decline; enterprises may increase planned maintenance expenditure while reducing major breakdowns, downtime, and emergency-recovery costs.

Financial evaluation should therefore consider lifecycle cost and vehicle availability rather than repair expenditure alone. A predictive-maintenance initiative should be considered successful only if it reduces total downtime and increases the number of days that vehicles are available to generate revenue.

3.2.4. Revenue growth and revenue quality

Digital transformation also affects the revenue side. Real-time tracking, reliable ETA information, automated status reporting, historical delivery data, and customer portals increase the perceived value of the service. For business customers, shipment visibility and data integration can be as important as freight rates. This provides a basis for enterprises to move from selling transport capacity to providing information-rich transport services.

Such capability can support larger contracts, higher renewal rates, value-added services, and better revenue quality. Lai et al. (2008) show that the IT capability of logistics providers is associated with innovative and customized services and with quality improvement, suggesting that the revenue mechanism is not limited to lower prices generated by cost savings.

3.2.5. Shortening the documentation and cash-flow cycle

A frequently overlooked financial issue is the time between delivery and the completion of documents required for invoicing and collection. Paper proof of delivery, missing signatures, manual reconciliation, and delays in document transfer can lengthen this cycle. e-POD, electronic reconciliation, and integration between transport and accounting systems can shorten invoice preparation, reduce errors, and lower dispute frequency.

This mechanism can improve liquidity even when revenue and profit margins remain unchanged. For enterprises with substantial working-capital needs for fuel, wages, road charges, and maintenance, reducing days sales outstanding can be strategically as important as part of an improvement in profitability.

Beyond shortening document cycles, digitalization and standardization of financial data can improve the quality of information available to creditors, investors, and financial partners. In a study of the startup ecosystem in Thanh Hoa Province, Le and Tran (2025) find that greater financial-statement transparency, more reliable information, and data standardization are positively associated with capital attraction and can shorten due diligence and reduce transaction costs. Although the study does not examine transport enterprises, the mechanism suggests that integrating operational data with accounting, e-invoicing, and management reporting can create additional financial value through information quality, not merely through faster document processing.

Table 4. Digital-transformation mechanisms and expected effects on financial performance

Digital application	Operational mechanism	Financial outcome to monitor
TMS/digital dispatching	Better allocation of orders and vehicles	Coordination cost; revenue per vehicle; asset-utilization rate
GPS/telematics	Control of routes, stops, and fuel consumption	Fuel; empty kilometres; cost per kilometre
Route/load optimization	Reduce distance and increase load factor	Operating margin; cost per order; asset turnover
e-POD/digital documents	Shorten document completion	Invoice-preparation time; DSO; administrative cost
Predictive maintenance	Reduce failures and vehicle downtime	Lifecycle cost; available operating days
Customer portal/API	Increase transparency and reduce transaction friction	Customer retention; contract revenue; service cost
Data analytics/AI	Forecasting, price optimization, and capacity optimization	ROA; operating margin; revenue per asset

Source: *Compiled by the author from Lai et al. (2008), Cichosz et al. (2020), Mikalef et al. (2020), Le and Tran (2025), Nguyen, Thai, and Tran (2025), and Nguyen et al. (2026).*

3.3. Mechanisms affecting competitiveness

3.3.1. Cost advantage and pricing capability

If digital transformation reduces empty kilometres, fuel consumption, errors, and coordination costs, an enterprise has two options: retain the savings to improve margins or share part of the savings with customers through more competitive pricing. Operational efficiency can therefore be converted directly into cost advantage.

However, advantage based solely on widely available software is difficult to sustain. Competitors can purchase similar technology. More difficult to imitate are accumulated data, operational discipline, partner networks, forecasting models, and coordination among sales, dispatching, drivers, and accounting. This is the central RBV argument when applied to digital freight transport.

3.3.2. Reliability, transparency, and customer experience

In freight transport, uncertainty is itself a cost to customers. A low freight rate does not compensate for uncertainty about cargo location, arrival time, or how disruptions are being handled. Real-time tracking, ETA information, exception alerts, and delivery data reduce information uncertainty and help customers coordinate inventory, production, and receiving activities more effectively.

Digital transformation therefore creates competitiveness through information quality alongside the quality of physical transport. Digital systems should consequently be evaluated using on-time delivery, ETA accuracy, incident-response time, and customer self-service rates rather than only the number of software users.

3.3.3. Responsiveness and flexibility

Data on spare capacity, vehicle location, and order status enable enterprises to respond more quickly to unexpected demand. In markets characterized by seasonal volatility, schedule changes, or urgent orders, accurate visibility of available resources can shorten quotation and transport-confirmation times.

This capability corresponds to the logic of dynamic capabilities: enterprises sense signals, seize opportunities, and reconfigure resources more rapidly. Bag et al. (2020) emphasize the role of Logistics 4.0 capabilities in improving supply-chain agility and responsiveness.

3.3.4. Customer integration and relationship switching costs

When a freight carrier's systems are integrated with a customer's ordering or supply-chain management systems, the transactional relationship becomes deeper. Customers receive transport data automatically, reduce manual data entry, and develop shared routines. The cost of replacing the carrier is then no longer limited to finding a different freight rate; it also includes redesigning data connections and operating routines.

Digital integration can therefore support customer retention, particularly in high-volume B2B contracts. Competitive value lies in the ability to fit into customer processes, not simply in the visual design of an application.

3.3.5. Service innovation and digital-green convergence

Operational data enable additional services such as route-performance reports, delivery-time analytics, proactive alerts, customized dashboards, and emissions reporting. As supply chains face increasing requirements for traceability and emissions information, transport data can become part of the service offering rather than remaining purely internal data.

Decision No. 2229/QD-TTg places digital transformation alongside green transformation. This creates a new competitive pathway: route and load optimization can reduce both fuel consumption and emissions, while fuel-use data can support both cost control and environmental reporting. Enterprises that integrate these objectives may gain an advantage when participating in the supply chains of exporters and companies subject to environmental, social, and governance (ESG) requirements.

This convergence approach is also supported at the mechanism level by Vu and Tran (2026). In the context of community-based tourism in Vietnam, the authors show that dual transformation - digital and green transformation - simultaneously creates pressure for innovation in products, processes, organization, and markets, while requiring digital capability, green capability, and value-chain linkages. The present study does not extrapolate sector-specific findings, but uses this mechanism to reinforce the argument that freight enterprises can create greater value when digital data are used not only for cost optimization but also for process redesign, lower resource consumption, and the development of transport services that respond to customers' green requirements.

Table 5. Digital-transformation mechanisms and competitiveness

Mechanism	Manifestation in freight transport	Possible competitiveness indicator
Cost advantage	Reduce empty kilometres, fuel consumption, and manual processing	Cost per order; pricing capability; operating margin
Reliability	Real-time tracking, ETA, exception alerts	On-time delivery; ETA accuracy; complaint rate
Responsiveness	Visibility of spare capacity and network status	Quotation time; order-confirmation time; urgent-order response rate

Customer integration	API/EDI, customer portals, digital reconciliation	Share of integrated customers; retention rate; transaction-processing time
Service innovation	Dashboards, analytics, carbon reporting	Share of revenue from digital/value-added services
Resilience	Network visibility and exception management	Recovery time after disruption; service-completion rate

Source: *Compiled by the author from Porter and Millar (1985), Lai et al. (2008), Cichosz et al. (2020), Bag et al. (2020), and Vu and Tran (2026).*

3.4. The digitalization paradox and heterogeneous outcomes

The key takeaway from the evidence synthesis is that the impacts of digital transformation are contingent. Vu et al. (2024) shows that financial gains from digital transformation in Vietnam are more apparent for companies with relatively good financial performance. In an inverted U-shaped relationship, Qi et al. (2025) then establish a link between digitalization and financial performance, while demonstrating that firms that are aligned with their suppliers obtain benefits from digitalization. These two results, taken together, signal insecurity about the notion that doing more equals doing better with technology.

First of all, the condition of process maturity is a precondition. Implementing an inefficient process with automation can just make mistakes happen more quickly. Before scaling up automation, enterprises ought to agree upon order codes, vehicle codes, trip definitions, delivery time-stamps, as well as exception-handling policies.

Second, the quality of the data is critical. Without accurate, complete and consistent data, analytics or artificial intelligence systems will not provide good decisions. For freight transport, delivery time, actual kilometres, fuel consumption or customer codes are all prone to error, and this not only affects cost analysis but also dispatching decisions.

Third, the resources--both financial and human--that are available dictate the potential capacity for absorptive capacity. Financial capability, digital skills and leadership from top management are key factors that contribute to digital transformation in Vietnamese shipping companies, according to Nguyen (2024). This is particularly crucial for smaller and medium sized enterprises where the cost of integration and training can be quite significant compared to the income from the business.

Fourth, is compatibility between customers and partners that reflects end-to-end effectiveness. When the partner is not digitally compatible, it is possible for an enterprise to have its internal processes digitized, but still need to print documents, re-enter data, and confirm transactions over the phone. Digital-transformation performance is thus not just a firm-specific value, but also a value that is dependent on the digital maturity of the network of firms in which the firm operates.

It is also important to consider at the environmental level the quality of institutions and the support provided as a factor that can either strengthen or weaken the relationship between inputs and outputs. Nguyen, Luong, and Tran (2026) find that the impact of fundraising signals is amplified when the institutional and support-infrastructure conditions are positive. While the context of the empirical example is somewhat different from freight transport, the result confirms the overall proposition that the capability of enterprises to a large extent relies on the quality of the external ecosystem. In the context of freight transport, these elements are digital infrastructure, data standards, system connectivity, payment platforms and the digital maturity of related logistics nodes.

Fifth, data security and access governance turn into new areas of risk. The greater the system integration, the more valuable the data becomes, and the more severe are the repercussions if it is leaked from the system or disrupted. One of the biggest challenges for logistics service providers to undertake digital transformation is data protection (Cichosz et al., 2020).

Table 6. Boundary conditions affecting the conversion of digital investment into outcomes

Condition	Risk when weak	Required management response
Process standardization	Digitalizes waste and increases complexity	Standardize order-dispatch-delivery-reconciliation flows before automation
Data quality	Dashboards/AI produce misleading outputs	Assign data ownership; define data standards; implement quality checks
Financial capacity	Scattered investment and insufficient maintenance budget	Implement by business case and in stages
Digital skills	Systems are not used correctly	Role-specific training; link system use to job accountability
Leadership	Technology becomes detached from strategy	Set value objectives and establish project-portfolio governance
Partner compatibility	End-to-end digital processes break down	Prioritize open standards, API/EDI, and data agreements
Cybersecurity and safety	Data leakage and operational disruption	Access control, backups, monitoring, and recovery plans

Source: *Compiled by the author from Cichosz et al. (2020), Nguyen (2024), Vu et al. (2024), Qi et al. (2025), and Nguyen, Luong, and Tran (2026).*

3.5. A value-oriented digital-transformation roadmap

Based on the identified mechanisms and boundary conditions, the study proposes a five-stage roadmap. Stage 1 is process and data standardization: harmonizing codes, roles, control points, and data flows. Stage 2 is core operational digitalization: transport orders, dispatching, GPS/telematics, e-POD, and invoicing. Stage 3 is internal integration: linking transport with accounting, sales, maintenance, and customer management. Stage 4 is ecosystem integration: connecting customers, subcontractors, warehouses, ports, freight platforms, and payment systems. Stage 5 is advanced analytics and digital-green convergence: forecasting, optimization, AI, predictive maintenance, and emissions reporting.

The central principle of the roadmap is that every stage must be linked to outcome indicators. Enterprises should not move to the next stage simply because a system has been purchased or installed. For example, e-POD implementation should be tied to a target for reducing invoice preparation time; route optimization should be linked to empty kilometres and fuel consumption; customer portals should be linked to response time and customer self-service rates.

IV. DISCUSSION

4.1. Theoretical implications

The findings reinforce a capability-based rather than technology-ownership-based approach. The RBV explains why commonly available software does not automatically generate sustainable advantage, whereas dynamic-capability theory explains how data and technology help enterprises reconfigure operations. Combining these perspectives shows that digital capability is only the starting point of the value-creation chain.

A second contribution is to position financial performance and competitiveness within the same framework without treating them as identical outcomes. A mechanism such as load optimization can simultaneously reduce costs and improve pricing capability, while a mechanism such as API integration may not immediately improve profit but can deepen customer relationships. Separating the two outcome groups therefore supports a more balanced evaluation of digital investment.

A third contribution is to clarify operational conversion as an intermediate layer. Many studies measure digital transformation using technology indicators and measure performance using financial indicators. The proposed framework adds operational indicators such as empty kilometres, vehicle utilization, on-time delivery, document-processing time, and ETA accuracy. This layer makes it possible to determine whether digital investment has actually changed operations before expecting financial effects.

4.2. Comparison with empirical evidence

The synthesis is consistent with Nguyen et al. (2026), who identify a positive relationship between digital transformation and financial performance among Vietnamese logistics enterprises. The present study does not, however, conclude that every freight carrier will experience a positive effect, because Vu et al. (2024) demonstrate differences according to firms' initial financial positions. Taken together, these two evidence streams support a conditional conclusion: digital transformation has the potential to improve financial performance, but the extent of value realization depends on absorptive and organizational capabilities.

The findings are also consistent with Lai et al. (2008), who show that IT capability can generate competitive advantage through cost reduction, innovation/customization, and service quality. The contemporary extension is that real-time data, platform integration, and AI deepen these mechanisms while creating additional risks related to cybersecurity and system compatibility.

Nguyen's (2024) study of Vietnamese shipping companies shows that technological, organizational, and environmental factors jointly affect digital-transformation implementation. This result supports the proposed boundary-condition framework: without skills, financial capacity, or leadership commitment, firms are unlikely to move from technology experimentation to digital operating capability.

4.3. Managerial implications

For managers, the most important shift is from an IT-project mindset to a value-creation project portfolio. Every digital initiative should answer three questions: Which process will change? Which operational indicator will improve? Which financial or competitive outcome is expected to benefit? If this chain cannot be specified, the project does not yet have a sufficiently clear business case.

Enterprises should also establish baseline indicators before digitalization. Without initial data on empty kilometres, waiting time, on-time delivery, fuel consumption, invoice-preparation time, or customer-retention rates, it is difficult to demonstrate benefits after investment. Measurement should therefore be designed together with the digital initiative rather than after the system has already been implemented.

Another implication is to prioritize integration rather than the number of applications. Many enterprises may own GPS systems, accounting software, CRM, and dispatching applications, yet the systems do not exchange data. In such cases, employees become manual APIs by repeatedly re-entering data, which eliminates much of the expected value of digital transformation.

4.4. Policy implications

The target for 80% of logistics enterprises to use digital-transformation solutions by 2035 is an important indicator, but policy effectiveness should not be measured only by adoption rates. Support programmes should also consider the level of integration and outcomes such as shorter processing time, lower empty running, standardized documentation, and greater data connectivity.

For small and medium-sized enterprises, support should focus on foundational infrastructure and interoperability standards rather than subsidizing isolated systems that are difficult to connect. Common standards for transport data, electronic documents, and APIs can lower integration costs across the ecosystem.

Human-resource policy should likewise move beyond software-use skills toward freight-data analytics, process design, digital-project management, and cybersecurity. These capabilities determine whether technology is absorbed into organizational capability.

V. CONCLUSIONS AND RECOMMENDATIONS

5.1. Conclusions

The influence of digital transformation on financial performance and competitiveness of freight transport enterprises in Vietnam is analysed based on theoretical and empirical studies and using official data. The results indicate that digital transformation is not just about buying and implementing technology but a transformation of data and digital connectivity into changes in operations' organization.

The five key mechanism groups for financial performance are: Lowering operating and transaction costs, Vehicle and asset utilization, Maintenance management, Revenue and value added services, Documentation and cash flow. The key enablers that can drive competitiveness are: cost advantage, reliability and transparency, responsiveness, customer-partner integration, service innovation and digital-green convergence.

The results are, however, not linear nor homogeneous. Processes need to be standardized, data needs to be of good quality, there is a need for sufficient financial resources, digital skills, leadership, ecosystem compatibility, and data security. Thus, the study suggests the Digital Capability - Operational Conversion - Firm Outcomes Framework in which operational conversion is the link between technology investment and financial outcomes or competitive advantage.

5.2. Recommendations for freight transport enterprises

First, standardize processes and data before automation. Enterprises should map the entire quotation - order receipt - dispatching - delivery - proof of delivery - reconciliation - invoicing - collection process and standardize data codes and control points before selecting technology.

Second, prioritize the digitalization of the core transport cycle. For many enterprises, TMS, telematics, digital dispatching, e-POD, and invoice integration will create more immediate value than AI implementation when basic operational data remain incomplete.

Third, establish a unified data architecture. Vehicle, driver, route, customer, order, fuel, maintenance, and delivery data require common definitions, clear ownership, and quality-control mechanisms.

Fourth, evaluate projects through business cases and key performance indicators. Every project should be linked to baseline indicators and specific targets such as reducing empty kilometres or fuel consumption, shortening invoice preparation, increasing on-time delivery, or improving customer retention.

Fifth, gradually integrate with customers and partners after internal processes become stable. API/EDI connections, freight-matching platforms, and digital reconciliation can create greater network value, but only when internal processes are sufficiently standardized.

Sixth, develop role-specific digital skills. Dispatchers need dashboard and optimization capability; drivers need data discipline; sales staff need customer-data skills; accounting teams need integrated transport-cost data; and senior managers need the ability to govern a portfolio of digital investments.

Seventh, connect digital transformation with green transformation. Route, load, and fuel data should simultaneously support cost control, emissions measurement, and operational improvement. Following the logic of dual transformation, enterprises should regard digitalization and greening as a common restructuring programme rather than two separate projects. This approach links financial performance, process innovation, and the ability to respond to increasingly demanding environmental requirements from customers (Vu & Tran, 2026).

5.3. Policy recommendations

First, implement the 2025-2035 Logistics Strategy by measuring value-generating digital transformation rather than merely the share of enterprises using digital solutions. The indicator set should include data-integration levels, use of electronic documents, platform-connectivity rates, and operational outcomes.

Second, develop common data standards and interoperability mechanisms for transport and logistics. Standardized APIs/EDI, documents, and identifiers can reduce connectivity costs for small enterprises and prevent lock-in to isolated proprietary systems.

Third, support small and medium-sized enterprises through a digital-maturity roadmap that includes current-state assessment, process standardization, foundational technology selection, data security, and training, rather than support focused primarily on equipment purchases.

Fourth, develop interdisciplinary human resources that combine transport, logistics, data, and management capabilities. Training programmes should expand content on transport-cost analytics, network optimization, digital-process design, data governance, and cybersecurity.

Fifth, coordinate digital-transformation policy with green-logistics policy. Transport-data systems can provide a basis for measuring fuel use, load factors, and emissions, thereby supporting both enterprise management and transport-sector emissions-reduction policy.

5.4. Limitations and directions for future research

The study has three main limitations. First, because the design is based on documentary and secondary evidence, it does not provide a new causal estimate specifically for Vietnamese freight transport enterprises. Second, freight transport includes road, inland waterways, maritime, rail, and air transport, and the cost structure and value of individual technologies differ across modes. Third, part of the available empirical evidence concerns logistics enterprises broadly and is therefore used to identify mechanisms rather than to represent all freight carriers.

Future research should construct firm-level panel datasets linking digital-transformation indicators with ROA, ROE, operating margins, cost-to-revenue ratios, asset turnover, and DSO. Transport-specific indicators should also be included, such as empty-kilometre ratios, load factors, fuel consumption per tonne-kilometre, on-time delivery, vehicle turnaround time, and the interval from delivery to invoicing.

Methodologically, future studies could use fixed-effects models, quantile regression, difference-in-differences designs around identifiable system-implementation events, or instrumental-variable approaches to address endogeneity. A particularly important direction is to test threshold effects: digital transformation may create benefits only after an enterprise reaches minimum levels of data standardization, integration, and workforce capability. Comparative analysis should also examine differences by firm size, transport mode, and participation in international supply chains.

Finally, the relationship between digital transformation and green transformation requires empirical testing. The ability to use the same data to optimize costs, reduce empty running, measure emissions, and provide carbon reporting may become an important source of competitive advantage for Vietnamese freight transport enterprises in the coming period.

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