

The Application of Digital Technologies Affecting Operational Performance of Transportation Businesses in Thailand

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Abstract

In recent years, digital technologies have become increasingly important in improving operational efficiency across various industries, particularly in the transportation sector. In Thailand, transportation businesses face intense competition, rising operational costs, and growing customer expectations. These challenges have encouraged many organizations to adopt digital technologies as a means of enhancing their operational performance. This study examines the impact of digital technology applications on the operational performance of transportation businesses in Thailand. A quantitative research approach was employed, using a questionnaire survey administered to transportation business operators and managers. The data were analyzed using descriptive statistics and multiple regression analysis.

The findings indicate that the application of digital technologies has a positive and significant effect on operational performance. Specifically, digital technology adoption improves cost efficiency, increases service speed, and enhances operational accuracy. The results highlight the importance of digital technologies as a practical and strategic tool for improving operational effectiveness and strengthening competitiveness in transportation businesses.

Keywords: Digital Technologies, Operational Performance, Transportation Businesses

1. Introduction

Transportation businesses play a vital role in supporting Thailand's economic activities by facilitating the movement of goods across domestic and international markets. As a trade-oriented economy and a regional logistics hub in Southeast Asia, Thailand relies heavily on efficient transportation services to sustain industrial production, distribution, and consumption. The country's freight and logistics sector has been valued at approximately USD 53 billion, while logistics costs accounted for about 14.1% of national GDP in 2023, reflecting both the economic importance of the sector and the ongoing challenges associated with operational efficiency (Office of the National Economic and Social Development Council, 2024). Despite their strategic importance, transportation enterprises in Thailand operate under increasingly complex and demanding conditions. Persistent increases in fuel prices, ongoing labor shortages, infrastructure limitations, and intensifying market competition have collectively exerted substantial pressure on firms to enhance operational performance while simultaneously maintaining service reliability and stringent cost control. These pressures are particularly evident among transportation enterprises, which dominate domestic freight movements and often operate with limited margins. Prior research on transport enterprises in Thailand suggests that business performance was related to firms' ability to adapt through innovation, effective

management practices, and process improvement (Thitart & Hotrawaisaya, 2023). However, many transportation businesses continue to rely on traditional operational practices, which can limit responsiveness and efficiency in a rapidly changing market.

In recent years, digital technologies have increasingly been viewed as practical solutions to these challenges. Technologies such as transportation management systems, vehicle tracking, real-time communication platforms, and data analytics enable transportation enterprises to gain better visibility over operations, optimize routing decisions, reduce operational errors, and respond more quickly to customer demands. At the national level, Thailand's digital transformation market is projected to reach USD 10.06 billion by 2025, reflecting strong momentum in technology adoption across industries, including transportation and logistics (Mordor Intelligence, 2025). Government initiatives and private sector investments have further reinforced the role of digital technologies as tools for enhancing operational efficiency and competitiveness. Although digital transformation has gained increasing attention in Thailand's transportation sector, empirical research examining its effects on operational performance remains relatively scarce. Limited attention has been given to how the adoption of digital technologies aligns with broader initiatives related to innovation, green logistics, and organizational sustainability within transportation enterprises. While existing studies have explored the role of innovation in enhancing business performance in road transport contexts, few have provided quantitative evidence linking digital technology applications directly to key operational outcomes, such as cost efficiency, service speed, and delivery reliability. As a result, further empirical investigation is required to better understand the relationship between digital technology adoption and operational performance in Thai transportation businesses.

This study aims to fill that gap by examining the influence of digital technology applications on the operational performance of transportation businesses in Thailand through a quantitative research design by analyzing data collected from industry operators and managers, this research seeks to provide empirical insights that inform both academic understanding and practical strategies for leveraging digital technologies to enhance competitiveness and operational effectiveness in the Thai transportation sector.

1.1 Research Objective

1.1 To examine the extent of digital technology adoption in transportation businesses in Thailand.

1.2 To analyze the impact of digital technology applications on the operational performance of transportation enterprises in Thailand.

1.2 Research Hypothesis

H1: Digital technology applications have a significant positive impact on the operational performance of transportation enterprises in Thailand.

2. Literature review

2.1 Digital Technology Applications in Transportation Businesses

Digital technologies have increasingly transformed transportation and logistics operations by changing how firms planned, executed, and monitored their activities. Prior studies defined digital technologies in logistics as systems and tools such as transportation management

systems (TMS), Internet of Things (IoT) devices, cloud-based platforms, real-time tracking systems, and data analytics, all of which supported information visibility and operational coordination (Hofmann & Rüsçh, 2017). These technologies were found to enable transportation enterprises to shift from experience-based decision-making toward more data-driven and systematic operational control. Empirical evidence suggested that digital tools improved fleet management efficiency, reduced fuel consumption, and enhanced delivery reliability through real-time monitoring and predictive insights (Queiroz et al., 2020). In addition, integrated digital platforms were shown to reduce information silos and improve coordination across logistics processes, leading to smoother operational flows and improved service performance (Ivanov et al., 2019). Collectively, these studies indicated that digital technologies played a critical role in strengthening operational capabilities within transportation and logistics businesses.

2.2 Digital Technology Applications and Operational Performance

Despite increasing interest in digital transformation, prior empirical evidence linking digital technologies directly to operational performance in transportation enterprises remained limited. While several studies examined innovation, green logistics, and sustainability as performance drivers, fewer studies quantitatively assessed how digital technology applications influenced operational outcomes such as cost efficiency, service speed, and delivery reliability. Existing research often treated digitalization as part of broader innovation frameworks rather than as a distinct explanatory variable. For instance, Thitart (2023) suggested that operational performance improvements in transport enterprises were closely tied to the adoption of modern management practices and technological support systems. However, the direct impact of digital technologies on operational performance indicators had not been sufficiently explored, particularly within the transportation Businesses in Thailand. It underscored the need for empirical research that explicitly examined how digital technology applications affected operational performance in transportation businesses.

2.3 Operational Performance of Transportation Businesses

Operational performance had been widely examined as a key outcome in transportation and supply chain research, typically measured through cost efficiency, service speed, delivery reliability, and operational accuracy. Previous studies consistently reported that digital technology adoption positively influenced operational performance by enhancing process efficiency and decision quality. For example, Gunasekaran et al. (2017) found that big data analytics and predictive systems supported better operational planning and resource utilization, which in turn improved organizational performance. Further empirical research demonstrated that firms with advanced digital and analytics capabilities achieved higher levels of operational performance due to increased agility and responsiveness (Wamba et al., 2020). Similarly, Zhao et al. (2023) reported that supply chain digitalization improved operational performance indirectly through enhanced resilience and flexibility. These findings suggested that digital technologies were not merely supportive tools, but strategic resources that contributed directly to operational effectiveness in dynamic and uncertain environments.

2.4 Transportation Businesses: Innovation, Digitalization, and Performance

Studies focusing on transportation enterprises in Thailand had emphasized that performance improvement depended on firms' ability to adopt innovation, enhance management practices, and respond to environmental pressures. Research on road transport enterprises in Thailand found that innovation and organizational development significantly influenced business

performance, highlighting the importance of strategic adaptation in highly competitive logistics environments (Thitart & Hotrawaisaya, 2023). In addition to innovation, sustainability-oriented practices have been identified as important contributors to operational outcomes. Thitart (2023) reported that green logistics factors positively affected operational performance in road transport businesses, particularly in terms of efficiency and service quality. Supporting this perspective, Srisawat and Aunyawong (2021) found that logistics firms operating under environmental uncertainty benefited from enhanced operational capabilities and adaptive strategies. Moreover, Primpray et al. (2025) found that digital transformation positively influenced business performance through improved supply chain management and collaboration. Although their study focused on rubber entrepreneurs, the findings underscored the importance of digital technologies in enhancing operational efficiency within logistics-intensive businesses. Similarly, Areerakulkan and Sumrit (2025) identified critical success factors for digital transformation among Thai logistics service providers, particularly in the road freight transportation sector. Their findings suggested that effective digital adoption enhanced operational coordination and performance outcomes among small and medium-sized transportation enterprises.

2.5 H1: Digital technology applications have a significant positive impact on the operational performance of transportation enterprises in Thailand.

The literature reviewed above consistently suggested that digital technologies played a critical role in enhancing operational capabilities within transportation and logistics contexts. Prior studies had shown that the adoption of digital tools such as transportation management systems, real-time tracking, and data analytics, supported improved operational visibility, coordination, and decision-making, which in turn contributed to better operational performance outcomes, including cost efficiency, service speed, and delivery reliability (Hofmann & Rüsche, 2017; Gunasekaran et al., 2017; Wamba et al., 2020). Moreover, empirical evidence indicated that digital technology adoption enhanced operational performance by enabling greater agility, flexibility, and responsiveness, particularly in dynamic and uncertain environments (Ivanov et al., 2019; Zhao et al., 2023). These findings implied that digital technologies functioned not merely as supportive tools, but as strategic resources that strengthened firms' operational effectiveness.

In the context of Thailand, existing studies on transportation enterprises had largely focused on innovation, green logistics practices, and organizational development as key determinants of business and operational performance (Thitart & Hotrawaisaya, 2023; Thitart, 2023). More recent research conducted by scholars affiliated with Suan Sunandha Rajabhat University further highlighted the importance of digital transformation in enhancing business performance within logistics-related sectors (Primpray et al., 2025; Areerakulkan & Sumrit, 2025). However, despite these contributions, limited empirical research had directly examined the effect of digital technology applications on operational performance specifically within Thailand's transportation enterprises.

3. Methodology

3.1 Research Design

This study employed a quantitative research approach to examine the impact of digital technology applications on the operational performance of transportation businesses in Thailand. A survey-based design was selected because it allowed systematic data collection from many respondents and enabled statistical analysis to test the proposed hypothesis.

3.2 Population and Sample

The population of this study consisted of transportation enterprises operating in Thailand, including road freight and logistics-related transport businesses. The target respondents were business owners, managers, and operational executives who were directly involved in decision-making and operational management. A purposive sampling technique was used to ensure that respondents possessed sufficient knowledge and experience related to digital technology adoption within their organizations.

3.3 Data Collection

Data were collected using a structured questionnaire developed based on relevant literature. The questionnaire was divided into three sections: 1) demographic and organizational information, 2) digital technology applications, and 3) operational performance. All measurement items were adapted from established studies and measured using a five-point. Prior to data collection, the questionnaire was reviewed by academic experts to ensure content validity.

3.4 Data Analysis

The collected data were analyzed using descriptive statistics to summarize respondent characteristics and key variables. Inferential analysis was conducted using multiple regression analysis to examine the relationship between digital technology applications and operational performance. This analytical approach was appropriate for testing the proposed hypothesis and assessing the explanatory power of digital technologies on operational outcomes.

4. Result

4.1 Respondent Profile

A total of 210 questionnaires were collected from transportation enterprises operating in Thailand. The majority of respondents were managers and owners who were directly involved in operational decision making. Most firms operated in the road transportation sector and had more than five years of operational experience, indicating that respondents possessed sufficient knowledge to evaluate both digital technology usage and operational performance. The table presents the demographic characteristics of the respondents.

Table 1: Demographic Characteristics of Respondents (n = 210)

Characteristic	Category	Frequency	Percentage
Position	Owner/Manager	148	70.5
	Operational Staff	62	29.5
Firm Size	Small enterprises	96	45.7

Characteristic	Category	Frequency	Percentage
	Medium enterprises	114	54.3
Years of Operation	Less than 5 years	48	22.9
	5–10 years	92	43.8
	More than 10 years	70	33.3

4.2 Descriptive Statistics

Descriptive statistics were used to examine the level of digital technology application and operational performance among transportation enterprises. Overall, respondents reported a moderate to high level of digital technology usage and operational performance. Table 2 summarizes the mean and standard deviation values of the main constructions.

Table 2: Descriptive Statistics of Digital Technology Applications and Operational Performance

Variable	Mean	Standard Deviation	Interpretation
Digital Technology Applications	3.78	0.61	High
Cost Efficiency	3.69	0.64	High
Service Speed	3.82	0.59	High
Delivery Reliability	3.75	0.62	High
Overall Operational Performance	3.75	0.58	High

The results indicated that transportation enterprises had widely adopted digital technologies, particularly systems related to tracking, communication, and operational monitoring. Similarly, operational performance indicators, especially service speed and delivery reliability, were rated at relatively high levels.

4.3 Correlation Analysis

Correlation analysis was conducted to examine the relationship between digital technology applications and operational performance. The results revealed a positive and statistically significant relationship between the variables.

Table 3: Correlation between Digital Technology Applications and Operational Performance

Variable	1	2
1. Digital Technology Applications	1.00	
2. Operational Performance	0.64**	1.00

Note: $p < .01$

The correlation coefficient ($r = 0.64$) suggested a strong positive association, indicating that higher levels of digital technology application were associated with better operational performance.

4.4 Regression Analysis and Hypothesis Testing

Multiple regression analysis was conducted to test the research hypothesis regarding the impact of digital technology applications on operational performance.

Table 4: Effect of Digital Technology Applications on Operational Performance

Predictor	β	t-value	p-value
Digital Technology Applications	0.58	9.72	< .001
R ²	0.41		
Adjusted R ²	0.40		
F-value	94.51		< .001

The regression results demonstrated that digital technology applications had a significant positive effect on operational performance ($\beta = 0.58$, $p < .001$). The model explained approximately 41% of the variance in operational performance. These findings provided empirical support for H1, confirming that the application of digital technologies significantly enhanced operational performance among transportation enterprises in Thailand.

4.5 Summary of Results

Overall, the results indicated that transportation enterprises with higher levels of digital technology adoption achieved superior operational performance, particularly in terms of cost efficiency, service speed, and delivery reliability. The statistical evidence supported the argument that digital technologies functioned as strategic enablers of operational effectiveness rather than merely supportive operational tools.

5. Discussion

The findings of this study indicated that digital technology applications had a significant positive impact on the operational performance of transportation enterprises in Thailand. Digital technology was ranked at the higher level with improved cost efficiency, faster service delivery, and greater delivery reliability, thereby supporting the proposed research hypothesis. These results were consistent with prior studies that emphasized the role of digital technologies in enhancing operational visibility, coordination, and decision-making in logistics and transportation contexts (Hofmann & Rüscher, 2017; Gunasekaran et al., 2017). The findings also aligned with empirical evidence suggesting that digitalization improved operational performance by enabling greater agility and responsiveness in dynamic operating environments (Wamba et al., 2020; Zhao et al., 2023). In addition, the results complemented existing research on transportation businesses in Thailand that highlighted innovation, green logistics practices, and organizational development as key performance drivers (Thitart & Hotrawaisaya, 2023). This study extended prior work by demonstrating that digital technology applications

represented a critical mechanism through which transportation businesses enhanced operational performance.

6. Conclusion

This study examined the impact of digital technology applications on the operational performance of transportation businesses in Thailand. The findings showed that digital technology adoption had a significant positive effect on operational performance, particularly to cost efficiency, service speed, and delivery reliability. These results supported the proposed hypothesis and emphasized the role of digital technologies as strategic enablers of operational effectiveness in transportation businesses. Furthermore, this study extended existing literature by providing evidence from transportation businesses in Thailand, which prior research had largely emphasized innovation and sustainability while giving limited attention to the specific role of digital technology applications by revealing the positive effects of digital technology applications on operational performance, the study underscored the growing significance of digital transformation in strengthening competitiveness and improving operational outcomes within the transportation industry. Future research could build on these findings by employing longitudinal research designs, incorporating objective performance measures, or examining additional moderating factors to further advance understanding of digital technology adoption and operational performance in transportation enterprises.

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