

# The Impact of Artificial Intelligence on Logistics Performance: Evidence from Road Transport Companies in Bangkok

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## Abstract

As logistics businesses face increasing pressure to improve efficiency, reduce costs, and enhance service quality, artificial intelligence (AI) has become an important technological tool. The objectives of this study are to examine the level of artificial intelligence adoption in road transport companies in Bangkok and to analyze the impact of artificial intelligence on logistics performance. Data was collected from a questionnaire survey distributed to managers and operational staff in road transport companies in Bangkok. The data was analyzed using descriptive statistics and multiple regression analysis. The findings show that road transport companies in Bangkok have adopted artificial intelligence at a moderate level, with technologies such as real-time tracking and route optimization being the most widely implemented. In addition, the results indicate that artificial intelligence adoption has a significant positive impact on overall logistics performance, particularly in improving delivery speed and reducing operational errors, while also contributing to cost efficiency and service reliability. These findings provide practical implications for road transport companies seeking to enhance competitiveness through digital transformation and contribute empirical evidence to the growing body of literature on artificial intelligence applications in logistics.

**Keywords:** Artificial Intelligence, Logistics Performance, Road Transport Companies

## 1. Introduction

Logistics plays a vital role in supporting economic activities by enabling the efficient movement of goods across supply chains. In Thailand, the logistics sector has expanded rapidly in response to growth in domestic consumption, e-commerce, and regional trade integration. Road transport remains the dominant mode of freight transportation, accounting for the largest share of goods nationwide due to its flexibility and extensive road network. As the capital city and main economic center, Bangkok serves as the core logistics hub of the country, hosting a large concentration of road transport and logistics service providers. Moreover, recent industry data indicate that the Bangkok Metropolitan Region accommodates more than 21,000 transportation and logistics establishments, representing the highest density of logistics-related businesses in Thailand. While these establishments include various logistics services, road transport companies constitute a substantial proportion, reflecting Bangkok's heavy reliance on road-based freight distribution. In addition, Thailand's logistics sector comprises over 30,000 registered logistics and transport firms nationwide, reinforcing the strategic importance

of major urban centers such as Bangkok for logistics operations (Department of International Trade Promotion [DITP], 2023).

Operating in such a densely populated and highly congested urban environment presents significant challenges for road transport companies. Traffic congestion, rising fuel costs, delivery delays, and increasing customer expectations for fast and reliable services place continuous pressure on logistics firms to improve operational efficiency and service performance. In response to these challenges, many transport companies have begun adopting digital technologies to support decision-making and operational control. Among these technologies, AI has emerged as a key enabler of logistics transformation. AI applications in road transport include real-time vehicle tracking, route optimization, demand forecasting, predictive maintenance, and automated scheduling systems. These technologies allow transport companies to process large volumes of operational data, anticipate disruptions, and respond more effectively to dynamic traffic and customer conditions. Prior studies suggest that AI adoption can improve logistics performance by enhancing delivery speed, reducing operational errors, lowering costs, and improving service reliability (AbdEllatif & Baazeem, 2025).

Although interest in AI-driven logistics solutions continues to grow, empirical evidence on how extensively AI is adopted and how it affects logistics performance among road transport companies in Bangkok is still limited. Many studies have largely focused on advanced economies or broader supply chain contexts, leaving a gap in understanding how AI influences logistics performance in urban road transport settings in developing countries. Addressing this gap is particularly important given Bangkok's role as a logistics hub and the increasing pressure on transport companies to remain competitive. Therefore, this study aims to examine the level of artificial intelligence adoption in road transport companies in Bangkok and to analyze the impact of artificial intelligence on logistics performance. By providing empirical evidence from Bangkok's road transport sector, this study contributes to the literature on AI applications in logistics and offers practical insights for transport companies seeking to enhance operational performance through digital transformation.

## **1.2 Research Objective**

1.2.1 To examine the level of artificial intelligence adoption in road transport companies in Bangkok.

1.2.2 To analyze the impact of artificial intelligence adoption on logistics performance in road transport companies in Bangkok.

## **2. Literature review**

### **2.1 Road Transport Companies in Bangkok**

Road transport companies play a crucial role in Thailand's logistics system, particularly in Bangkok, which serves as the country's main economic and distribution hub. Road transport remains the dominant mode of freight movement due to its flexibility and extensive road network Thitart & Hotrawaisaya (2023). However, operating in Bangkok presents significant challenges, including severe traffic congestion, rising fuel costs, and increasing customer expectations for fast and reliable delivery services. Previous studies indicate that logistics performance in urban road transport is highly dependent on delivery speed, reliability, and cost efficiency (Christopher, 2016; Rushton et al., 2014). The rapid growth of e-commerce has

further intensified competition among road transport companies in Bangkok, increasing demand for shorter delivery times and real-time service visibility (DITP, 2023).

Accordingly, digital technologies have become increasingly important in road transport operations. Information systems and data-driven tools have been shown to improve coordination and delivery performance (Gunasekaran et al., 2017). More recently, artificial intelligence has been recognized as a promising solution for enhancing logistics performance in urban road transport. However, empirical evidence on AI adoption and its performance impact among road transport companies in Bangkok remains limited, highlighting the need for further empirical research.

### 2.2 Artificial Intelligence (AI)

Artificial intelligence (AI) has become an increasingly important tool in logistics and transportation, as companies seek smarter ways to manage operations and respond to growing market complexity. (Malhotra & Kharub, 2025). AI enables logistics firms to process large volumes of data, automate routine activities, and support more accurate and timely decision-making. In road transport operations, AI is commonly applied in areas such as route optimization, vehicle scheduling, predictive maintenance, and real-time tracking systems. Davenport and Ronanki (2018) explained that AI creates value by enhancing operational processes and enabling organizations to move from reactive to data-driven decision-making. Similarly, Gunasekaran et al. (2017) emphasized that AI-based information systems help logistics firms manage uncertainty and improve coordination across transportation activities.

For road transport companies, AI-driven solutions play a critical role in addressing daily operational challenges. Technologies such as real-time vehicle tracking and intelligent route planning help reduce fuel consumption, shorten delivery times, and improve fleet utilization. These benefits are especially important in urban environments, where traffic congestion and unpredictable conditions frequently disrupt logistics operations.

### 2.3 Logistics Performance

Logistics performance refers to the extent to which logistics activities are carried out efficiently and effectively in order to meet organizational goals and customer expectations. (Fatorachian, 2024) It is commonly evaluated through dimensions such as cost efficiency, delivery speed, reliability, flexibility, and service quality. High logistics performance enables transport companies to remain competitive while maintaining operational sustainability. Christopher (2016) described logistics performance as a key determinant of supply chain competitiveness, emphasizing the importance of speed, reliability, and cost control. Mentzer et al. (2001) also argued that logistics performance should be assessed not only in terms of internal efficiency, but also through customer service outcomes such as responsiveness and delivery accuracy. In the road transport context, Rushton et al. (2014) noted that performance is particularly sensitive to factors such as on-time delivery, vehicle utilization, and cost management, given intense competition and relatively thin profit margins.

Prior research suggests that improvements in logistics performance are closely linked to higher customer satisfaction and stronger competitive advantage. For road transport companies operating in congested urban areas, maintaining high levels of logistics performance is essential for meeting service expectations and sustaining long-term business viability.

#### 2.4 Impact of Artificial Intelligence on Logistics Performance

A growing body of literature suggests that the adoption of artificial intelligence has a positive impact on logistics performance. (Chen, Wenwen, et al., 2024) AI technologies enhance planning accuracy, reduce human error, and improve operational responsiveness, leading to more efficient and reliable logistics operations. Setthachotsombut et al. (2024) also examined smart logistics management among logistics service providers in Thailand and highlighted the important role of digital and intelligent technologies in improving operational efficiency and service quality. The study suggested that advanced technologies, including artificial intelligence, are key drivers of logistics performance improvement. This evidence supports the relevance of examining AI adoption in transport and logistics companies in Thailand. Wamba et al. (2017) found that advanced analytics and AI capabilities significantly improve logistics efficiency and service quality by supporting predictive and prescriptive decision-making. AbdEllatif and Baazeem (2025) similarly demonstrated that AI and machine learning applications contribute to better logistics performance by reducing operational costs, improving delivery reliability, and enhancing overall service outcomes. In addition, Queiroz et al. (2020) highlighted that AI-driven logistics systems strengthen supply chain resilience and performance, particularly in dynamic and uncertain operating environments.

Nevertheless, much of the existing empirical research has focused on large logistics firms or developed economies. As a result, limited insight is available regarding the extent of AI adoption and its performance impact within road transport companies operating in developing urban contexts such as Bangkok. This gap highlights the need for further empirical investigation to better understand how AI influences logistics performance in road transport operations.

### **3. Methodology**

3.1 Research Design: this study was quantitative research to examine the level of artificial intelligence impact on logistics performance in road transport companies in Bangkok. A survey-based approach was adopted as it allows for the systematic collection of data from many respondents and enables statistical analysis to identify relationships between variables.

3.2 Population and Sample: the population of this study consisted of road transport companies operating in Bangkok, Thailand. The respondents included managers, supervisors, and operational staff who were directly involved in logistics and transportation activities and possessed sufficient knowledge of their company's operations and technology usage. A purposive sampling technique was employed to select respondents who were familiar with artificial intelligence applications in logistics operations, as this study required informed perspectives on technology adoption. A total of 200 questionnaires were distributed, and all 200 valid responses were collected and used for data analysis.

3.3 Research Instrument: Data was collected using a structured questionnaire developed based on a review of relevant literature. The questionnaire was divided into three main sections. The first section collected demographic information of the respondents and organizational characteristics. The second section measured the level of artificial intelligence adoption, including applications such as route optimization, real-time tracking, predictive analytics, and automated scheduling. The third section assessed logistics performance in terms of cost efficiency, delivery speed, operational accuracy, and service reliability. All measurement items

were evaluated using a five-point Likert scale, ranging from 1 (strongly disagree) to 5 (strongly agree).

3.4 Data Collection: The questionnaire survey was distributed to managers and operational staff of road transport companies in Bangkok through both online and offline channels. Respondents were informed about the purpose of the study, and confidentiality of their responses was assured. Data collection was conducted over a specified period to ensure adequate response rates.

3.5 Data Analysis: The data collected was analyzed using statistical software. Descriptive statistics were employed to examine the level of artificial intelligence adoption among road transport companies in Bangkok. Multiple regression analysis was then conducted to analyze the impact of artificial intelligence adoption on logistics performance. The results were used to test the research objectives and to determine the significance and strength of the relationships between variables.

## 4. Result

A total of 200 valid questionnaires were collected and used for data analysis. The respondents included managers, supervisors, and operational staff from road transport companies operating in Bangkok who were directly involved in logistics and transportation activities, ensuring the reliability of the data. The research findings are presented in accordance with the two research objectives: (1) to examine the level of artificial intelligence adoption and (2) to analyze the impact of artificial intelligence adoption on logistics performance.

### 4.1 Level of Artificial Intelligence Adoption in Road Transport Companies in Bangkok

Descriptive statistical analysis was used to examine the level of artificial intelligence adoption among road transport companies in Bangkok. The results indicate that the overall level of AI adoption is at a moderate level, suggesting that many companies have begun to integrate AI technologies into their logistics operations.

**Table 4.1: Level of Artificial Intelligence Adoption (n = 200)**

AI Adoption Indicators	Mean	S.D.	Level
Real-time vehicle tracking	3.92	0.68	High
Route optimization systems	3.81	0.71	High
Predictive analytics	3.47	0.79	Moderate
Automated scheduling systems	3.39	0.82	Moderate
<b>Overall</b>	<b>3.65</b>	<b>0.65</b>	<b>Moderate</b>

The results indicate that artificial intelligence adoption among road transport companies in Bangkok is at a moderate level. Real-time vehicle tracking and route optimization systems are the most widely adopted AI applications, reflecting their importance in supporting daily transport operations and delivery efficiency.

### 4.2 Impact of Artificial Intelligence Adoption on Logistics Performance

Multiple regression analysis was conducted to examine the impact of artificial intelligence adoption on logistics performance. Logistics performance was measured in terms of cost efficiency, delivery speed, operational accuracy, and service reliability.

**Table 4.2: Regression Results for Impact of AI Adoption on Logistics Performance**

Logistics Performance	$\beta$	t-value	Sig.
Artificial Intelligence Adoption	0.57	8.14	0.000***
R <sup>2</sup>	0.33		
Adjusted R <sup>2</sup>	0.33		

\*\* $p < 0.001$

The regression results demonstrate that artificial intelligence adoption has a statistically significant positive impact on overall logistics performance. The model explains approximately 33% of the variance in logistics performance.

**Table 4.3: Impact of AI Adoption on Individual Logistics Performance Dimensions**

Logistics Performance Dimensions	$\beta$	Sig.	Result
Cost efficiency	0.42	0.001**	Supported
Delivery speed	0.54	0.000***	Supported
Operational accuracy	0.51	0.000***	Supported
Service reliability	0.39	0.003**	Supported

\*\*\* $p < 0.001$ , \* $p < 0.01$

The findings indicate that artificial intelligence adoption has the strongest impact on delivery speed and operational accuracy, followed by cost efficiency and service reliability.

In summary, based on responses from 200 road transport professionals in Bangkok, the results show that artificial intelligence technologies are adopted at a moderate level. Furthermore, adoption of artificial intelligence has a significant positive impact on logistics performance, particularly in improving delivery speed and operational accuracy. These findings directly address both research objectives of the study.

## 5. Discussion

The findings of this study provide empirical support for the role of artificial intelligence in enhancing logistics performance among road transport companies in Bangkok. In line with previous studies on artificial intelligence and logistics management, the results show that artificial intelligence adoption has a significant positive impact on logistics performance, especially in improving delivery speed and operational accuracy. This is consistent with the work of Davenport and Ronanki (2018) and Wamba et al. (2017) noted that artificial intelligence supports data driven decision making and enhances operational efficiency in logistics operations. Similar to the conclusions of Christopher (2016) and Rushton et al. (2014), this study confirms that delivery speed, reliability, and cost efficiency are key dimensions of logistics performance for road transport companies. The strong influence of artificial

intelligence on delivery speed observed in this study highlights the effectiveness of applications such as route optimization and real time tracking, which are widely recognized in literature as important tools for improving urban logistics performance. Furthermore, the moderate level of artificial intelligence adoption identified in this study is consistent with prior research on technology adoption in logistics in developing economies. Although advanced artificial intelligence applications offer clear performance benefits, many road transport companies still rely mainly on basic digital tools rather than fully integrated intelligent systems. This finding aligns with Sethachotsombut et al. (2024) highlighted that smart logistics adoption in Thailand is progressing but remains uneven across logistics service providers.

## 6. Conclusion

This study examined the level of artificial intelligence adoption and its impact on logistics performance among road transport companies operating in Bangkok. The findings reveal that artificial intelligence technologies have been adopted at a moderate level, with greater emphasis on applications such as real-time vehicle tracking and route optimization. These technologies are primarily used to support daily operational control and improve delivery efficiency in congested urban environments. The results further demonstrate that artificial intelligence adoption has a significant positive impact on logistics performance. AI adoption strongly improves delivery speed and operational accuracy, while also contributing to cost efficiency and service reliability. These findings highlight the important role of artificial intelligence as a strategic tool for enhancing logistics performance in road transport companies.

This study contributes to the existing literature by providing empirical evidence from the road transport sector in Bangkok, a context that has received limited academic attention. From a practical perspective, the results suggest that road transport companies should consider investing in artificial intelligence technologies as part of their digital transformation strategies to improve operational performance and competitiveness. Future research may extend this study by employing longitudinal designs, incorporating qualitative insights, or examining additional factors that may influence the relationship between artificial intelligence adoption and logistics performance.

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## References

- AbdEllatif, A., & Baazeem, N. (2025). The impacts of artificial intelligence and machine learning on the performance of logistics and supply chain management. *International Journal of Logistics Management*, 36(1), 45–62.
- Chen, W., Men, Y., Fuster, N., Osorio, C., & Juan, A. A. (2024). Artificial intelligence in logistics optimization with sustainable criteria: A review. *Sustainability*, 16(21), 9145.
- Christopher, M. (2016). *Logistics and supply chain management* (5th ed.). Pearson Education.
- Davenport, T. H., & Ronanki, R. (2018). Artificial intelligence for the real world. *Harvard Business Review*, 96(1), 108–116.

- Department of International Trade Promotion. (2023). Logistics industry in Thailand. Ministry of Commerce, Thailand.
- Fatorachian, H. (2024). Leveraging artificial intelligence for optimizing logistics performance: a comprehensive review. *Global Journal of Business Social Sciences Review (GATR-GJBSSR)*, 12(3).
- Gunasekaran, A., Subramanian, N., & Papadopoulos, T. (2017). Information technology for competitive advantage within logistics and supply chains. *Transportation Research Part E: Logistics and Transportation Review*, 99, 14–33. <https://doi.org/10.1016/j.tre.2016.12.001>
- Malhotra, G., & Kharub, M. (2025). Elevating logistics performance: harnessing the power of artificial intelligence in e-commerce. *The International Journal of Logistics Management*, 36(1), 290-321.
- Mentzer, J. T., DeWitt, W., Keebler, J. S., Min, S., Nix, N. W., Smith, C. D., & Zacharia, Z. G. (2001). Defining supply chain management. *Journal of Business Logistics*, 22(2), 1–25. <https://doi.org/10.1002/j.2158-1592.2001.tb00001.x>
- National Economic and Social Development Council. (2024). Thailand logistics and transport report. NESDC.
- Queiroz, M. M., Ivanov, D., Dolgui, A., & Fosso Wamba, S. (2020). Impacts of epidemic outbreaks on supply chains: Mapping a research agenda amid COVID-19. *International Journal of Production Economics*, 227, 107599. <https://doi.org/10.1016/j.ijpe.2020.107599>
- Rushton, A., Croucher, P., & Baker, P. (2014). *The handbook of logistics and distribution management* (5th ed.). Kogan Page.
- Setthachotsombut, N., Sommanawat, K., & Sua-iam, G. (2024). Logistics business management of provider in Thailand with smart logistics. *Journal of Open Innovation: Technology, Market, and Complexity*, 10(4), 100422.
- Thitart, P., & Hotrawaisaya, C. (2023). Development Model of Increasing Business Performance of Road Transport Enterprises of Eastern Economic Corridor (EEC) in Thailand. *Journal of Logistics and Supply Chain Operations (JLSCO)*, 9(2 July-December), 121-139.
- Wamba, S. F., Gunasekaran, A., Akter, S., Ren, S. J., Dubey, R., & Childe, S. J. (2017). Big data analytics and firm performance: Effects of dynamic capabilities. *Journal of Business Research*, 70, 356–365. <https://doi.org/10.1016/j.jbusres.2016.08.009>