

Article

The Role of Artificial Intelligence in Logistics Firm Performance with Supply Chain Consistency and Logistics Capabilities in Saudi Arabia

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Abstract

Background: Rapid adoption of artificial intelligence (AI) in logistics enhances operational efficiency and firm performance; however, empirical evidence on its capability-driven impact remains limited, particularly in Saudi Arabia's e-commerce sector. This study's purpose is to examine the influence of AI on logistics firm performance through the mediation role of supply chain consistency and logistics capabilities. **Methods:** A quantitative study was conducted and data were collected using a convenience sampling technique from 275 employees working in the Saudi Arabian logistics firms. Partial Least Squares Structural Equation Modeling was used to perform data analysis. **Results:** The study findings indicated that AI usage has significant and positive influence on supply chain consistency ($\beta = 0.290$) and logistics capabilities ($\beta = 0.303$). Furthermore, supply chain consistency ($\beta = 0.115$) and logistics capabilities ($\beta = 0.171$) play mediating role between AI usage and firm performance. The research model exhibits substantial predictive capability, explaining 74.6% ($R^2 = 0.746$) of the variance in firm performance, while AI usage explains a smaller portion of the variance in supply chain consistency 8.4% ($R^2 = 0.084$) and logistics capabilities 9.2% ($R^2 = 0.092$). **Conclusions:** The findings demonstrate that AI-based logistics operations provide extensive support to streamline operations and reduce costs.

Keywords: artificial intelligence; performance; logistics; technology

1. Introduction

Technological transformation has been observed in the logistics industry. Smart technologies such as artificial intelligence (AI) have appeared as an important drive to enhance operational efficiency, make better strategic decisions and gain competitive advantage [1]. AI includes a range of tools and systems comprising predictive analytics, real-time tracking systems, and machine learning. Hence, it enables organizations to make decisions based on real-time data, improve the supply chain, and respond to disruptions whenever they arise [2]. AI integration into logistics operations is a strategic approach to minimize logistics costs, provide better quality services and minimize complexities in operations.

From a theoretical point of view, the study is based on the resource-based view (RBV) and dynamic capabilities theory, which indicate that a firm's ability to adopt technological resources becomes a critical driver to gain a competitive advantage. In view of that, AI can be considered as a strategic resource that supports the enhancement of a firm's capabilities through real-time decision-making and adaptive logistics processes. Logistics operations



Academic Editor: Mladen Krstić

Received: 19 February 2026

Revised: 20 April 2026

Accepted: 22 April 2026

Published: 1 May 2026

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comprise complex processes of procurement, warehousing and distribution. In view of that, AI adoption for logistics organizations brings positive outcomes to streamline routine operations [3]. Hence, real-time data monitoring supports logistics operations to optimize routes and quickly respond to hurdles in the supply chain. Most importantly, predictive analytics provides results that help to forecast demand and enable organizations to make strategic decisions to manage resources effectively [4]. Network optimization provides competitive advantage to decide low-cost delivery routes, fleet utilization and workload balance [5]. As a result, AI provides extensive support in order to enhance the logistics capabilities and attain long-term advantages.

Logistics capabilities include organizational abilities to integrate activities known as order handling, information sharing and distribution management [6]. When organizations practice efficient systems, it increases responsiveness and customer satisfaction. Logistics capabilities are a necessary component to overcome the hurdles in operations. In view of that, logistics firms can avail long-term benefits and gain competitive advantage [7]. Moreover, consistency in the supply chain leads to maintaining smooth operations. Thus, it indicates that logistics organizations handle timely delivery, coordinate with distributors and suppliers and ensure the delivery of quality products.

Prior research studies have mentioned the positive influence of AI on operational efficiency [8,9]; however, the literature focused on direct effects, with limited attention paid to capacity-based mechanisms related to the value created by AI. Specifically, there is insufficient scholarly work examining how AI usage translates into firm performance through supply chain consistency and logistics capabilities. Such mechanisms have rarely been studied within an integrated framework in the logistics context, which is undergoing rapid digital transformation. This limitation is more prominent in emerging market contexts, where contextual factors vary significantly from developed markets. Accordingly, this study addresses this gap by investigating how AI usage influences firm performance through supply chain consistency and logistics capabilities within the context of the Saudi logistics sector.

AI-based applications and their strategic implications for logistics firms remain unexplored in scholarly research, specifically in transition economies. For the case of Saudi Arabia, as the national Vision 2030 takes place, logistics companies present distinctive characteristics supported by rapid expansion in e-commerce, increased dependence on digital infrastructure, and evolving supply chain networks. Hence, the sector-specific context makes Saudi Arabia a theoretically important setting to investigate how AI-based transformation impacts logistics operations and performance. Keeping this in view, this study addresses the following research questions: how does AI usage influence supply chain consistency and logistics capabilities, which in turn enhance firm performance? Moreover, how do AI-based capabilities collectively enhance strategic outcomes in the logistics sector in Saudi Arabia?

The study motivation is based on the direct effect model and provides an understanding of the mechanism connecting AI usage to firm performance. Theoretically, this study contributes to the RBV and dynamic capabilities by examining the mediation effect of logistics capabilities and supply chain consistency. Empirically, this study contributes to the context of the logistics sector in Saudi Arabia, addressing the next set of studies in the logistics market. It provides insights for managers by emphasizing how AI-based strategic investment can leverage operational capabilities and ensure sustainable supply chain networks. Thus, this study examines the relationship among AI usage, supply chain consistency, logistics capabilities, and firm performance of logistics firms in Saudi Arabia.

The structure of the paper is as follows: Section 2 presents a review of the literature, Section 3 for research methodology. Section 4 presents the results and Section 5 for discus-

sion of the findings. Section 6 presents conclusion along with implications and directions for future research.

2. Literature Review

This study is based on the RBV and dynamic capabilities perspectives. RBV refers to the specific resources of a firm, including technological assets, that support the achievement of sustainable competitive advantage. Dynamic capabilities relate to a firm's ability to integrate and reconfigure resources in order to respond to market changes and a dynamic environment. In this context, AI is considered a strategic resource that increases logistics capabilities and supply chain consistency, thereby enhancing firm performance.

Smart technology has given the edge to the logistics industry in order to execute e-commerce businesses across the globe [10]. Technology plays a vital role in improving operational efficiency. It supports operational efficiency in a way that overcomes the logistics cost and gains competitive advantage. AI adoption for logistics firms plays a vital role in enhancing performance and gaining long-term benefits [11]. AI technology comprises networking systems, machine learning and predictive analytics that help to optimize logistics operations. AI provides fundamental support to handle the operations wisely and overcome the challenges on time.

As the logistics industry has observed significant growth due to e-commerce, it is important for logistics firms to streamline their systems via AI adoption [12]. AI-based logistics operation provides benefits in terms of tracking, monitoring and managing delivery. AI systems help to monitor real-time operations in order to overcome delays and handle issues related to delivery of parcels [13]. Nonetheless, this is more of a technology investment for logistics companies to secure competitive advantage.

2.1. Artificial Intelligence Usage and Supply Chain Consistency

AI-based systems for logistics operations provide optimal performance and efficiency in supply chain management. From the point of view of RBV, AI usage signifies an organizational resource that supports firms to enhance their superior operational capabilities and secure efficiency advantages. Digital transformation provides ultimate support to make effective decisions in order to have smooth logistics operations [14]. From the point of view of the dynamic capabilities framework, AI supports firms to deal with disruptions in real time and improve logistics processes to ensure stability in a dynamic environment. AI-based systems consist of real-time monitoring of data for parcels and set appropriate directions to overcome disruptions [15]. Hence, real-time monitoring provides support to overcome variability in logistics operations, thereby developing supply chain consistency as a part of operational capability. Moreover, networking and automation of logistics processes help to minimize errors and ensure on-time delivery. Such capabilities transform technological resources into organizational capabilities and link with RBV logic, where resources improve operational performance. It enhances the responsiveness of logistics operations. Improved responsiveness is a key dimension of dynamic capabilities, showing an organizational ability to adapt its logistics processes to environmental changes.

Supply chain consistency refers to the optimal process of operations, which includes coordination among the departments of procurement, transport and distribution channels. Such a system ensures timely delivery and overcomes variability [16]. Supply chain consistency is operationalized based on stability and reliability in logistics processes in terms of transportation and distribution activities. AI-based systems provide ultimate support to ensure consistency in supply chains via predictive analytics. Moreover, network optimization provides competitive advantage to logistics firms to streamline processes [17]. Logistics shipment tracking and monitoring could be supportive in managing daily op-

erations automatically. Logistics managers can perform better with real-time tracking of operations [18]. The adoption of AI supports supply chain consistency in order to ensure real-time monitoring and sensing within the dynamic capabilities framework. With the support of network optimization, AI provides an edge to logistics firms by enabling them to dynamically reconfigure operational processes to ensure stability and respond to queries on time. It differs from the concept of resilience, as supply chain consistency ensures timely responses to deliveries. It helps to take corrective actions, streamline strategies and make effective decisions. Such corrective measures reveal dynamic capability, where organizations continuously improve operations to maintain performance outcomes. AI-based systems provide predictive analytics to understand future demand for the supply chain, manage resources and ensure uninterrupted logistics systems. AI usage in the supply chain can help firms to have greater stability in operations, which is most important for optimal performance. Keeping that in view, the following hypothesis is proposed.

H1. *AI usage influences supply chain consistency.*

2.2. Artificial Intelligence Usage and Logistics Capabilities

Logistics capabilities refer to the ability to execute the plan and manage workflow and service delivery from start to end. Logistics capabilities are operationalized when organizations are able to integrate and coordinate logistics activities in terms of order processing and distribution management for better service delivery. It includes processing orders, handling inventory wisely and sharing information with their customers [19]. Such capabilities present organizational competencies in line with RBV to sustain competitive advantage. When logistics firms are capable of handling logistics operations on time, it gives better results in delivering quality services. From the point of view of the dynamic capabilities perspective, this operational effectiveness shows the organizational ability to reconfigure resources and quickly respond to changing demands and environmental uncertainty. It helps to handle demand from customers and minimize operational errors.

AI-based logistics capabilities with automation provide an advantage to maintain information flow and make decisions based on predictive analytics [20]. AI acts as a strategic enabler to enhance organizational capabilities to manage logistics operations and deploy automatic processes. It helps to ensure a rapid system for logistics management and an accurate system to track the parcels and share information with customers [21]. AI integration with logistics operations enhances capabilities to overcome disruption and improve coordination between departments and link with RBV for capability transformation. Furthermore, it helps to coordinate with multiple channels to make sure that logistics systems perform effectively. AI usage provides extensive support to manage logistics with real-time data and open access to broader markets [22]. Moreover, AI gives an edge to develop dynamic capabilities by adding to their ability to respond to market needs abruptly. AI gives a competitive advantage and strengthens the existing system without facing delays in service [23]. Therefore, logistics capabilities appear as an outcome of better resource orchestration, where AI helps to support continuous capability. From the point of view of RBV, logistics capabilities refer to specific resources that provide the ultimate return on technological investments in operational efficiency. AI provides extensive support to automate processes, improve decision-making, and connect multiple channels to enhance service quality. Hence, this theoretical grounding supports the expected influence of AI on logistics capabilities. It allows logistics firms to undergo technological transformation and have better improvement in operational performance. Keeping that in view, the following hypothesis is proposed.

H2. *AI usage influences logistics capabilities.*

2.3. Supply Chain Consistency and Firm Performance

Firm performance refers to the achievement of the organization in terms of financial and operational performance. This is operationalized in the context of a logistics firm in order to achieve financial and operational outcomes. It comes under the domain of profitability, sales and market positioning. Such dimensions relate to outcomes of better utilization of resources and capability enhancement within logistics organizations. Supply chain consistency has a direct influence on firm performance to ensure that all the operations are performed with quality [24]. From the point of view of the dynamic capabilities perspective, supply chain consistency is related to an organization's ability to coordinate operations, specifically in the context of environmental uncertainty, thereby changing operational stability for better performance outcomes. When an organization has proper consistency in logistics operations, it leads to meeting the delivery schedule and overcoming challenges. Stability in operations minimizes variability in resource utilization and customer satisfaction and contributes to better results in firm performance. Supply chain consistency plays a necessary role in optimizing processes, and workers can deliver better results on time [25]. From the point of view of RBV, supply chain consistency presents organizational capabilities that come from resource optimization that enable a firm to achieve a competitive edge in the long run. Hence, consistency ensures that logistics companies are using efficient systems that help to speed up the workflow. Furthermore, it allows companies to use resources more efficiently and deal with market changes. The adaptability shows dynamic capability deployment, where organizations regularly improve operational processes to secure stability. When logistics firms focus more on consistency, it enables them to have better customer trust in the services [26]. It is more important for companies to maintain a high level of trust from customers and enhance resilience to market demands. It gives a competitive edge to logistics companies to face market competition proactively and achieve sustainable performance. Thus, supply chain consistency works under a capability mechanism that changes operational reliability into better organizational performance. Supply chain consistency reduces delays by ensuring coordination across procurement, distribution, and transportation networks. Consistency in performing operations ensures the effective utilization of resources. Dynamic capabilities support the relationship between supply chain consistency and firm performance, enabling firms to respond to market changes in an effective manner and secure a competitive advantage.

Regardless of the direct influence of supply chain consistency, it plays an intermediary role between AI and firm performance [27]. AI supports the establishment of a reliable system that helps to coordinate supply chain operations effectively [28]. This shows that AI does not directly enhance firm performance but improves performance with the development of a reliable and consistent supply chain. It ensures the sustainability of logistics operations and enables managers to execute their tasks diligently. Logistics firms can achieve high performance results with AI adoption and streamline processes for the supply chain. Hence, it helps to maintain high-quality standards. Thus, the following hypotheses are proposed.

H3. *Supply chain consistency positively influences firm performance.*

H4. *Supply chain consistency mediates the relationship between AI usage and firm performance.*

2.4. Logistics Capabilities and Firm Performance

Logistics capabilities play an integral role in the performance of logistics firms. Logistics capabilities are operationalized when an organization is able to coordinate and execute logistics activities while carrying out the process of inventory management and informa-

tion sharing to offer better services. It supports a way to manage the logistics operations that includes order placement, conversation with customers and timely response to issues and disruptions [29]. From the point of view of RBV, logistics capabilities show organizational competencies that give sustained competitive advantage with effective utilization of resources. When logistics firms have a high level of capabilities, then it gives a competitive advantage in terms of service quality and operational efficiency [30]. Such capabilities show the effective transposition of resources into operational competencies that enhance firm performance. Smart technologies like AI provide extensive support to automate the processes and provide real-time information to system users [31]. From the point of view of the dynamic capabilities framework, AI supports organizations in managing operational requirements, linking logistics resources and strengthening logistics capabilities. AI-based logistics systems provide accurate information flow and better decision-making to managers to make sure all the parcels are delivered on time with real-time tracking. This shows that AI plays a vital role in transforming technological resources into logistics capabilities with automation.

Logistics capabilities lead to achieving indicators for performance. Moreover, logistics capabilities play an intermediary role between AI usage and firm performance. Smart technologies like AI increase operational efficiency and improve internal processes, which helps to achieve better performance outcomes [32]. AI-based systems provide support to enhance logistics capabilities, and this supports enhancing firm performance. The RBV and dynamic capabilities theories specify logistics capabilities that represent the ability to coordinate and utilize resources in an efficient manner. Keeping this in view, AI is considered as a strategic tool in order to enhance logistics capabilities and respond to market conditions promptly. AI provides extensive support to enhance these capabilities by tracking workflows and automating processes to achieve optimal performance. Thus, logistics capabilities play an integral role in AI and firm performance. Thus, it is hypothesized that

H5. *Logistics capabilities influence firm performance.*

H6. *Logistics capabilities mediate the relationship between AI usage and firm performance.*

Figure 1 shows the research model.

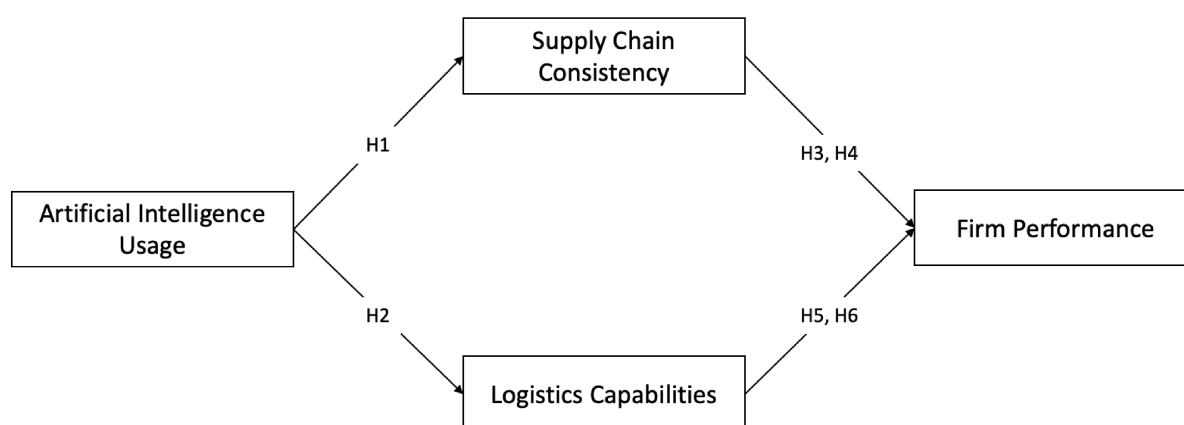


Figure 1. Research model.

3. Methodology

This study used quantitative research to measure the relationship between constructs. It supports a way to examine the numerical influence of independent variables on dependent variables with advanced statistical techniques. The selection of a cross-sectional de-

sign is appropriate for examining the relationships among the study constructs at a single point in time.

Data were collected from employees working in logistics organizations in Saudi Arabia using a convenience sampling technique. This technique was considered appropriate due to the lack of availability of a complete sampling frame for logistics employees in Saudi Arabia and the lack of a possibility of accessing employee data due to restrictions imposed by organizations. Employees who have had exposure to AI-based systems were targeted to ensure response relevance. This sampling strategy is commonly considered in logistics and information technology research, where respondents are dispersed and organizational access is limited. The selection of a convenience sampling technique was based on organizational constraints in accessing logistics employees. Hence, this approach may limit generalizability; however, it is widely used in organizational research contexts where reaching study participants is restricted. The selection of employees was based on their direct involvement with smart technologies to manage logistics operations. Most importantly, participants were selected due to their experience with smart technologies in managing logistics operations within their organizations. A total of 450 respondents were approached via online survey and secured 275 valid responses for the final analysis, resulting in a response rate of 61.1% over the period from November to December 2025. This sample size was considered adequate for Partial Least Squares Structural Equation Modeling (PLS-SEM) to meet the threshold for statistical power. A bootstrapping procedure with 5000 resamples was applied and used to ensure the robustness of the results.

An online survey questionnaire was distributed to logistics organizations, including third-party logistics providers, e-commerce logistics companies, and freight services, to ensure comprehensive representation of the data in Saudi Arabia. The measurement instrument was carried out from previously published questionnaires to ensure content validity and reliability, and responses were recorded on a five-point Likert scale (1 = strongly disagree to 5 = strongly agree). Six items were used for AI usage adapted from Malhotra and Kharub [33]. Five items were used for logistics capabilities, adapted from Joong-Kun et al. [34]. Four items were used for supply chain consistency, adapted from Ruiz-Hernandez et al. [35]. Four items were used for firm performance, adapted from Ellinger et al. [36]. The questionnaire was translated into the Arabic language to ensure clarity and accessibility. A back-translation was performed to ensure the accuracy of the items and to confirm content validity in the Saudi context.

PLS-SEM was used due to its suitability for complex data analysis with latent constructs and mediation effects, performed with SmartPLS software (Version 4.1.1.8). Moreover, PLS-SEM is widely considered for indirect effects using bootstrapping. The first step was to perform the measurement model assessment to evaluate validity and reliability. The second step involved performing the structural model assessment using path coefficients and the coefficient of determination (R^2) to examine the direct and indirect effects.

Common method bias was addressed with procedural and statistical remedies. Procedurally, the anonymity and confidentiality of study participants were ensured. Statistically, Harman's single-factor test was conducted to ensure that no single factor accounted for the majority of the variance. Hence, common method bias was not a major concern in the study. Voluntary participation was ensured while taking informed consent from study participants. This study followed established ethical guidelines for research.

4. Results

The demographic profile of 275 study participants is depicted in Table 1. Most of the participants were males, accounting for 79% as compared to females (21%). The age

group 35–44 years showed major participation (37%). Regarding experience, most of the participants had 4–6 years of experience and a bachelor's degree (66%).

Table 1. Demographic profile of participants (n = 275).

Demographic Variable	Category	Frequency	Percentage (%)
Gender	Male	217	79%
	Female	58	21%
Age (Years)	Less than 25	81	29%
	25–34	74	27%
	35–44	102	37%
	45–54	18	7%
	More than 54	0	0%
Experience	Less than 1 year	76	28%
	1–3 years	82	30%
	4–6 years	106	39%
	7–10 years	10	4%
	More than 10 years	1	0%
Educational	Secondary or below	56	20%
	Bachelor's degree	182	66%
	Master's degree	37	13%

Table 2 presents the assessment of the measurement model. Factor loadings were above the threshold of 0.7 for all constructs. AI usage shows good convergent validity and internal consistency with Cronbach's alpha (0.901), composite reliability (0.868) above the threshold of 0.7 and average variance extracted (AVE) (0.833) above the threshold of 0.5. Supply chain consistency represents a good score for reliability (Cronbach's alpha = 0.805; composite reliability = 0.872) and AVE (0.631). Similarly, logistics capabilities represent a good score for reliability (Cronbach's alpha = 0.799; composite reliability = 0.863) and AVE (0.567). Firm performance indicates strong measurement with high reliability scores (Cronbach's alpha = 0.889; composite reliability = 0.823) and AVE (0.750).

The discriminant validity was assessed with the Fornell–Larcker criterion in Table 3. The square roots of AVE values higher than inter-construct correlation depict adequate discriminant validity. It shows satisfactory results for discriminant validity.

Table 2. Measurement model.

Items with Constructs	Loadings	Cronbach's Alpha	Composite Reliability	Average Variance Extracted (AVE)
Artificial Intelligence Usage		0.901	0.868	0.833
AIU1: "Our company makes extensive use of AI-driven network optimization tools to improve delivery"	0.812			
AIU2: "Network optimization has cut our fleet's costs and sped up delivery"	0.722			
AIU3: "Real-time network/route management systems help our company make logistics decisions"	0.919			
AIU4: "Real-time shipment and delivery tracking improve our logistics operations"	0.812			
AIU5: "We can see our entire supply chain thanks to real-time tracking and monitoring"	0.810			
AIU6: "Our logistics operations often make critical decisions using real-time tracking system data"	0.871			

Table 2. Cont.

Items with Constructs	Loadings	Cronbach's Alpha	Composite Reliability	Average Variance Extracted (AVE)
Supply Chain Consistency		0.805	0.872	0.631
SCC1: "To what extent does your supply chain maintain a consistent record of adhering to delivery schedules without substantial disruptions or delays?"	0.851			
SCC2: "To what degree do you provide a uniform level of quality and precision in inventory management across every phase of our supply chain?"	0.810			
SCC3: "How well do your supply chain components—procurement, manufacturing, logistics, etc.—coordinate to ensure smooth operations?"	0.768			
SCC4: "To what extent does your supply chain maintain operational consistency and dependability while adapting to changes (such as supply disruptions and fluctuations in demand)?"	0.744			
Logistics Capabilities		0.799	0.863	0.567
LC1: "My firm can communicate shipping and delivery information with customers"	0.820			
LC2: "My firm can handle and fill orders using a web-based order handling system"	0.876			
LC3: "My firm can provide widespread and/or intensive distribution coverage effectively"	0.821			
LC4: "My firm can provide global distribution coverage effectively"	0.724			
LC5: "My firm can effectively target selective or exclusive distribution outlets"	0.747			
Firm Performance		0.889	0.823	0.750
FP1: "Relative to your business's most significant competitors, how well does your company perform in terms of profitability"	0.865			
FP2: "Relative to your business's largest competitors, how well does your company perform in terms of sales growth"	0.877			
FP3: "Relative to your business's largest competitors, how well does your company perform in terms of customer satisfaction"	0.870			
FP4: "Relative to your business's largest competitors, how well does your company perform in terms of overall performance"	0.852			

Table 3. Discriminant validity.

	Artificial Intelligence Usage	Firm Performance	Logistics Capabilities	Supply Chain Consistency
Artificial Intelligence Usage	0.912			
Firm Performance	0.605	0.866		
Logistics Capabilities	0.503	0.604	0.753	
Supply Chain Consistency	0.490	0.638	0.607	0.794

Table 4 shows the assessment of the structural model and hypothesis testing. AI usage has a positive and significant influence on supply chain consistency ($\beta = 0.290$, $t = 2.862$, $p < 0.004$); H1 is accepted. AI usage has a positive and significant influence on logistics capabilities ($\beta = 0.303$, $t = 3.181$, $p < 0.001$); H2 is accepted. This indicates that AI plays a vital role in improving the supply chain operations in logistics organizations. Supply chain consistency has a positive and significant influence on firm performance ($\beta = 0.396$, $t = 6.398$, $p < 0.000$); H3 is accepted. Additionally, supply chain consistency mediates the relationship between AI usage and firm performance ($\beta = 0.115$, $t = 2.805$, $p < 0.005$); H4 is accepted. Logistics capabilities have a positive and significant influence on firm performance ($\beta = 0.564$, $t = 8.786$, $p < 0.000$); H5 is accepted. Additionally, logistics capabilities mediates the relationship between AI usage and firm performance ($\beta = 0.171$, $t = 2.937$, $p < 0.003$); H6 is accepted.

The mediation effects for H4 and H6 are partial, meaning that AI usage influences firm performance through supply chain consistency and logistics capabilities. This indicates that while capability development plays a vital role in improving firm performance, AI also maintains a direct influence on performance outcomes.

Model robustness and fit indices were checked with SRMR and NFI values indicating acceptable model fit within recommended thresholds. Robustness was checked with R^2 values, which represented strong explanatory power for firm performance, and f^2 effect sizes, showing small to large effects across relationships. VIF values were below the recommended threshold, indicating no multicollinearity issues.

Figure 2 depicts the coefficient of determination, where firm performance indicates that 74.6% variance is explained in the model, showing strong explanatory power. On the other hand, supply chain consistency ($R^2 = 0.084$) and logistics capabilities ($R^2 = 0.092$) depict lower explanatory power.

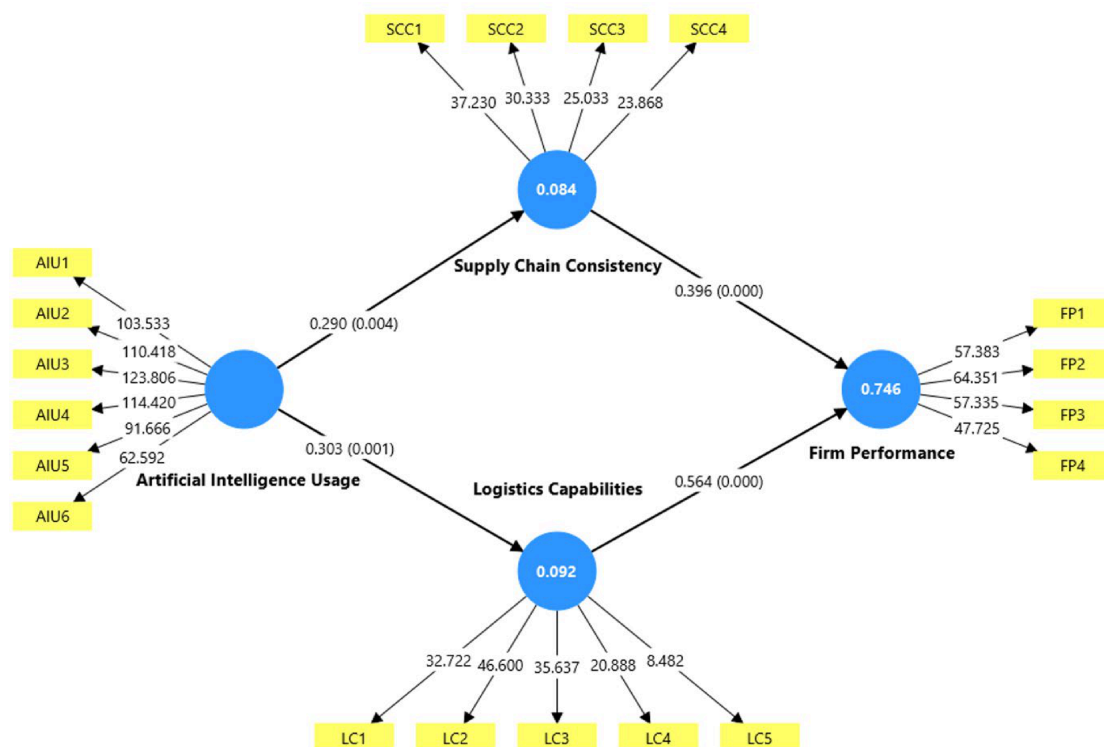


Figure 2. Structural model.

Table 4. Path coefficients.

Paths	Beta	Standard Deviation	<i>t</i> Statistics	<i>p</i> Values	<i>f</i> ² (Effect Size)	Results
AIU → SCC	0.290	0.101	2.862	0.004	0.08 (small)	H1 accepted
AIU → LC	0.303	0.095	3.181	0.001	0.09 (small)	H2 accepted
SCC → FP	0.396	0.062	6.398	0.000	0.15 (medium)	H3 accepted
AIU → SCC → FP	0.115	0.041	2.805	0.005	0.05 (small)	H4 accepted
LC → FP	0.564	0.064	8.786	0.000	0.25 (large)	H5 accepted
AIU → LC → FP	0.171	0.058	2.937	0.003	0.06 (small)	H6 accepted

Notes: AIU = Artificial Intelligence Usage, SCC = Supply Chain Consistency, LC = Logistics Capabilities, FP = Firm Performance.

5. Discussion

The study findings provide empirical support to examine the influence of AI usage in improving the supply chain within the Saudi Arabian logistics sector. The statistical significance was confirmed through structurally significant relationships among the study constructs, with strong *t*-values and *p*-values for both direct and indirect effects. From a practical point of view, AI integration for logistics improvement plays a vital role in streamlining workflows and enabling better decision-making within Saudi logistics organizations. The results indicate that AI usage has a significant influence on supply chain consistency and logistics capabilities, showing that AI usage for logistics organizations provides predictive analytics to make better decisions for operations management [1]. It gives real-time tracking and monitoring of routine operations to handle the disruptions on time. Hence, AI-based systems provide extensive support to manage supply chain operations smoothly and make accurate decisions to overcome costs [7]. AI is confirmed as a strategic enabler under the RBV, while logistics processes and operational stability are linked to dynamic capabilities theory. The low *R*² values for supply chain consistency (0.084) and logistics capabilities (0.092) indicate that AI usage in logistics firms explains a modest portion of the variability. However, there could be other factors, such as workflow skills, coordination mechanisms, and infrastructure quality, that play a prominent role in shaping capabilities and consistency. This confirms that AI does not directly regulate capability enhancement; rather, it serves as an enabling resource to support contingent logistics capabilities in line with dynamic capabilities logic. Thus, AI support is vital, but its greater impact may be realized at a broader level of organizational capabilities and processes, as suggested by the RBV and dynamic capabilities frameworks.

The positive influence of supply chain consistency on firm performance indicates the significance of reliable logistics operations. Consistency relates to timely delivery, better coordination and handling the delivery issues on time. The mediation factor analysis indicates that AI indirectly influences firm performance via supply chain consistency, showing that AI-based logistics firms can obtain vital support through smart technologies to sustain their operations and accomplish their tasks. The indirect effect demonstrates the role of AI through capability development rather than direct performance enhancement, aligning with the RBV argument that resources should be translated into capabilities to secure competitive advantage. Thus, proper consistency in the supply chain provides extensive support to enhance firm performance. Moreover, the stability in logistics operations leads to a gain in competitive advantage in the logistics industry [11].

Logistics capabilities appeared to have a significant influence on firm performance and became a strong indicator that helps to derive organizational success. When an organization is capable of handling orders on time and distributing them to the final customers, then it helps to maintain organizational performance [8]. As a result, it gives better performance outcomes in the form of customer satisfaction, a reduction in expenses, and profitability [15]. Hence, this shows that AI plays a vital role in managing opera-

tions, along with enhancing logistics firms' ability to manage their resources effectively and integrate systems across multiple operations, thereby improving organizational capabilities. Considering the practical significance, the findings provide actionable insights for logistics managers: AI-based investments should be part of strategic initiatives in order to achieve better cross-departmental coordination and real-time monitoring, rather than focusing only on routine operational optimization.

5.1. Theoretical Contribution

This study makes a theoretical contribution in terms of expanding RBV by validating AI as a strategic enabler with technological resources that transform capabilities into firm performance. Furthermore, dynamic capabilities theory is advanced by demonstrating how AI-based systems enhance supply chain consistency and logistics capabilities in a dynamic environment. The integration between RBV and dynamic capabilities within a unified framework for the Saudi logistics sector explains the direct effect of AI, along with the capability-based mechanisms through which value is created.

5.2. Research Implications

Based on the findings, the research implications have been set for the Saudi logistics sector. AI-based systems provide ultimate support in logistics management and ensure an efficient supply chain. AI usage in logistics operations leverages systems and provides efficient resources for managers to ease their tasks.

Managers can benefit from AI-based systems and handle queries on time. AI-based systems provide predictive analytics to monitor logistics operations on a daily basis and execute plans wisely to reduce costs. Network optimization provides fundamental support to handle day-to-day operations and strengthen supply chain operations. Logistics firms that opt for strategic investment in digital transformation would avail long-term benefits such as wider distribution coverage, timely delivery, and order management.

At the organizational level, Saudi logistics companies can opt for AI systems to perform day-to-day operations to overcome competition and gain better customer satisfaction and retention. Logistics firms should integrate AI systems under the strategic domain to gain optimal benefits and enhance performance.

At the policy level, the initiatives to promote digital transformation in the logistics sector make this sector a major contributor to the economy due to significant growth in e-commerce. Policymakers can redesign policies and provide infrastructure and skill development initiatives to companies in order to leverage AI tools and systems for profit maximization.

5.3. Study Limitations and Future Research

Regardless of the valuable insights from this research, it has some limitations. First, the convenience sampling technique may limit generalizability. Hence, future research could be conducted using a random sampling technique across logistics firms, especially focusing on freight forwarding and e-commerce logistics. Second, the cross-sectional study design limits causal inference; thereby, a longitudinal study can provide deeper insights to understand the role of AI in process optimization in logistics firms. Third, AI explains a modest portion of variance in the mediation variables; thereby, other factors like organizational and environmental factors can be examined in future studies to better understand their combined effects. Thus, future studies can focus on moderating effects by considering factors such as culture, workforce skills, and managerial support to provide a nuanced understanding of the vital role of AI in logistics performance.

6. Conclusions

This study examined the influence of AI on logistics firm performance with the mediating role of supply chain consistency and logistics capabilities in the Saudi logistics sector. In response to the research questions, the empirical findings indicate that AI has a positive and significant influence on supply chain consistency and logistics capabilities. Additionally, supply chain consistency and logistics capabilities are positively associated with improved logistics firm performance, confirming the mediating role of these capabilities. The theoretical contribution relates the RBV and dynamic capabilities theories in order to explain how AI usage enhances logistics firm performance indirectly through supply chain consistency and logistics capabilities. This study confirms that AI usage has a positive and significant influence on firm performance via the mediation of supply chain consistency and logistics capabilities. This study makes a theoretical contribution by demonstrating that AI functions as a strategic resource that helps create value through capability development. This enables a mechanism-based elaboration of how AI adds value by addressing the limited empirical evidence on capability-based performance outcomes. This provides a competitive advantage and helps firms stay ahead of market competition. Logistics managers should pay close attention to deploying AI-based systems to optimize operational processes and strengthen operational consistency and capabilities. AI systems should be considered a strategic investment and aligned with experiential training to enhance workforce readiness and operational efficiency. The study limitations include its cross-sectional design, convenience sampling, and data collection from a single source. Therefore, future studies can focus on longitudinal designs, random sampling, and data collection at different time intervals. Moreover, moderating factors can be examined in relation to AI, supply chain consistency, and logistics capabilities to provide diverse perspectives.

Author Contributions: Conceptualization, S.A. (Sura Alayed) and S.A. (Sultan Alateeg); methodology, S.A. (Sura Alayed); software, S.A. (Sura Alayed); validation, S.A. (Sura Alayed) and S.A. (Sultan Alateeg); formal analysis, S.A. (Sultan Alateeg); investigation, S.A. (Sura Alayed); resources, S.A. (Sultan Alateeg); data curation, S.A. (Sura Alayed); writing—original draft preparation, S.A. (Sultan Alateeg); writing—review and editing, S.A. (Sura Alayed); visualization, S.A. (Sura Alayed); supervision, S.A. (Sultan Alateeg); project administration, S.A. (Sura Alayed); funding acquisition, S.A. (Sura Alayed). All authors have read and agreed to the published version of the manuscript.

Funding: The authors extend their appreciation to the Arab Open University for funding this work through research fund No. (AOUKSA-524008). The author extends the appreciation to the Deanship of Postgraduate Studies and Scientific Research at Majmaah University for funding this research work through the project number R-2026-163.

Institutional Review Board Statement: The study is exempt from IRB approval in accordance with the institutional research regulations of Majmaah University, Saudi Arabia. As stated in the regulations issued by the Deanship of Scientific Research (Graduate Studies and Scientific Research), researchers are granted the freedom to publish the results of their research without obtaining prior approval from project funders, provided that such publication does not compromise the security or interests of the country or cause harm to society (see page 5, line 1). The relevant regulation can be accessed at the following link: <https://www.mu.edu.sa/sites/default/files/content/2016/01/dsr.pdf> (accessed on 26 March 2026). أمن يمس لا وبما البحثي، للمشروع الممولين موافقة أخذ دون بحوثهم نتائج نشر في الباحثين حرية. Translation: The researchers have the freedom to publish the results of their research without obtaining the approval of the project funders, provided that the document does not affect the security or interests of the country or cause harm to society. Based on these institutional guidelines, prior ethical approval was not required for this study.

Informed Consent Statement: Informed consent was obtained from all subjects involved in the study.

Data Availability Statement: The data presented in this study are available on request from the corresponding author.

Conflicts of Interest: The authors declare no conflicts of interest.

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