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Business Intelligence Capabilities and AI-Driven Logistics Innovation: The Roles of Decision Support and Supply Chain Visibility

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ABSTRACT

This study explores the effects of business intelligence capabilities on AI-driven logistics innovation by conceptualizing two serial mediation mechanisms: decision support and supply chain visibility. Based on the dynamic 'capability's perspective and resource-based view, the study has the following argument: BI capabilities will enable logistics firms to gather, integrate, analyze, and convert the data from operations to useful knowledge, which helps in making intelligent decisions. A quantitative, explanatory and cross-sectional research design was used. A structured questionnaire was administered to 327 employees/managers in logistics-related companies to gather data. The data was statistically analyzed by SmartPLS software using structural equation modeling. The results indicated that the business intelligence capabilities have a positive impact on decision support as well as AI-powered logistics innovation. Results show that decision support has a positive influence on supply chain visibility, and that supply chain visibility has a positive influence on AI-enabled logistics innovation. Further results demonstrated that BI capabilities and AI-enabled logistics innovation is serially mediated by decision support and supply chain visibility. The research enlightens the literature by detailing how data-driven functionalities can be turned into AI-powered logistics innovation through enhanced decision-making capabilities and supply chain transparency.

Keywords: Business Intelligence Capabilities, AI-Enabled Logistics Innovation, Decision Support, Supply Chain Visibility, Logistics Firms, Serial Mediation
JEL Classifications: M15, O32, D83, M1

1. INTRODUCTION

Digital transformation has revolutionized the logistics companies' information management, decision making and innovative service solutions. In highly competitive logistics market, enterprises are facing more and more requirements to shorten delivery time, eliminate operational uncertainty, improve delivery tracking, quickly solve delivery problems, and provide more intelligent logistics services in the event of logistic disruption. When logistics operations become more complex and data-heavy, businesses can't rely on managerial experience nor operational data spread across various systems (Adama et al., 2024). But what they require is advanced analytical functions that can turn logistics data into accurate and timely knowledge, which can then be used for action (Camilleri, 2024; Khaddam and Alzghoul, 2025).

Today, business intelligence (BI) capabilities are considered a strategic organizational capability for logistics companies (Abu-AlSondos, 2025; Li and Xu, 2025). BI capabilities are the capabilities that the firm has to collect, integrate, analyze and present data in a way that supports managerial decision making and operational improvement. These capabilities include data

integration, reporting systems, dashboards, analytics tools and information processing routines. Previous research reveals that BI capabilities facilitate the use of raw data to derive business knowledge that enables an organization to make better decisions, become more efficient and perform better (Ellikkal and Rajamohan, 2024; Schmitt, 2023).

BI capabilities are especially crucial in the logistics industry where logistics companies deal with vast amounts of data concerning transportation, warehousing, orders, customers, routes, delivery time, inventory, and their supply chain (SC) partners (Gao et al., 2025). If these data are properly collected and analyzed, they can help to improve planning, quicken problem solving, and increase the accuracy of operational decisions. Thus, BI can make the groundwork for clever logistics practices, particularly when businesses try to make use of AI-driven tools like clever routing, automated tracking, predictive alerts, clever storage space systems, and AI-powered distribution optimization (Bataineh et al., 2022; Kashive et al., 2020).

But it is not a foregone conclusion that BI capabilities automatically translate into logistics innovation. Firms need to translate BI outputs into effective decision support. Decision support: Use information, analytics, dashboards, and intelligent systems to help managers make operations and strategic decisions (Mahmoud et al., 2025). In logistics, decision support can assist managers along the way in determining the best delivery routes, prioritizing deliveries, responding to delay, inventory risk management, and more efficient resource coordination. BI capabilities can therefore help with decision support by giving accurate and timely info that can only help with managerial judgment or actions in the day-to-day operations of the company (Alghizzawi et al., 2025).

Another crucial component of the relationship is supplying chain visibility. SC visibility is the firm's capacity to gain access to and share information about orders, shipments, inventory, transportation status, suppliers, customers and logistics processes throughout the SC in real time. Visibility allows logistics businesses to track operations, identify potential disruptions, minimize uncertainty, and boost the level of coordination between partners. Past research on SCs indicates that visibility is important for responsive and coordinated SCs and better SC performance (Dubey et al., 2019; Sahay et al., 2015).

Integrating AI in logistics operations makes it even more important to have visibility into the SC (Ali et al., 2024). All applications of AI need accurate, timely, and integrated data to be able to make a useful prediction, to take an automated action, or to provide an innovative solution in logistics. In the absence of a wide-ranging SC view, AI tools might be working with limited or partial data, reducing their efficacy (Alzuod et al., 2025). For this reason, decision support can enhance the visibility of the SC by helping companies to improve their monitoring of SC activities using BI outputs and analytical tools.

The dependent variable of this study is AI-enabled logistics innovation which is the firm's capability of developing and implementing innovative logistics solutions with the support of AI. Examples of these innovations are AI-powered route planning, real-time delivery tracking, automated warehouse management, predictive maintenance, demand prediction systems, chatbots for customer service, inventory control, and AI support for risk identification (Oubrahim et al., 2022). With AI-driven innovations in logistics, companies can not only boost their service quality but also minimize delays, boost efficiency, enhance customer satisfaction, and adapt more effectively to market and operational fluctuations (De Vass et al., 2021).

While research has been conducted on BI on its own, on SC visibility and on logistics innovation and interfaces between them, only little research has been done to explain how BI capabilities can be used to support logistics innovation by applying AI and to increase visibility of the SC (Oubrahim et al., 2022). This represents a significant research gap, particularly within the logistics sector where innovation becomes more and more data-driven, analytical, visible and intelligent decision-making. So, it is proposed in this research that BI capabilities can contribute directly to supporting decision-making, which can in turn lead to a better SC visibility, which can also lead to AI enabled logistics innovation (Kalaiarasan et al., 2022).

Thus, this study seeks to analyze the influence of the BI capabilities on AI-based logistics innovation, and studies the role of the following serial mediating variables: decision support and SC visibility. The study adds to the literature by providing a mechanism to understand how BI still can be translated into AI startup for logistics innovation. On the practical side, the study offers valuable insights for logistics companies looking to boost their data analytics, enhance decision-making tools, increase SC transparency, and create innovative AI-powered logistics solutions (Abousweilem et al., 2026).

The proposed model is based on the assumption that BI capabilities have a serial mediation effect on the relationship between AI-driven logistics innovation and logistics innovation. First, BI capabilities augment decision making by delivering accurate, consistent and timely information for logistics decision making. Second, decision support enhances SC visibility, allowing firms to monitor SC activities better, facilitating information sharing, and identify operational problems. Third, in a world driven by AI, logistics innovation also relies on the availability of data transparency, as third parties can be connected to offer visibility across the supply. The model also reflects the relationship between BI capabilities and logistics innovation through AI. This direct route enables the study to analyze if BI capabilities not only have an indirect influence on logistics innovation in terms of decision support and SC visibility, but also a direct impact.

2. LITERATURE REVIEW AND HYPOTHESES DEVELOPMENT

2.1. Business Intelligence Capabilities

BI capabilities are those of an organization to gather, synthesize, analyze and convert all the data into meaningful information and use it for managerial and operational decision making (Belhadi

et al., 2019). These include data warehousing, reporting systems, dashboards, analytics tools, information integration and data visualization. For logistics companies, BI features are particularly significant, as the logistics operations produce vast amounts of operational data on orders, inventory, transportation routes, delivery time, as well as in the warehouse, customer requests, and SC partners (Apasrawirote et al., 2022; Khawaldeh and Alzghoul, 2024).

Previous studies reveal that BI and analytics can be a source of value for businesses in terms of productiveness in information quality, decision-making, and responsiveness of organizations (Al-Sartawi et al., 2024). Likewise, (Onesi-Ozigagun et al., 2024) stressed the importance of data warehousing and BI systems for the success of an organization, as it allows a firm to better manage and utilize information. So, strategically speaking, BI capabilities are like any other organizational capability, which helps companies turn iniquitous data into knowledge that enables action and innovation.

In logistics, the BI functions can assist logistics managers, offering them reliable, up-to-date, and comprehensive data on logistics processes. This allows companies to pinpoint delivery delays, keep an eye on service performance, optimize routes, and address issues promptly. Thus, BI capabilities should reinforce decision support, and make sure that the logistics manager can rely on information and analytical product outputs.

- H_1: BI capabilities have positive impact on decision support.

2.2. Decision Support

Decision support is the support of information systems, analytical tools, reports, dashboards, and intelligent technologies that aid management in decision making. Decision support systems are used in logistics management to examine alternatives, to address operational issues and to decide on routing and delivery schedules, inventory, warehouse and supplier management and customer service. Decision support is closely related to BI, as BI systems will give you the analysis output and data that will help you make better decisions. By providing accurate dashboards, analytical reports, and real-time data, managers can make informed decisions and minimize uncertainties. According to (Altay et al., 2018) decision support systems evolved not only as information systems but also as analytical and knowledge-based systems, which aid decision making in complex situations (Ivanov, 2021; Roque Júnior et al., 2023). This is very relevant to logistics companies, as many of the decisions made by them are uncertain, are made under time pressure, and involve multiple actors.

Decision support can also be used to improve the visibility of the SC. The more firms are able to use analytical systems to monitor shipments, inventory, suppliers and delivery processes, the more they are able to see what is happening across the SC. Improved decision support helps businesses to see disruptions, spot backlogs, monitor orders and communicate with involved parties. Therefore, it will be expected that decision support will lead to greater SC visibility.

- H_2: Decision support has a positive impact on SC visibility.

2.3. Supply Chain Visibility

SC visibility can be defined as the organization's capacity to access, monitor and disseminate accurate information on a firm's SC throughout the various stages and partners. It encompasses views of inventory, orders, shipments, transportation status, supplier activity, customer demand and delivery performance. The visibility in the SC allows companies to see what is going on throughout the SC and help them coordinate, respond, and risk manage. (Kalaiarasan et al., 2022) contended that it is important to have visibility of the SC to help with better coordination and less uncertainty. Similarly, (Oubrahim et al., 2022) suggested that SC visibility is valuable because of information availability and its utility in making operational decisions. For logistics businesses, visibility plays a crucial role as it influences delivery performance, allowing them to track shipments, monitor warehouse operations, and proactively address delays to ensure customers and partners receive the correct information at the right time.

AI-powered logistics innovation is also hinged on SC visibility. In the field of artificial intelligence, applications demand corrects and up-to-date information to make predictions, automate processes, optimize resources, and make informed decisions. For instance, AI-powered route optimization, predictive delivery notifications, demand anticipation, inventory management, and tracking systems are all reliant on accurate and transparent SC data. Thus, companies that have more visibility in the SC are more inclined to develop and implement logistics innovations with AI.

- H_3: SC visibility is positively related to AI-driven SC innovation.

2.4. AI-Enabled Logistics Innovation

Logistics Innovation with "AI" is the creation and adoption of novel or enhanced logistics processes, services, and solutions that leverage AI technology. The innovations can range from AI-driven route optimization and intelligent warehouse automation to predictive maintenance, automated shipment tracking, smart customer service systems, and AI-aided risk detection, amongst others.

With the growing significance of AI in logistics, businesses now have the capacity to leverage vast quantities of data to anticipate operational challenges, reduce repetitive tasks, and help expedite decision-making. AI applications can boost logistics efficiency, minimize delivery delays, enhance customer service, and enable more flexible and innovative logistics operations. (Ellram and Ueltschy Murfield, 2019) suggest that digital technologies and capabilities of data and analytics can help in enhancing the SC resilience and the response capacity of the organization (Dangelico and Vocalelli, 2017). This indicates that utility of data, analytics, and visibility are deeply linked with AI-powered logistics innovation (Kovács and Falagara Sigala, 2021).

BI capabilities can directly help logistic AI innovation because BI offers the data architecture and foundation of analytics that is used to create logistic AI solutions. Companies that possess robust BI capabilities can pick out opportunities for innovation, examine logistics challenges, track performance gaps, and help with AI-enhanced improvement initiatives. As such, it is expected that BI

capabilities will have a direct positive impact on the innovations in logistics, which are supported by AI.

- H_4: BI Capabilities have positive effects on AI-based innovation in business logistics.

2.5. Serial Mediation of Decision Support and Supply Chain Visibility

The validations of the mediation effect of decision support and SC visibility between BI capabilities and AI-enabled logistics innovation are as follows: Decision support plays a mediating role between BI capabilities and AI-enabled logistics innovation, and SC visibility also plays a mediating role between decision support and AI-enabled logistics innovation. That is, BI capabilities are primarily used to improve decision support through accurate and integrated information. Decision support, on the other hand, enhances visibility in the SC, allowing companies to better track and manage logistics operations and share information. Lastly, visibility in the SC is vital for AI-driven innovations in logistics, as it offers transparent and trustworthy data that is essential for AI-powered logistics solutions.

This logic of serial mediation, in itself, is in line with the notion that capabilities have to be transferred into decision-making processes and operational transparency if data is to drive innovation. BI capabilities is the base for the information processing, while decision support systems assist managers in their use of this information in actual logistics situations. These decisions enhance the visibility which creates the conditions necessary for AI-powered innovation across the SC. So the power of BI capabilities manifest themselves in a cascading manner starting with data becoming decision support, decision support leading to visibility, and then visibility driving AI-powered logistics innovation.

- H_5: BI capabilities positively influence AI-based innovation in logistics through the serial mediation model of decision support and SC visibility.

2.6. Conceptual Framework

The proposed conceptual framework explains how BI capabilities enhance AI-enabled logistics innovation through decision support and SC visibility. The framework assumes that organizations with strong BI capabilities can better collect, analyze, and utilize data to support intelligent logistics operations and strategic decision-making. The model proposes that BI capabilities improve decision support by enabling managers to make faster, more accurate, and data-driven logistics decisions. Improved decision support subsequently enhances SC visibility by increasing real-time information sharing, operational transparency, and coordination across SC activities. The framework further suggests that higher SC visibility enables organizations to implement AI-enabled logistics innovations more effectively, including intelligent routing, predictive logistics systems, automated warehousing, and AI-supported inventory management. In addition, the framework proposes a direct relationship between BI capabilities and AI-enabled logistics innovation, indicating that organizations with advanced analytical and technological capabilities are more prepared to adopt AI-driven logistics technologies (See Figure 1).

2.7. Theoretical Foundation

2.7.1. Dynamic capabilities theory

Dynamic capabilities theory is a theory that differentiates sensing, seizing, and reconfigure. This theory is appropriate for the current study due to the fact that logistics companies line up in an environment with uncertainty, digital transformation, customer pressure and SC disruptions. BI features enable businesses to sense information and uncover business opportunities. Decision support enables companies to make optimum choices to become aware of opportunities, choosing more beneficial logistics actions. Reconfiguration is enabled by SC visibility, which enables companies to coordinate information and processes within the SC. These capabilities combined, enable AI logistics innovation.

2.7.2. Resource-based view

The resource-based view holds that companies that have valuable, rare, inimitable, and well-organized resources are able to perform better and innovate. Considering in this study, the BI capabilities are viewed as strategic resources, since they facilitate the management of data, the creation of knowledge and the decision making in logistics. Decision support and chain visibility are other organizational capabilities that enable companies to convert data into innovation. Hence, RBV can be used to support this claim that companies who possess good BI abilities are more likely to develop AI-based logistics innovations.

3. METHODOLOGY

The study adopted a quantitative, explanatory, and cross-sectional research design to examine how BI capabilities influenced AI-enabled logistics innovation through decision support and SC visibility. The quantitative approach was selected because it enabled the researcher to test the proposed hypotheses and analyze the relationships among the study variables using statistical techniques. The explanatory design was considered appropriate because the study aimed to explain the role of BI capabilities in improving logistics innovation and understanding how decision support and SC visibility mediated these relationships. The cross-sectional approach was also adopted because the data were collected from respondents at a single point in time, which is commonly used in management, logistics, and information systems research when examining organizational capabilities and innovation relationships (Ellram and Ueltschy Murfield, 2019; Nicoletti and Appolloni, 2024).

The study population consisted of employees and managers working in logistics-related companies that utilized digital technologies, BI systems, and AI-supported logistics practices. The targeted organizations included logistics service providers, transportation companies, warehousing firms, ecommerce logistics companies, distribution companies, and SC organizations. A purposive sampling technique was used because the study required respondents with sufficient knowledge and practical experience in logistics operations, BI systems, SC visibility, and AI-enabled logistics innovation. 327 respondents from the logistics industry were targeted, and only valid and complete questionnaires

were included in the final analysis. This sampling approach was considered appropriate because not all employees in logistics companies possess adequate knowledge regarding BI capabilities and AI-supported logistics practices (Lai et al., 2023).

The data were collected using a structured questionnaire distributed electronically through Google Forms and direct communication with logistics companies. The questionnaire included demographic information and measurement items related to BI capabilities, decision support, SC visibility, and AI-enabled logistics innovation. A five-point Likert scale ranging from strongly disagree to strongly agree was used to measure all variables. The measurement items were adapted from previously validated studies to ensure content validity and reliability. BI capabilities were measured using items adapted from Ellram and Ueltschy Murfield (2019) and Nicoletti and Appolloni (2024), while decision support items were adapted from Lai et al. (2023). SC visibility was measured using items adapted from Ali et al. (2024) and Xu et al. (2023). The questionnaire was also reviewed by academic experts in logistics, SC management, BI, and digital transformation prior to final distribution to improve clarity and relevance.

4. RESULTS

4.1. Measurement Model Assessment

For the measurement model, the factor loadings, Cronbach's alpha, composite reliability, rho_A, and average variance extracted were examined. Findings suggested all the factor loadings were greater than or very close to 0.7, which is the recommended threshold value for good loading of the items to the constructs. Cronbach's alpha values were between 0.867 and 0.912 and composite reliability values were between 0.899 and 0.931. These values go beyond the acceptable limit of 0.70 indicating reliability of constructs. Moreover, the AVE was between 0.600 and 0.692, which was greater than the minimum acceptable value of 0.50. Thus, the measurement model was proven to have acceptable convergent validity and reliability (Table 1).

4.2. Discriminant Validity

The Fornell–Larcker criterion and HTMT were used to examine the discriminant validity. The Fornell-Larcker results showed that the square root of AVE for each construct was greater than its correlations with the other constructs. This means that every construct had enough distinction to be considered separate from the other constructs of the model. As in Table 2, the HTMT values were also below the recommended threshold of 0.90. Therefore, discriminant validity was confirmed.

Table 3 presents the HTMT results used to assess discriminant validity among the study constructs. The HTMT values ranged from 0.688 to 0.812, which were all below the recommended threshold value of 0.90. The HTMT values between BI capabilities and decision support, SC Visibility, and AI-enabled logistics innovation were 0.756, 0.703, and 0.688, respectively. In addition, the HTMT values between decision support and SC visibility, decision support and AI-enabled logistics innovation, and SC visibility and AI-enabled logistics innovation were 0.793, 0.741, and 0.812, respectively. Since all HTMT values remained below 0.90, the results confirmed that there was no serious discriminant validity problem among the study constructs. Therefore, adequate discriminant validity was achieved, indicating that each construct represented a distinct conceptual variable within the research model.

4.3. Structural Model Assessment

The structural model was tested as a next step after establishing the reliability and validity of the measurement model. Prior to

Table 1: Construct reliability and convergent validity

Construct	Item	Loading	Cronbach's alpha	CR ρ_a	CR ρ_c	AVE
Business intelligence capabilities	BIC1	0.812	0.912	0.916	0.931	0.692
	BIC2	0.845				
	BIC3	0.872				
	BIC4	0.834				
	BIC5	0.819				
	BIC6	0.803				
Decision support	DS1	0.781	0.884	0.889	0.911	0.631
	DS2	0.806				
	DS3	0.827				
	DS4	0.792				
	DS5	0.801				
	DS6	0.755				
Supply chain visibility	SCV1	0.798	0.895	0.898	0.919	0.654
	SCV2	0.826				
	SCV3	0.841				
	SCV4	0.817				
	SCV5	0.786				
	SCV6	0.781				
AI-enabled logistics innovation	AILI1	0.763	0.867	0.872	0.899	0.600
	AILI2	0.792				
	AILI3	0.809				
	AILI4	0.776				
	AILI5	0.748				
	AILI6	0.758				

BIC: BI capabilities, DS: Decision support, SCV: Supply chain visibility, AILI: AI-enabled logistics innovation

hypothesis testing, multicollinearity was determined by using variance inflation factors. The results indicated that all VIF values were below the recommended level of 5, thus indicating that there was no significant multicollinearity problem (Table 4).

4.4. Direct Effects

The bootstrapping procedure was used for testing the direct effects. The findings indicated that the BI capabilities were positively and significantly related to decision support. So, H_1 was accepted. Meanwhile, decision support was also observed to have a positive and significant impact on SCV, supporting H_2. Further, SC visibility positively and significantly influenced AI-driven logistics innovations as reflected on H_3. The findings also indicated that the BI had a direct positive impact on logistics innovation with AI, which indicated H_4.

Results in Table 5, showed that companies with higher BI level are able to enhance decision support. This means that BI tools, dashboards, reports, and analytics systems can aid the logistics manager in their operations and strategies. The study also reveals that the use of decision support improves the visibility of a value chain, as firms are able to trace their logistics activity, receive timely and correct information, and tackle issues in the chain more effectively. Moreover, SC visibility plays a crucial role in facilitating AI-driven innovations in logistics, as it enables the necessary transparency and information flow for implementing smart logistics.

4.5. Serial Mediation Analysis

The serial mediation effect was tested using bootstrapping. The findings as in Table 6, indicated the indirect impact of BI attributes on the AI facilitated logistics innovation via decision support and SC visibility was positive and significant. So, H_5 was accepted.

The findings corroborate the mediation stage, which reveals the presence of a serial mediation role between the BI capabilities and AI-provided logistics innovation via decision support and SC visibility. This results in BI capabilities boost decision-making, which in turn drives visibility of the SC, which in turn enables AI-powered innovations in logistics. The mediation was deemed partial since the direct effect of the BI constructs on the AI-based logistics innovations remained significant once the mediators were added.

5. DISCUSSION

Based on the results of this study, it is argued that BI capabilities have an important and significant role in improving logistics innovation that is supported by AI. It was revealed that the BI capabilities have a positive influence on decision support, meaning that companies with a higher BI capability have the ability to gather, consolidate, analyze and translate the data of logistics into valuable information to be used for managerial and operational decisions. This implies that BI capabilities are not just technical tools, but also strategic capabilities that can help logistics firms boost the quality, speed and accuracy of their decision making. The positive relationship between BI capabilities and decision support indicates that BI systems, dashboards, analytical reports, and data visualization tools indeed provide the managers with accurate and timely information. The logistics institutions are characterized by situations in which the decision can be influenced by delivery failures, fluctuating demand, transport issues and customer requirements. Thus, companies with well-built BI capabilities will be better able to assist logistics managers in choosing their routes, be able to react faster to a logistics disruption, manage inventory and improve their operational planning.

The results also showed that there is a positive impact on SC visibility due to decision support. This finding suggests that an effective application of analytical tools and decision support systems increases logistics companies' ability to monitor their shipments, track their stock, detect delays, and share information along the SC. Decision support can be used to help give clarity of information, by being able to organize and interpret operational information. Therefore, the managers can more efficiently gain insight to what is going in and around the logistics processes and better respond to the issues arising in the processes.

Moreover, the results confirmed that SC visibility positively affects AI-enabled logistics innovation. This discovery underscores the need for information transparency for innovative logistics solutions using artificial intelligence. Clear, timely and visible SC data is crucial for AI-powered solutions, including smart route optimization, predictive alerts, intelligent shipment tracking, automated warehousing, and AI-powered customer service. Such systems need high-quality data to make meaningful predictions and facilitate intelligent logistics decisions, but without adequate visibility, they can lack the necessary information.

Table 2: Fornell–Larcker criterion

Construct	BIC	DS	SCV	AILI
Business intelligence capabilities	**0.832**			
Decision support	0.667	**0.794**		
Supply chain visibility	0.621	0.692	**0.809**	
AI-enabled logistics innovation	0.604	0.638	0.701	**0.775**

Diagonal values represent the square root of AVE

Table 3: HTMT results

Construct	BIC	DS	SCV	AILI
Business intelligence capabilities	—			
Decision support	0.756	—		
Supply chain visibility	0.703	0.793	—	
AI-Enabled logistics innovation	0.688	0.741	0.812	—

Table 4: Multicollinearity assessment

Path	VIF
BIC→DS	1.000
DS→SCV	1.801
SCV→AILI	2.214
BIC→AILI	2.037

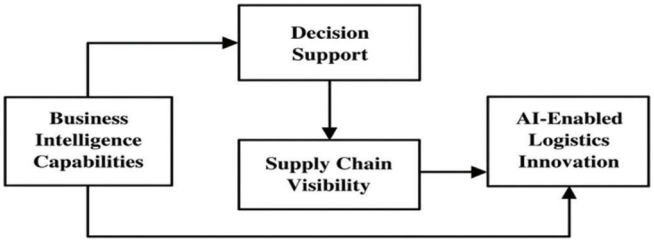
Table 5: Direct effects

Hypothesis	Path	β	t-value	P-value	Decision
H_1	BIC→DS	0.667	13.926	<0.001	Supported
H_2	DS→SCV	0.692	15.114	<0.001	Supported
H_3	SCV→AILI	0.512	8.764	<0.001	Supported
H_4	BIC→AILI	0.286	4.691	<0.001	Supported

Table 6: Serial mediation analysis

Hypothesis	Indirect path	β	t-value	P-value	Decision
H_5	BIC→DS→SCV→AILI	0.236	6.813	<0.001	Supported

Figure 1: Conceptual framework of the study



The impact of BI capabilities on AI-powered innovation in logistics had direct impact as well. The outcome indicates that the BI capabilities can have a direct impact on logistics innovation by supplying the data infrastructure and analysis base for AI-based solutions. Companies in the advanced usage of BI are more likely to see new avenues for innovation, measure performance gaps, and find opportunities for intelligent logistics improvement and solve operational issues. Thus, it is safe to include BI capabilities as one of the key enablers of AI driven logistics innovation.

The serial mediation result offers valuable insights regarding the mechanism of BI capabilities to AI-based logistics innovation. Results indicated that the association between BI capabilities and AI-enabled logistics innovation was serially mediated by decision support and SC visibility. This translates into BI strengthening decision making; then, decision making strengthening SC visibility; and finally, SC visibility strengthening AI-based logistical innovations. In fact, there's a sequence of events there that proves that the value of BI capabilities is only achieved when the data is converted into better decisions and then better decisions leads to better visibility into logistics and SC operations. Overall, the findings support the claim that logistics innovation with AI cannot be achieved merely by embracing AI technologies. To innovate logistics, companies should provide powerful BI competencies, effective decision support systems and high SC transparency. For logistics companies, this means that BI, decision support and visibility are complementary functions which together allow for AI-powered innovation.

5.1. Theoretical Contributions

This study makes a number of theoretical contributions. First, in the realm of BI literature, it reveals that BI capabilities are relevant not only for the overall performance of the organization, but also for logistics innovations enabled by AI. This brings the BI capabilities to the Logistics Innovation context. Secondly, the study adds to the literature on logistics and SCs by identifying the SC visibility as a mechanism which connects the decision support and the AI-enabled innovation. This study considers visibility as an innovation-enabling capability in AI-supported logistics environments whereas previous studies have been treated as a operational capability.

Third, the study enriches the literature on innovation with an understanding that logistics innovation with AI requires building an innovation stack. In particular, BI is complemented by decision support, which in turn promotes visibility in the SC, thereby facilitating innovation with the help of AI. This serial mediation model is a more precise account of the process of data capabilities becoming innovation outcomes. Fourth, the research found that logistics companies need to be able to sense, interpret, and act on the data related to their operations to create AI-informed innovation. The BI capability enables companies to sense information, the decision support capability enables them to interpret and act on information, and the SC visibility capability enables them to act on the information through reconfiguration of logistics processes that is being gained through visibility and coordination.

5.2. Practical Implications

The results have much practical significance for logistics companies and logistics managers. The first is for logistics companies to enhance their BI by investing in data warehouses, dashboards, reporting, analytics and integrated information platforms. These tools can support companies in the collection and use of logistics data. Second, managers should enhance the decision making support tools to make the logistics decisions better. Managers can use decision support tools to analyze routing options, track delivery performance, mitigate inventory challenges, react to disruption, and enhance operations planning.

Thirdly, companies need to boost SC transparency by implementing real-time tracking systems, digital platforms, information-sharing tools, and integrated logistics. Hence, better visibility helps companies track shipments, spot delays, collaborate with partners, and give customers the right information. Fourth, business logistics companies should leverage BI and visibility solutions as a starting point for AI-driven logistics innovation. Without accurate, visible data, AI-powered tools like predictive delivery notifications, intelligent logistics planning, automated warehouses, intelligent tracking systems and AI-driven customer support won't work. Thus, the companies shouldn't jump into the implementation of AI tools but rather should lay the foundation with the data and visibility tools that will help them in successful AI implementation. Lastly, managers need to ensure that workers who are part of the logistics, SC, IT and operations departments are appropriately trained to make effective use of BI tools and AI-assisted systems. Employee skills are critical to making digital technologies lead to innovation and improvement in performance.

6. CONCLUSION

This study aimed at uncovering how the capabilities of BI influence logistics innovation by using AI systems, where decision support and SC visibility act as serial mediators. The study suggested that the BI capabilities can be used to enhance the decision support that can lead to AI-enabled logistics innovations and better visibility within logistics SCs. All the hypotheses were supported

by the results. BI capabilities were found to have a positive impact on decision support and AI powered logistics innovation. Decision support had a positive influence on SCV, and SCV had a positive influence on AI-based logistics innovation. The findings also showed that decision support and SC visibility act as a serial mediator between the relationships of BI capabilities and AI enabled logistics innovation. The study makes a unique contribution to the literature by providing insights into how BI capabilities contribute to AI-based Logistics Innovation. In particular, the survey results indicate that the functionality of BI is being translated into innovation results via decision support and SC visibility. This offers a more comprehensive view of the potential of data-driven capabilities to enable AI-driven innovation in logistics companies. Logistically, the results indicate that logistics companies need to invest in BI systems, dashboards, data analytics tools, decision support systems and SC visibility systems. These investment activities can help companies make better logistics decisions, enhance logistics transparency, and create new logistics solutions based on artificial intelligence.

There are some drawbacks to this study. First, the study adopts the cross-sectional research design, that is, the data are collected at one point in time. The longitudinal data could be employed in future studies to understand the evolution of BI capabilities and the innovations in AI-enabled logistics. Secondly, the study concentrates on logistics-oriented companies. The same model could be tested in the future in sectors like manufacturing, retail, healthcare logistics, or ecommerce SCs to compare and contrast it with the findings in this study. Third, questionnaire-based data is used which could be vulnerable to common method bias. While such concern can be minimized through procedural and statistical procedures, future studies might incorporate survey-based data with objective performance indicators, interviews or case studies. Finally, decision support and SC visibility are discussed as mediating factors. Additional mediators can be added to future research to include predictive analytics capability, digital SC resilience, organizational learning or logistics process automation. Lastly, future research could investigate the role of moderator variables like environmental uncertainty, readiness for technological innovation, firm size, top management support, or AI readiness. These moderators might account for when and how BI capabilities are more likely to enable logistics innovation with AI.

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