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Explaining the Role of Knowledge Management and Digital Innovation in Enhancing Smart Supply Chain Performance in Defense Organizations: Analyzing the Mediating Role of Organizational Learning

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Abstract

Background & Purpose: In the era of expanding intelligent logistics processes, defense organizations are required to simultaneously leverage the capabilities of knowledge management and digital innovation. However, the mechanisms through which these capabilities influence smart supply chain performance, particularly through organizational mechanisms such as organizational learning, require further empirical investigation. Therefore, the present study aims to explain the role of knowledge management and digital innovation in enhancing the smart supply chain performance of defense organizations, with a particular emphasis on the mediating role of organizational learning.

Methodology: This study is applied in terms of purpose and adopts a descriptive-correlational design based on structural equation modeling (SEM). The statistical population consisted of managers and experts from the country's defense organizations, from which 330 participants were selected using simple random sampling. Data were collected through a standardized questionnaire. The validity of the research instrument was confirmed through content validity, while its reliability was established using Cronbach's alpha coefficient. Data were analyzed using the partial least squares structural equation modeling (PLS-SEM) approach with SmartPLS software.

Findings: Knowledge management has a positive and significant effect on both organizational learning and smart supply chain performance. Likewise, digital innovation exerts a positive and significant influence on organizational learning and smart supply chain performance. Furthermore, organizational learning directly and significantly enhances smart supply chain performance. The findings also confirmed the mediating role of organizational learning in the relationship between knowledge management and smart supply chain performance, as well as in the relationship between digital innovation and smart supply chain performance.

Conclusion: Investing in digital infrastructure, facilitating knowledge creation and sharing processes, empowering employees, and institutionalizing continuous learning provide the foundation for enhancing the agility, coordination, adaptability, and operational effectiveness of the defense supply chain.

Keywords: *Knowledge Management, Digital Innovation, Organizational Learning.*

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Introduction

In recent years, rapid advances in digital technologies have fundamentally transformed the structure, processes, and governance of supply chains. Supply chains are no longer viewed merely as operational or logistics systems; rather, they have evolved into intelligent, interconnected, and data-driven ecosystems capable of sensing environmental changes, processing vast amounts of information in real time, and making autonomous decisions. Emerging technologies such as the Internet of Things (IoT), artificial intelligence (AI), blockchain, cloud computing, and big data analytics have accelerated the transition toward smart supply chains, enabling organizations to improve visibility, responsiveness, agility, resilience, and collaborative decision-making across the entire supply network (Qu et al., 2025; Sharma et al., 2025; Ivanov & Dolgui, 2021). Consequently, smart supply chain management has become one of the most important strategic priorities for organizations seeking sustainable competitive advantage in an increasingly uncertain and digitally connected environment.

The importance of this transformation is even greater in defense organizations. Unlike commercial supply chains, defense supply chains operate in environments characterized by high uncertainty, technological complexity, strict security requirements, confidential information, geopolitical risks, and mission-critical operations. Therefore, supply chain performance in defense organizations directly influences operational readiness, national defense capability, and strategic resilience (Andrews, 2011; Korkmaz, 2024). Any disruption or inefficiency within defense supply chains may result not only in increased operational costs and delays but also in reduced military preparedness and potential threats to national security (Antai & Hellberg, 2025). Consequently, governments and defense agencies worldwide have invested heavily in digital transformation initiatives to modernize their supply chain systems. Recent reports indicate that more than 55% of defense suppliers have adopted digital supply chain management tools (Hellberg et al., 2025). Nevertheless, despite these substantial investments, organizations continue to encounter significant technological, managerial, and organizational barriers that hinder the realization of the full potential of smart supply chains (Shah et al., 2024; Motamedimoghadam et al., 2025).

A growing body of evidence suggests that the limited success of digital transformation initiatives cannot be explained solely by technological deficiencies. Rather, one of the fundamental challenges lies in organizations' inability to transform organizational knowledge into digital capabilities that effectively support smart supply chain operations. In many defense organizations, fragmented information systems, insufficient knowledge-sharing practices, weak organizational learning

cultures, and ineffective knowledge management mechanisms reduce the value generated by digital technologies (Ghaffarian Sokhanvar et al., 2025; Sekban et al., 2025). As a result, organizations often fail to translate technological investments into improved supply chain performance. This challenge may increase operational costs, reduce flexibility, weaken resilience against environmental disruptions, and ultimately diminish defense readiness (Korkmaz, 2024; Antai & Hellberg, 2025).

From a theoretical perspective, the knowledge-based view of the firm argues that knowledge constitutes the most valuable strategic resource for achieving sustainable competitive advantage (Nonaka & Takeuchi, 1995). Accordingly, knowledge management provides a systematic framework for creating, acquiring, storing, sharing, and applying organizational knowledge, thereby enhancing organizational capabilities and improving decision-making processes (Heisig, 2024; Anshari & Hamdan, 2022). Similarly, the theory of dynamic capabilities emphasizes that organizations must continuously integrate, build, and reconfigure internal and external competencies to respond effectively to rapidly changing environments (Teece, 2018). Within digitally enabled supply chains, such capabilities depend heavily on organizations' ability to leverage knowledge resources and transform them into innovative digital practices.

In this context, digital innovation represents more than the adoption of advanced technologies; it refers to the development of new products, services, business processes, and organizational practices through digital technologies (Yoo et al., 2024; Kroh et al., 2024). Successful digital innovation requires organizations to develop complementary capabilities, including data analytics, digital platforms, technological integration, and organizational coordination (Felicetti et al., 2024; Motamedimoghadam et al., 2025). However, accumulating evidence indicates that technological investments alone rarely generate sustainable performance improvements unless they are accompanied by effective knowledge management and organizational learning mechanisms (Shah et al., 2024).

Organizational learning constitutes the critical mechanism through which knowledge is transformed into collective capabilities, adaptive behaviors, and continuous innovation. It enables organizations to acquire, interpret, disseminate, and institutionalize knowledge while responding effectively to environmental uncertainty and technological change (Levitt & March, 1988; Basten & Haamann, 2018; Argote, 2013). Accordingly, organizational learning can be viewed as the missing link between knowledge management, digital innovation, and smart supply chain performance. Organizations that effectively learn from accumulated knowledge are more capable of exploiting digital technologies, adapting to environmental changes, and continuously improving supply chain processes.

Despite this theoretical foundation, empirical evidence remains fragmented. Domestic studies indicate that technological initiatives often fail because knowledge management strategies are not aligned with organizational strategies and because organizational learning cultures remain underdeveloped (Akbari et al., 2024; Moslemi et al., 2024). Likewise, international research demonstrates that digital technologies alone cannot generate superior supply chain performance without effective knowledge sharing, learning capabilities, and organizational integration (Rafi et al., 2025; Figueiredo et al., 2025; Nasution et al., 2025). These findings suggest that organizational learning may serve as a key explanatory mechanism through which knowledge management and digital innovation enhance smart supply chain performance.

Nevertheless, a critical gap remains in the literature. Previous studies have predominantly examined knowledge management, digital innovation, or organizational learning independently or within commercial and manufacturing contexts. Comparatively little attention has been devoted to investigating the integrated relationships among knowledge management, digital innovation, organizational learning, and smart supply chain performance, particularly within defense organizations where operational requirements, security considerations, and technological complexity differ substantially from those of civilian industries (Eryarsoy et al., 2022; Alaassar et al., 2026). More importantly, the mediating role of organizational learning in explaining how knowledge management and digital innovation jointly contribute to smart supply chain performance has not yet been comprehensively examined. Consequently, existing studies provide limited theoretical explanation of the mechanisms through which organizational knowledge and digital capabilities are transformed into superior smart supply chain performance in defense organizations.

Addressing this gap is not only theoretically significant but also practically imperative. As defense organizations continue investing in digital transformation initiatives, understanding the organizational mechanisms that convert technological and knowledge-based resources into operational excellence becomes increasingly essential. Therefore, the present study seeks to explain the role of knowledge management and digital innovation in enhancing smart supply chain performance in defense organizations by examining the mediating role of organizational learning. By integrating the knowledge-based view, dynamic capabilities theory, and organizational learning perspective within a single conceptual framework, this study contributes to the literature by providing a more comprehensive explanation of smart supply chain performance in defense organizations. Furthermore, its findings are expected to offer practical guidance for defense managers and policymakers seeking to improve supply chain agility, resilience, adaptability, and operational effectiveness

through knowledge-driven digital transformation.

Literature Review

Knowledge Management; Knowledge management (KM) is recognized as a systematic organizational capability for creating, acquiring, storing, sharing, and applying knowledge to enhance decision-making, innovation, and performance. From the perspective of the resource-based view and knowledge-based theory of the firm, knowledge represents a strategic resource that enables organizations to develop dynamic capabilities and sustain competitive advantage (Heisig, 2024). Through effective integration of knowledge processes, organizations can transform dispersed knowledge into valuable assets that improve adaptability, learning, and operational effectiveness.

Knowledge management includes interconnected processes of knowledge acquisition, creation, storage, sharing, and application, whose effective interaction facilitates innovation and organizational improvement (Andervazh & Sadrjahani, 2024). Domestic studies also emphasize that alignment between knowledge management strategies and organizational objectives enhances productivity and effectiveness (Manghoutaei & Sharifi Rad, 2025). Empirical evidence indicates that knowledge management contributes to sustainable supply chain performance through mechanisms such as eco-innovation (Shafiei Nikabadi et al., 2024). However, successful implementation depends not only on technological infrastructure but also on managerial support, organizational culture, and human capabilities, as cultural and managerial barriers may be more influential than technical limitations (Chegeni et al., 2025). Moreover, advances in artificial intelligence and generative AI have expanded knowledge management capabilities in knowledge creation and application, although they require careful consideration of ethical issues and the balance between human and machine knowledge (Jarrahi et al., 2023; Alavi et al., 2024). Therefore, knowledge management can be considered an integrated capability based on the interaction of people, technology, and processes that supports learning, innovation, and sustainable performance.

Digital Innovation; Digital innovation refers to the development and implementation of new products, services, processes, and business models through the application and recombination of digital technologies (Yoo et al., 2024). Unlike traditional innovation, digital innovation relies on modular architectures, continuous technological recombination, and data-driven value creation, enabling organizations to transform their capabilities and competitive strategies (Bogers et al., 2022).

At the organizational level, digital innovation represents a strategic capability that enhances the ability to identify opportunities, analyze data, utilize digital platforms, and coordinate technological resources

(Motamedimoghadam et al., 2025). From the dynamic capabilities perspective, digital innovation is supported by microfoundations such as digital orientation, digital mindset, innovation networks, data management capabilities, and resistance management, which enable organizations to sense opportunities, exploit resources, and continuously adapt (Kroh et al., 2024). Furthermore, digital innovation increasingly develops within digital ecosystems and collaborative networks through which organizations jointly create value and redesign business models (Felicetti et al., 2024). Bibliometric studies also demonstrate the rapid expansion of digital innovation as a multidisciplinary research field (Alaassar et al., 2026). Accordingly, digital innovation can be viewed as a multidimensional strategic capability that leverages digital technologies, data-driven decision-making, and resource reconfiguration to facilitate organizational transformation and sustainable competitive advantage.

Organizational Learning; Organizational learning refers to the continuous process through which organizations create, acquire, share, interpret, and apply knowledge to improve performance and adapt to environmental changes (Levitt & March, 1988; Odor, 2018). Beyond knowledge acquisition, organizational learning transforms individual experiences into collective capabilities that support innovation, continuous improvement, and strategic adaptation.

This process involves learning from experience, developing shared mental models, and creating organizational memory for future decision-making (DiBella et al., 1996). Organizational learning capability reflects the ability of organizations to generate new knowledge, disseminate innovative ideas, and institutionalize learning through experimentation, improvement, benchmarking, and knowledge acquisition mechanisms (Yeung, 1999). Recent studies show that learning networks, collaborative culture, cross-functional interactions, reward systems, flexible structures, and leadership support are important determinants of organizational learning development (Ghaffarian Sokhanvar et al., 2025; Sekban et al., 2025). Moreover, sustainable learning requires the integration of managerial, cultural, individual, and organizational dimensions (Khodaparast et al., 2025). From a theoretical perspective, effective learning systems depend on the interaction of people, processes, and technology (Basten & Haamann, 2018). Organizations that institutionalize learning environments and apply lessons learned are more capable of sustaining innovation and competitive advantage (Armstrong & Foley, 2003; Anand & Brix, 2022). Thus, organizational learning represents a strategic capability that converts knowledge into innovation, adaptability, and long-term performance.

Smart Supply Chain; The **smart** supply chain has emerged from the integration of advanced digital technologies with supply chain

management practices, transforming traditional supply chains into intelligent, interconnected, and data-driven systems. Unlike conventional supply chains, smart supply chains utilize digital technologies to provide real-time visibility, predictive analytics, intelligent decision-making, and adaptive coordination across supply networks.

Scientometric research indicates that technologies such as artificial intelligence, blockchain, big data analytics, the Internet of Things, Industry 4.0, and traceability systems constitute the technological foundation of supply chain smartification (Ghasemi Hamedani et al., 2023). Similarly, Sinaei et al. (2025) highlight technical, organizational, operational, and human dimensions as key components of digital supply chains, emphasizing sustainability, resilience, and digital collaboration. Qu et al. (2025) define smart supply chains as integrated systems based on digital infrastructure, intelligent decision-support mechanisms, and collaborative platforms that enable organizations to respond effectively to complexity and uncertainty. Furthermore, Saunders et al. (2025) demonstrate that artificial intelligence and machine learning improve forecasting, inventory management, and real-time decision-making, while Liu et al. (2025) emphasize the role of smart supply chain capabilities in enhancing logistics performance and responsiveness.

Accordingly, a smart supply chain can be defined as an intelligent and integrated network that, through advanced digital technologies, analytical capabilities, and collaborative platforms, enables predictive decision-making, operational flexibility, rapid responsiveness, resilience, and sustainable value creation across interconnected organizations.

Theoretical Framework and Hypothesis Development

Knowledge Management and Smart Supply Chain; Knowledge management has become one of the most critical organizational capabilities for developing intelligent, agile, and resilient supply chains. From the perspective of the resource-based view and dynamic capabilities theory, organizational knowledge represents a strategic asset whose value is realized only when it is effectively created, shared, integrated, and applied to support organizational decision-making and operational processes. In smart supply chains, where decision-making increasingly relies on real-time information, predictive analytics, and digital connectivity, effective knowledge management facilitates information integration, enhances collaboration among supply chain partners, and improves the quality and speed of operational decisions. Consequently, organizations with superior knowledge management capabilities are better positioned to exploit digital technologies, respond rapidly to environmental changes, and continuously optimize supply chain performance.

The relationship between knowledge management and supply chain performance has received considerable empirical support. Mousavi Shamsabad et al. (2020) demonstrated that knowledge management

positively influences supply chain performance across financial, internal process, stakeholder, and learning dimensions. Similarly, Mohammadi and Barforoshan (2014) identified knowledge management as a fundamental enabler of supply chain management, emphasizing that knowledge creation and sharing strengthen supply chain integration and coordination. More recently, Akbari et al. (2024) reported that supply chain knowledge management directly enhances strategic supply chain performance and that this relationship is reinforced through entrepreneurial bricolage and operational ambidexterity.

Emerging evidence also indicates that the contribution of knowledge management extends beyond operational efficiency toward building intelligent and resilient supply chains. Shayannia et al. (2025) found that market knowledge management enhances reverse supply chain resilience by enabling organizations to cope more effectively with environmental uncertainty. Likewise, Rafi et al. (2025) argued that knowledge management capabilities facilitate the integration of emerging digital technologies—including artificial intelligence, blockchain, and the Internet of Things—thereby accelerating the development of smart supply chains. Complementing these findings, Benseddik (2025) and Dzhuguryan et al. (2025) showed that knowledge-driven smart supply chain practices strengthen interorganizational collaboration, innovation, and overall supply chain performance.

Taken together, both theoretical arguments and empirical evidence suggest that knowledge management provides the organizational infrastructure required for smart supply chain development by enabling effective knowledge creation, real-time information sharing, collaborative decision-making, and continuous organizational adaptation. Accordingly, the present study proposes the following hypothesis:

Hypothesis 1: Knowledge management has a significant positive effect on smart supply chain performance.

Knowledge Management and Organizational Learning; Knowledge management and organizational learning are closely interconnected organizational capabilities that jointly determine an organization's ability to adapt, innovate, and sustain competitive advantage. The knowledge-based view of the firm suggests that knowledge creates value only when it is effectively absorbed, interpreted, disseminated, and embedded into organizational routines. Likewise, organizational learning theory emphasizes that learning emerges from the continuous acquisition, sharing, interpretation, and application of knowledge throughout the organization. Therefore, knowledge management provides the structural and procedural foundation through which organizational learning develops and becomes institutionalized.

Effective knowledge management enables organizations to capture both explicit and tacit knowledge, preserve organizational memory, facilitate knowledge exchange, and encourage continuous learning across functional boundaries. These processes enhance employees' ability to

interpret experiences, develop new competencies, solve complex problems, and adapt to environmental changes. Consequently, organizations with mature knowledge management systems generally exhibit stronger organizational learning capabilities and greater innovation capacity.

This theoretical relationship has been consistently supported by empirical studies. Nasirzade et al. (2025) found that knowledge management positively and significantly influences organizational learning and that this relationship is strengthened under empowering leadership. Similarly, Safari and Houshmandi Rad (2022) demonstrated that knowledge management infrastructure significantly contributes to the development of organizational learning capabilities. Azimi and Jafari (2023) further reported that improvements in knowledge management directly promote organizational learning and organizational growth by strengthening internal knowledge processes.

International studies provide additional evidence supporting this relationship. Figueiredo et al. (2025), through a comprehensive bibliometric analysis, identified knowledge management as the principal mechanism for facilitating knowledge flows and fostering organizational learning cultures. Likewise, Tinh (2025) confirmed that knowledge management practices significantly enhance organizational learning capability, which subsequently improves organizational performance. Although Al Zoubi et al. (2026) primarily examined knowledge management as a mediating mechanism between organizational learning and innovative performance, their findings further underscore the strong interdependence between these two organizational capabilities.

Overall, the existing theoretical and empirical evidence indicates that knowledge management strengthens organizational learning by systematically supporting knowledge creation, storage, sharing, and application. Through these mechanisms, organizations improve their capacity to acquire, interpret, integrate, and utilize knowledge, thereby establishing a culture of continuous learning and adaptation. Based on this theoretical rationale, the present study proposes the following hypothesis:

Hypothesis 2: Knowledge management has a significant positive effect on organizational learning.

Digital Innovation and Smart Supply Chain; Digital innovation has become one of the principal drivers of smart supply chain transformation by enabling organizations to redesign operational processes, integrate digital technologies, and improve strategic decision-making. Drawing upon the resource-based view, dynamic capabilities theory, and the Technology–Organization–Environment (TOE) framework, digital innovation represents a strategic organizational capability that enables firms to exploit emerging technologies, reconfigure existing resources, and continuously adapt to rapidly changing business environments. Within smart supply chains, digital innovation facilitates real-time information processing, predictive analytics, intelligent automation, and seamless

coordination among supply chain partners, thereby improving operational agility, resilience, and responsiveness.

Existing empirical evidence strongly supports the strategic contribution of digital innovation to supply chain development. Rashedi et al. (2025) demonstrated that innovation ecosystems built upon knowledge-based startups enhance supply chain flexibility, resilience, and strategic alignment while accelerating innovation adoption in technologically intensive industries. Likewise, Babak et al. (2024) reported that organizational innovation, combined with entrepreneurial orientation, significantly strengthens supply chain dynamism and business development. At the international level, Rehman Khan et al. (2022) argued that digital transformation and smart technologies constitute fundamental prerequisites for sustainable supply chain management, emphasizing that sustainability objectives cannot be achieved without digital innovation. Similarly, Wang et al. (2025) found that innovation-oriented policies substantially promote supply chain digitalization through industrial upgrading and inclusive digital financing, whereas Chen et al. (2025) showed that digital innovation policies improve firms' sustainable performance by stimulating innovation investment and reducing operational costs.

Furthermore, Nasution et al. (2025) highlighted that digital technologies—including the Internet of Things, blockchain, cloud computing, and big data analytics—significantly improve supply chain transparency, coordination, visibility, and responsiveness. Collectively, these findings indicate that digital innovation serves as the technological foundation of smart supply chains by integrating intelligent technologies, facilitating real-time information exchange, and strengthening organizations' analytical and decision-making capabilities.

Based on these theoretical arguments and empirical findings, digital innovation is expected to play a significant role in enhancing smart supply chain performance. Therefore, the following hypothesis is proposed:

Hypothesis 3: Digital innovation has a significant positive effect on smart supply chain performance.

Digital Innovation and Organizational Learning; Digital innovation not only transforms organizational technologies and business processes but also reshapes how organizations acquire, create, disseminate, and utilize knowledge. According to the dynamic capabilities perspective, successful digital innovation requires organizations to continuously develop learning capabilities that enable employees to absorb new technologies, interpret digital information, and adapt organizational routines to changing technological environments. Consequently, digital innovation stimulates organizational learning by creating new knowledge, encouraging experimentation, and facilitating continuous organizational adaptation.

Theoretical arguments suggest that the implementation of digital technologies generates new organizational knowledge, which subsequently strengthens learning capabilities and organizational

adaptability. Digital platforms, data analytics, and collaborative technologies enable organizations to share knowledge more effectively, support cross-functional learning, and accelerate organizational problem-solving. Consequently, organizations that actively invest in digital innovation are more likely to develop stronger organizational learning capabilities.

Empirical studies provide substantial support for this relationship. Razmi and Ahmadi (2023) found that digital innovation and knowledge management reinforce organizational learning by enhancing organizational knowledge flows. Likewise, Moslemi et al. (2024) emphasized that digital transformation initiatives become effective only when supported by organizational cultures that encourage learning, experimentation, and innovation. International evidence further confirms this relationship. Galanti and Fantinelli (2025) identified digital learning as an essential capability for learning organizations operating in digital environments. Awad and Martín-Rojas (2024) demonstrated that digital transformation enhances organizational resilience through organizational learning and innovation, while Heriansyah et al. (2025) reported that digital innovation significantly improves organizational learning capability and digital maturity, ultimately enhancing organizational performance.

Overall, these findings suggest that digital innovation provides organizations with new technological opportunities that stimulate continuous learning, knowledge acquisition, and organizational adaptation. Accordingly, the present study proposes the following hypothesis:

Hypothesis 4: Digital innovation has a significant positive effect on organizational learning.

Organizational Learning and Smart Supply Chain; Organizational learning is widely recognized as one of the most important organizational capabilities for enabling intelligent, adaptive, and resilient supply chains. According to the resource-based view and dynamic capabilities theory, organizations continuously improve their competitive position by acquiring, integrating, and applying knowledge to respond effectively to environmental uncertainty and technological change. In smart supply chains, organizational learning enables firms to interpret real-time information, improve collaborative decision-making, strengthen technological adaptation, and continuously optimize operational processes.

Previous studies consistently support this theoretical relationship. Hemmati Noedoust Gilani and Khosh Tinat (2024) demonstrated that organizational learning significantly improves supply chain performance, thereby enhancing overall business outcomes. Likewise, Bagherimanesh et al. (2019) reported that organizational learning strengthens supply chain resilience through organizational innovation. Similarly, Andervazh et al. (2020) found that organizational learning improves supply chain coordination, which represents a critical prerequisite for supply chain digitalization and intelligent integration.

International evidence further reinforces these findings. Eryarsoy et al. (2022) showed that organizational learning enhances supply chain resilience through organizational agility and innovation. Sharma et al. (2025) further argued that organizational learning, combined with green innovation and institutional support, strengthens supply chain flexibility, one of the defining characteristics of smart supply chains. Likewise, Benseddik (2025) found that smart supply chain practices improve interorganizational collaboration and knowledge integration, both of which depend heavily on organizational learning capabilities.

Taken together, these findings indicate that organizational learning provides the cognitive and organizational infrastructure necessary for smart supply chains by improving knowledge integration, collaborative decision-making, technological adaptation, and continuous process improvement. Therefore, the following hypothesis is proposed:

Hypothesis 5: Organizational learning has a significant positive effect on smart supply chain performance.

The Mediating Role of Organizational Learning; The knowledge-based view, organizational learning theory, and dynamic capabilities theory collectively suggest that organizational learning functions as the mechanism through which knowledge resources and digital capabilities are transformed into superior organizational performance. While knowledge management enables organizations to create, store, and disseminate valuable knowledge, and digital innovation provides advanced technological capabilities, organizational learning ensures that these resources are effectively absorbed, interpreted, and embedded within organizational routines. Consequently, organizational learning represents the critical process through which knowledge and technology are translated into sustainable improvements in smart supply chain performance.

Empirical evidence supports this mediating perspective. Yekdast and Pashaei (2024) found that organizational learning mediates the relationship between knowledge management and employees' professional development by transforming knowledge resources into organizational capabilities. Araei and Mohammadi Mehr (2020) similarly demonstrated that organizational learning mediates the relationship between knowledge management and organizational innovation. Likewise, Salimi and Abdsharifi (2015) reported that human resource management practices improve organizational innovation primarily through organizational learning, while Ghorbani et al. (2017) confirmed the mediating role of organizational learning capability between knowledge sharing and innovation capability.

International studies also emphasize the importance of learning as the mechanism linking knowledge, digital transformation, and organizational outcomes. Cristache et al. (2025) and Erzurum et al. (2025) highlighted innovation as the mechanism connecting digital knowledge management with organizational performance, a relationship fundamentally grounded in organizational learning processes. Furthermore, Hashem and

Aboelmaged (2025) demonstrated that learning capability exerts an even stronger influence than innovation on digital supply chain adoption and serves as a key mediating mechanism. XiaoWen and Atour (2025) likewise emphasized that knowledge-based digitalization creates organizational value by facilitating digital supply chain innovation through continuous organizational learning.

Accordingly, organizational learning is expected to mediate the effects of both knowledge management and digital innovation on smart supply chain performance by transforming organizational knowledge and technological capabilities into adaptive organizational behaviors and superior operational outcomes.

Therefore, the following hypotheses are proposed:

Hypothesis 6: Organizational learning mediates the relationship between knowledge management and smart supply chain performance.

Hypothesis 7: Organizational learning mediates the relationship between digital innovation and smart supply chain performance.

Based on the theoretical framework presented, the conceptual model of the present study is illustrated in Figure 1:

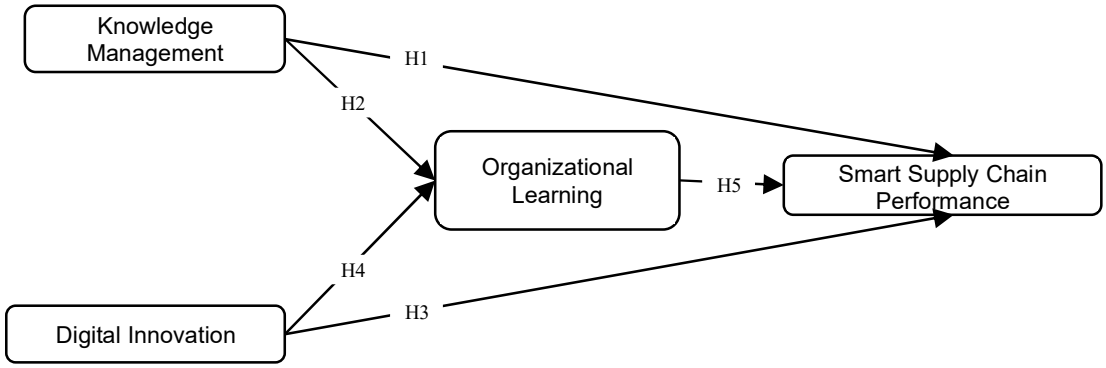


Figure 1. Conceptual Model of the Research

Research Methodology

The present study is applied in terms of research purpose and adopts a quantitative approach using a descriptive-correlational design. Given that the study aims to examine the structural relationships among knowledge management, digital innovation, organizational learning, and smart supply chain performance, structural equation modeling (SEM) was employed to analyze the causal relationships among the research variables. In the proposed conceptual model, knowledge management and digital innovation are considered exogenous (predictor) variables, smart supply chain performance is the endogenous (criterion) variable, and organizational learning is examined as a mediating variable. The research model was developed to explain how knowledge management and digital innovation contribute to improving smart supply chain performance in defense organizations and to identify the mediating mechanism through

which organizational learning influences these relationships. Regarding the unit of analysis, the study adopts a multilevel perspective by incorporating both individual-level perceptions and organizational-level capabilities and mechanisms.

The statistical population consisted of managers and experts working in defense organizations of the country. To enhance the representativeness and generalizability of the findings, respondents were selected using a simple random sampling method. A total of 330 questionnaires were distributed electronically among members of the target population, and the collected responses were used as the basis for subsequent statistical analyses. To evaluate the proposed model and test the direct and indirect relationships among variables, partial least squares structural equation modeling (PLS-SEM) was applied using SmartPLS software.

The data collection instrument was a structured standard questionnaire adapted from validated international studies. The questionnaire consisted of 65 items measured on a five-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree).

To measure smart supply chain performance, a nine-item scale adapted from the digital supply chain performance indicators proposed by Rasool et al. (2022) was utilized. This construct was operationalized through three dimensions: supply chain communication effectiveness, supply chain member connectivity, and information exchange synergy. These dimensions reflect the extent of integration, coordination, and intelligent interaction among supply chain actors.

To measure knowledge management, a 16-item questionnaire based on the Newman and Conrad (2000) framework was employed. According to this model, knowledge management consists of four dimensions: knowledge creation, knowledge application, knowledge transfer, and knowledge retention. These dimensions represent the comprehensive knowledge management cycle within organizations and have been widely recognized as fundamental components in recent knowledge management research (Farooq, 2024).

Digital innovation was measured using a 16-item scale adapted from the Wang and Ahmed (2004) innovation framework. This construct includes four dimensions: product and service innovation, process innovation, behavioral innovation, and strategic innovation. These dimensions capture an organization's capability to utilize digital technologies, develop innovative solutions, and create sustainable value through technological transformation (Khin & Ho, 2019).

Furthermore, organizational learning as the mediating variable was measured using the 24-item questionnaire developed by Neefe (2001). This scale evaluates organizational learning across four dimensions: personal mastery, mental models, shared vision, and systems thinking. These

dimensions emphasize the development of individual and collective cognitive capabilities and provide the foundation for strengthening strategic orientations, adaptability, and organizational performance (Yazdanpanah et al., 2023).

For data interpretation, qualitative responses were transformed into quantitative scores, and the mean value of each construct was used as an indicator of its overall status. Based on the classification proposed by Hejazi et al. (2008), mean values ranging from 1 to 2.33 indicate an unfavorable condition, values between 2.33 and 3.66 represent a relatively favorable condition, and values between 3.66 and 5 indicate a favorable condition.

To establish the content validity of the measurement instrument, the questionnaire was reviewed by a panel of experts in knowledge management, digital innovation, and supply chain management. Based on their feedback and suggested modifications, the final version of the questionnaire was developed. Furthermore, the reliability of the measurement instrument was assessed using Cronbach's alpha coefficient. The results confirmed that all measurement scales achieved acceptable reliability levels, with alpha coefficients exceeding the recommended threshold of 0.70.

Research Findings

The demographic analysis of the respondents revealed that 76.2% of the participants were male and 24.8% were female, reflecting the prevailing gender composition within defense organizations. Regarding educational attainment, 60.3% of respondents held a master's degree or higher, while 40.7% had a bachelor's degree or lower. This distribution indicates a relatively high level of academic qualification and professional expertise among the studied population.

Prior to evaluating the structural model and testing the research hypotheses, the descriptive characteristics of the study variables were examined to assess the distribution patterns of the data and determine the appropriateness of their variability. Accordingly, the descriptive statistics of the research constructs are presented in Table 1.

Table 1. Descriptive Statistics of Research Variables

Variable	Dimensions	Mean	S.D	Skewness	Kurtosis	Status	K-S
Knowledge Management	Knowledge Creation	3.89	0.708	-0.279	-0.014	Favorable	0.001
	Knowledge Application	3.34	0.749	0.322	0.118	Relatively Favorable	
	Knowledge Transfer	3.13	0.788	-0.098	0.018	Relatively Favorable	

	Knowledge Retention	4.26	0.438	1.111	-0.770	Favorable	
	Total	3.65	0.492	0.610	-0.049	Relatively Favorable	
Digital Innovation	Product/Service Innovatio	4.09	0.573	0.004	-0.011	Favorable	0.001
	Process Innovation	3.54	0.533	-0.492	-1.032	Relatively Favorable	
	Behavioral Innovation	3.39	0.522	0.346	-0.961	Relatively Favorable	
	Strategic Innovation	3.32	0.486	0.536	-1.134	Relatively Favorable	
	Total	3.58	0.396	0.426	-0.747	Relatively Favorable	
Organizational Learning	Personal Mastery	4.43	0.648	-0.700	-0.535	Favorable	0.001
	Mental Models	4.32	0.693	-0.527	-0.824	Favorable	
	Shared Vision	2.36	1.169	0.726	-0.346	Relatively Favorable	
	Systems Thinking	3.93	0.811	0.128	-1.469	Favorable	
	Total	3.76	0.585	0.241	-0.523	Favorable	
Smart Supply Chain	Ease of Communication	3.56	0.622	0.229	-0.404	Relatively Favorable	0.001
	Member Correlation	3.96	0.390	0.221	-0.384	Favorable	
	Synergy in Information Exchange	3.41	0.634	0.657	-0.705	Relatively Favorable	
	Total	3.64	0.468	0.765	-0.334	Relatively Favorable	

Based on the results reported in Table 1, the descriptive analysis of the research constructs indicated that, among the dimensions of knowledge management, the knowledge retention dimension obtained the highest mean score and was evaluated as being at a favorable level. Regarding digital innovation, the product and service innovation dimension demonstrated the highest mean value among all dimensions and was also assessed as favorable. In relation to organizational learning, the personal mastery dimension achieved the highest score, indicating a desirable status among the evaluated dimensions. Furthermore, within the dimensions of the smart supply chain, the member correlation dimension recorded the highest value and was considered to be in a favorable condition.

The results of the Kolmogorov–Smirnov test revealed that the significance level for all research variables was 0.001, which is below the

critical value of 0.05. Therefore, the assumption of normality was rejected, indicating that the data did not follow a normal distribution. Given the non-normal distribution of the data and the multidimensional and complex structure of the proposed research model, the Partial Least Squares Structural Equation Modeling (PLS-SEM) approach was employed for data analysis. This method was selected due to its flexibility in analyzing non-normally distributed data, its suitability for moderate sample sizes, and its ability to simultaneously estimate complex relationships among multiple latent constructs. Moreover, PLS-SEM enables researchers to examine both direct causal relationships and mediating effects within conceptual models (Cepeda-Carrion et al., 2019).

Before interpreting the structural relationships and testing the research hypotheses, the adequacy and quality of the model were evaluated through three main components of PLS-SEM: the measurement model, structural model, and overall model assessment. Such evaluation is essential because the reliability and validity of the research findings depend on the robustness of these model components (Hair & Alamer, 2022). The results indicated that all Cronbach's alpha coefficients and composite reliability values exceeded the recommended threshold of 0.70, confirming the satisfactory internal consistency and reliability of the measurement model.

Furthermore, the assessment of convergent validity showed that the Average Variance Extracted (AVE) values for all constructs were greater than 0.50, demonstrating adequate convergent validity. In addition, the Variance Inflation Factor (VIF) index was examined to assess potential multicollinearity among the predictor variables. According to the results presented in Table 2, all VIF values were below the recommended threshold of 5, confirming the absence of critical multicollinearity issues and indicating the suitability of the structural model for subsequent hypothesis testing.

Table 2. Extracted Variance Values and Reliability Indicators

Construct	Dimensions	Factor Loading	Significance Statistic	VIF	Cronbach's Alpha (≥0.7)	Composite Reliability (≥0.7)	AVE (≥0.5)
Knowledge Management	Knowledge Creation	0.709	26.520	1.214	0.789	0.811	0.520
	Knowledge Application	0.816	37.238	1.723			
	Knowledge Transfer	0.729	26.895	1.543			
	Knowledge Retention	0.616	12.761	1.179			

Construct	Dimensions	Factor Loading	Significance Statistic	VIF	Cronbach's Alpha (≥0.7)	Composite Reliability (≥0.7)	AVE (≥0.5)
Digital Innovation	Product/Service Innovation	0.796	41.281	1.501	0.741	0.837	0.565
	Process Innovation	0.594	15.168	1.202			
	Behavioral Innovation	0.803	39.710	1.643			
	Strategic Innovation	0.795	29.717	1.512			
Organizational Learning	Personal Mastery	0.588	13.452	1.217	0.728	0.777	0.571
	Mental Models	0.615	13.472	1.203			
	Shared Vision	0.849	60.909	1.419			
	Systems Thinkin	0.664	15.701	1.191			
Smart Supply Chain	Ease of Communication	0.915	174.714	2.144	0.799	0.881	0.712
	Member Correlation	0.763	24.054	1.538			
	Synergy in Information Exchange	0.846	56.750	1.807			

Furthermore, to evaluate the discriminant validity of the research constructs, the Heterotrait–Monotrait (HTMT) ratio was examined based on the criteria proposed by Hair and Alamer (2022). According to this criterion, HTMT values below the threshold levels of 0.85 or 0.90 indicate satisfactory discriminant validity among the constructs. The results confirmed that all HTMT values were within the acceptable range, demonstrating that the constructs were empirically distinct from one another and that the measurement model possessed adequate discriminant validity.

After confirming the reliability and validity of the measurement model, the structural model was evaluated. In this stage, the coefficient of determination (R^2) and the predictive relevance index (Q^2) were employed to assess the explanatory and predictive capabilities of the proposed model. The R^2 value indicates the proportion of variance in endogenous constructs explained by the exogenous variables and reflects the extent to which independent constructs contribute to explaining changes in dependent variables. In other words, this index demonstrates the explanatory strength

of the structural relationships and the extent of alignment between the measurement and structural components of the model.

Additionally, the Q^2 index was used to assess the predictive relevance of the model and determine its ability to accurately predict endogenous constructs. A higher Q^2 value indicates greater predictive capability and demonstrates that the model has sufficient predictive relevance. The results associated with the R^2 and Q^2 indices are presented in Table 3.

Table 3. Discriminant Validity and Structural Model Fit of the Research

Construct	HTMT				$R^2 \geq 0.19$	$Q^2 \geq 0.15$
	(1)	(2)	(3)	(4)		
Smart Supply Chain (1)	-				0.875	0.603
Knowledge Management (2)	0.535	-			-	-
Digital Innovation (3)	0.717	0.667	-		-	-
Organizational Learning (4)	0.651	0.697	0.868	-	0.507	0.223

As presented in Table 3, all constructs in the research model demonstrate satisfactory discriminant validity, as all HTMT values are below the recommended threshold of 0.90. These findings indicate that the constructs are empirically distinct from one another and adequately represent separate concepts within the proposed model.

Furthermore, the results reported in Table 3 show that knowledge management and digital innovation jointly explain 50.7% of the variance in organizational learning, indicating a substantial explanatory capacity for this endogenous construct. Moreover, the combined effects of knowledge management, digital innovation, and organizational learning account for 87.5% of the variance in smart supply chain performance, demonstrating the strong explanatory power of the proposed structural model.

The predictive relevance assessment based on the Q^2 index also confirmed the predictive capability of the model. The Q^2 value for the organizational learning construct was calculated as 0.223, while the value for the smart supply chain construct was 0.603. Given that both values are greater than zero, the model possesses acceptable predictive relevance. In particular, the high Q^2 value for smart supply chain performance indicates that the model has strong predictive capability and provides an appropriate representation of the relationships among the research constructs.

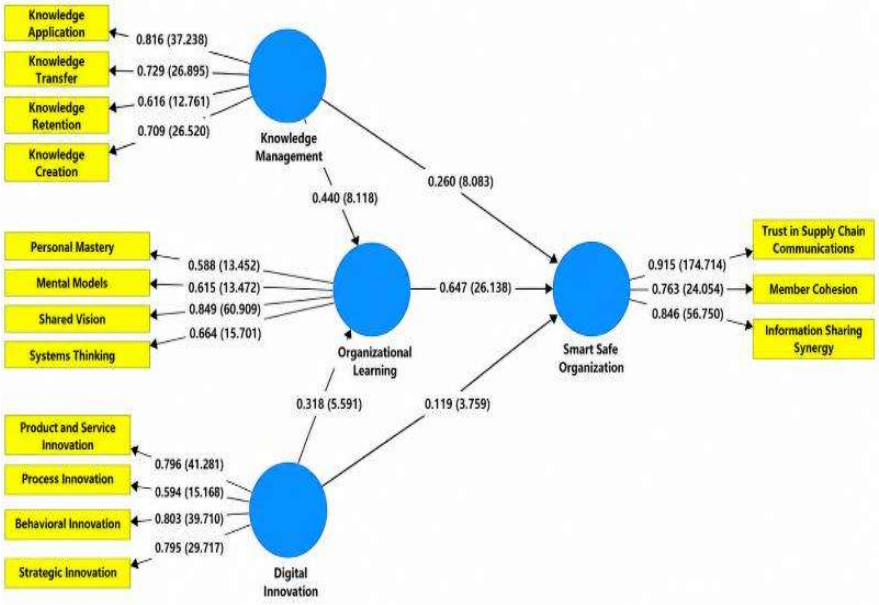
Finally, to evaluate the overall model fit, the Goodness-of-Fit (GOF) index was employed. In partial least squares structural equation modeling, the GOF index represents the overall predictive quality of the model, and

values above 0.30 are considered indicative of an acceptable model fit (Wetzels et al., 2009). The GOF value was calculated for the proposed research model using the following formula. The obtained result confirms that the overall model demonstrates a strong level of predictive quality and provides an adequate basis for testing the structural relationships and research hypotheses.

$$GOF = \sqrt{(Communality \times R^2)} = 0.640$$

The hypothesized relationships among the research constructs were examined based on the proposed causal model using the Partial Least Squares Structural Equation Modeling (PLS-SEM) approach. Within this framework, the factor loading coefficients were assessed to determine the strength of the relationships between observed indicators and their corresponding latent constructs. Factor loading values range from zero to one, where values below 0.30 indicate weak indicator reliability and are generally considered candidates for removal, whereas values above 0.70 represent satisfactory and desirable indicator loadings (Hair & Alamer, 2022).

In addition to evaluating the measurement model, the structural model (path model) was analyzed to examine the relationships among the latent constructs and assess the proposed causal paths. To determine the statistical significance of the estimated path coefficients, t-values were calculated using the bootstrapping procedure. The results of the standardized factor loadings, path coefficients, and significance levels are presented based on the output generated by SmartPLS software. The final structural model of the study, illustrating the relationships among the research constructs, is presented in Figure 2



[Figure 2: Path Coefficient and Significance Statistics of the Research Model - See original for diagram]

Table 4. Results of Research Hypotheses

Hypothesis	Path	Path Coefficient	T-Statistic	P-Value	Test Result
H1	Knowledge Management → Smart Supply Chain	0.260	8.083	0.000	Confirmed
H2	Knowledge Management → Organizational Learning	0.440	8.118	0.000	Confirmed
H3	Digital Innovation → Smart Supply Chain	0.119	3.759	0.000	Confirmed
H4	Digital Innovation → Organizational Learning	0.318	5.591	0.000	Confirmed
H5	Organizational Learning → Smart Supply Chain	0.647	26.138	0.000	Confirmed
H6	Knowledge Management → Organizational Learning → Smart Supply Chain	0.285	8.051	0.000	Partial Mediation
H7	Digital Innovation → Organizational Learning → Smart Supply Chain	0.206	5.581	0.000	Partial Mediation

Discussion and Conclusion

The present study aimed to explain the role of knowledge management and digital innovation in enhancing smart supply chain performance in defense organizations by examining the mediating role of organizational learning. Based on the theoretical foundations of the resource-based view, dynamic capabilities theory, and organizational learning theory, a conceptual model was developed and empirically tested using the partial least squares structural equation modeling (PLS-SEM) approach based on data collected from defense organizations. The findings confirmed all direct and indirect hypotheses of the study, demonstrating that organizational learning partially mediates the relationships between knowledge management and smart supply chain performance, as well as between digital innovation and smart supply chain performance.

The results of testing the first hypothesis indicated that knowledge management has a positive and significant effect on smart supply chain performance. This finding is consistent with the results of Mousavi Shamsabad et al. (2020), Mohammadi and Barforoshan (2014), Akbari et al. (2024), Rafi et al. (2025), and Dzhuguryan et al. (2025), who emphasized the critical role of knowledge infrastructures in enhancing supply chain integration, coordination, and smart transformation. These findings suggest that systematic processes of knowledge creation, transfer, application, and retention improve information accessibility, enhance decision-making quality, and facilitate the development of intelligent communication, member connectivity, and knowledge-based collaboration across the supply chain. Accordingly, defense organizations should

develop integrated knowledge management systems at the supply chain level by emphasizing the documentation of operational experiences, establishment of specialized knowledge repositories, and creation of formal mechanisms for knowledge exchange among logistics, procurement, and technology units.

The findings related to the second hypothesis demonstrated that knowledge management has a positive and significant effect on organizational learning. This result supports previous studies conducted by Nasirzade et al. (2025), Safari and Houshmandi Rad (2022), Azimi and Jafari (2023), Figueiredo et al. (2025), and Tinh (2025). In this regard, knowledge management can be considered as the foundation through which organizations enhance their capacity for knowledge acquisition, experience interpretation, individual capability development, and continuous improvement. In other words, when knowledge creation and sharing processes are systematically managed, organizations become more capable of revising mental models, strengthening systems thinking, and institutionalizing learning mechanisms. Therefore, defense organizations are recommended to design learning programs based on operational experiences, conduct after-action review processes, and establish professional knowledge-sharing communities to strengthen continuous learning capabilities.

The results of the third hypothesis revealed that digital innovation has a positive and significant effect on smart supply chain performance. This finding is consistent with the studies of Rashedi et al. (2025), Rehman Khan et al. (2022), Wang et al. (2025), Chen et al. (2025), and Nasution et al. (2025), which highlight the essential role of digital technologies in enabling supply chain smartification. The findings indicate that digital innovation in areas such as product and service innovation, process innovation, behavioral innovation, and strategic innovation enhances supply chain transparency, agility, responsiveness, and technological integration. Accordingly, defense organizations should prioritize the development of digital infrastructures based on technologies such as the Internet of Things (IoT), big data analytics, and blockchain for monitoring strategic assets, improving traceability, and establishing real-time analytical platforms for evaluating supplier and logistics performance.

The fourth hypothesis examined the relationship between digital innovation and organizational learning, and the results confirmed a positive and significant relationship between these two constructs. This finding is consistent with the studies of Razmi and Ahmadi (2023), Moslemi et al. (2024), Awad and Martín-Rojas (2024), and Heriansyah et al. (2025). These results indicate that digital innovation is not merely a technological transformation process but also a learning-oriented organizational change mechanism. The adoption of digital technologies

requires organizations to develop new competencies, reconsider existing assumptions, improve employees' digital capabilities, and foster a culture of experimentation and learning. Therefore, establishing digital innovation laboratories within defense organizations, implementing pilot digital transformation initiatives, and developing employee digital literacy programs can facilitate the alignment between digital innovation and organizational learning.

The results of the fifth hypothesis showed that organizational learning has a positive and significant effect on smart supply chain performance, and among the direct relationships examined in the model, this variable demonstrated the strongest effect. This finding is consistent with the results of Hemmati Noedoust Gilani and Khosh Tinat (2024), Bagherimanesh et al. (2019), Eryarsoy et al. (2022), and Sharma et al. (2025). The findings suggest that learning-oriented defense organizations possess greater capabilities in developing supply chain coordination, resilience, flexibility, and adaptability. Through strengthening individual competencies, promoting shared vision, and enhancing systems thinking, organizational learning enables defense supply chains to respond more effectively to uncertainty and operational complexity. Accordingly, institutionalizing organizational learning mechanisms through systematic error analysis, cross-project experience sharing, and the development of defense supply chain knowledge maps is recommended to enhance alignment and collaboration among supply chain members.

Regarding the sixth hypothesis, the findings confirmed that knowledge management indirectly influences smart supply chain performance through organizational learning, and the mediating role of organizational learning was found to be partial. This result is consistent with the findings of Yekdast and Pashaei (2024), Araei and Mohammadi Mehr (2020), and Hashem and Aboelmaged (2025). This finding highlights that knowledge resources alone cannot guarantee superior supply chain outcomes unless they are transformed into organizational capabilities through learning processes. In other words, organizational learning acts as a mechanism that converts accumulated knowledge into improved behaviors, innovative practices, and operational capabilities. Therefore, defense organizations should integrate knowledge-sharing activities into managerial performance evaluation systems and develop collaborative learning programs between research and development units, logistics departments, and operational teams.

Finally, the results of the seventh hypothesis demonstrated that digital innovation has an indirect and significant effect on smart supply chain performance through organizational learning, confirming the partial mediating role of organizational learning. This finding supports the results of Cristache et al. (2025), Erzurum et al. (2025), and XiaoWen and Atour

(2025), who identified learning capabilities as the mechanism linking digital transformation initiatives with organizational performance outcomes. These findings indicate that technological investments achieve their maximum impact when organizations possess the capacity to learn, adapt, and integrate digital innovations into existing processes. Therefore, implementing digital change management programs, conducting team-based learning workshops, and establishing interorganizational learning networks within the defense supply chain are recommended to accelerate technology adoption and maximize the benefits of digital transformation.

Overall, the findings demonstrate that although knowledge management and digital innovation directly contribute to smart supply chain performance, organizational learning represents the central strategic mechanism that strengthens and operationalizes these relationships. Therefore, achieving sustainable smart supply chain transformation in defense organizations requires an integrated approach that simultaneously emphasizes the development of knowledge infrastructures, expansion of digital innovation capabilities, and institutionalization of a learning-oriented organizational culture. Such an integrated perspective can enhance supply chain agility, resilience, coordination, and operational effectiveness in complex defense environments.

The limitations of the present study primarily arise from the dynamic and continuously evolving nature of the investigated constructs, including knowledge management, digital innovation, organizational learning, and smart supply chain performance within defense organizations. These variables are highly influenced by technological advancements, strategic transformations, security considerations, and defense-level policies. Therefore, changes in organizational structures, innovation strategies, digital transformation priorities, or knowledge management practices may alter the strength and direction of the relationships among the research constructs and potentially lead to different findings across different time periods or organizational contexts.

Moreover, the specific characteristics of defense organizations, including information confidentiality requirements, restricted access to organizational data, and security-related sensitivities, may limit the generalizability of the findings beyond the studied context. In addition, organizational conditions such as learning culture, digital maturity, technological infrastructure, knowledge-sharing mechanisms, and leadership approaches may significantly influence the extent to which knowledge management and digital innovation contribute to smart supply chain development. Differences in these organizational factors can strengthen or weaken the effectiveness of the proposed relationships.

Furthermore, individual-level characteristics, including professional experience, digital competence, attitudes toward knowledge sharing, and

readiness to adopt emerging technologies, may function as contextual factors influencing organizational learning capabilities and the successful implementation of digital innovations. Accordingly, future studies are encouraged to investigate the role of individual factors such as digital literacy, cognitive flexibility, professional resilience, and continuous learning orientation as moderating or complementary variables in models related to smart supply chain transformation.

Future researchers may also employ mixed-method research designs (quantitative–qualitative) by combining survey approaches with in-depth interviews with defense supply chain managers, technology experts, and knowledge management specialists. Such approaches can provide deeper insights into the underlying mechanisms through which knowledge, learning, and digital capabilities interact to facilitate supply chain smartification. Additionally, conducting case studies of successful digital transformation initiatives in defense organizations can contribute to identifying practical patterns and contextual factors affecting digital innovation adoption.

Finally, longitudinal research designs are recommended to examine how the relationships among knowledge management, digital innovation, organizational learning, and smart supply chain performance evolve over time. Such studies can provide a more comprehensive understanding of the sustainability of these effects and reveal how defense organizations progressively develop the capabilities required for long-term digital transformation and intelligent supply chain development.

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Conflict of Interest

The author(s) declare that there is no conflict of interest regarding the publication of this article. In addition, ethical issues including plagiarism, informed consent, misconduct, data fabrication, and duplicate submission/publication have been observed by the authors.

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