Guest editorial: Theorizing the role of artificial intelligence in supply chain process: unveiling managerial perspectives and strategic applications

1. Introduction: framing AI theorizing in supply chain management

In recent years, the integration of artificial intelligence (AI) in supply chain management (SCM) has transitioned from a phase of theoretical exploration to a practical necessity. This evolution, from a computational novelty to a strategic imperative, highlights the capability of AI to improve decision-making processes, operational efficiency and competitiveness across the entire supply chain. A decisive stage in this evolution trajectory was the introduction of large language models (LLMs) in 2023. This technological development underscores the potential of AI tools in reshapes SCM through innovative applications for demand forecasting, logistic optimization and real-time tracking and tracing (Fosso Wamba *et al.*, 2023; Hendriksen, 2023), confirming the overall strategic role of digital technologies within supply chains (such as the Internet of Things, blockchain and sensors) (e.g. Corallo *et al.*, 2018; Latino *et al.*, 2025).

Specifically, studies have pinpointed that AI is playing an increasingly central role across the different supply chain functions, contributing to the improvement of decision-making processes and operational performance. Specifically, in *planning* areas, AI is a driver in harmonizing complex inter-organizational activities, allowing managers to extend the unit of analysis beyond company boundaries, including broader relationship and networks of actors. In this context, coordination can be supported by machine learning technologies, natural language processing and robotics (Helo and Hao, 2022). Coherently, several studies highlighted the contribution of AI in enhancing supply chain resilience, acting as an enabler of transparency, forecasting performance and risk management capabilities (Riahi *et al.*, 2021). These elements become fundamental to ensuring operational continuity, reducing negative impacts also in the current supplier challenges arising from the global political issues (e.g. energy supply disruptions, trade restrictions and geopolitical tensions). Additionally, literature shows how AI-based predictive models are changing the interactions along the supply chain, allowing partners to be more responsive to demand variations and therefore contributing to the reduction of waiting time, the optimization of inventory and the reduction of operational costs (Mohsen, 2023). Other studies have highlighted positive effects of AI in *procurement* processes and in *supplier relationship management*, improving decision-making capabilities, redefining organizational roles and enhancing cross-functional collaborations (Borsani *et al.*, 2026; Dwivedi and Wang, 2022; Guida *et al.*, 2023a, b).

In *manufacturing*, the adoption of AI has led to higher levels of productivity, quality and profitability, contributing to the development of smart operations models (Kovalenko *et al.*, 2023). Similarly, in *logistics and transport*, AI supports supply chain actors in improving flow planning and service efficiency, acting as cost reducers and enhancing service quality (Gao *et al.*, 2023; Jackson *et al.*, 2024). However, these investigations often treat AI capabilities as a monolith, neglecting the nuanced differences among AI technologies and their respective impacts on specific SCM tasks (Dubey *et al.*, 2020; Fosso Wamba *et al.*, 2023; Grover *et al.*, 2022). Therefore, it emerged that AI is capable of generating benefits across different dimensions of the supply chain, affecting not only individual operational tasks but also systemic and inter-organizational performance, thanks to the propagation of decision effects across the overall network (Mohsen, 2023).

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From the theoretical perspective, existing studies are developed well according to established theoretical framework such as those related to innovation diffusion theory, technology adoption models and strategic management perspectives. Yet, there remains a critical gap in integrating these theories with the specific characteristics and challenges presented by AI in SCM contexts. Specifically, a large part of these studies has relied on the traditional technology adoption models (e.g. technology acceptance model (TAM) and the unified theory of acceptance and use of technology (UTAT)), which have provided key contributions to understanding the technological adoption processes (e.g. Aslam *et al.*, 2025; Hasija and Esper, 2022; Mouloudj *et al.*, 2026; Pramanik and Jana, 2025; Shams *et al.*, 2025; Song *et al.*, 2025). However, these approaches are limited in capturing the dynamic, complex and continuously evolving nature of AI technologies in the supply chain context. Moreover, the literature is scant on empirical studies that delve into the real-world implementation of AI by supply chain managers and enterprises. This gap underscores the emerging need for research that not only examines the technological aspects of AI but also its strategic and managerial implications in SCM (Durach and Gutierrez, 2024; Guida *et al.*, 2023a). Moreover, the majority of existing literature is conceptual or with a practical approach, whereas an in-depth discussion of how theories could support the understanding of this relevant phenomenon is missing.

From these issues emerged the need to develop new theoretical constructs capable of capturing the complexity of AI integration in supply chain networks, overcoming the limitations of traditional models. Shifting from a techno-centric perspective on AI to a managerial perspective is crucial for understanding how AI technologies are selected, developed and integrated into supply chain strategies and operations. Moreover, the need to move beyond the merely technological view, to adopt a more managerial and theory-grounded approach, is necessary. In this context, the managerial implications of AI adoption in SCM are both significant and underexplored, limiting the full potential of AI to function as a supportive mechanism within complex supply networks.

In this context, the special issue "*Theorizing the role of artificial intelligence in supply chain process: unveiling managerial perspectives and strategic applications*" aims to contribute to addressing these emerging gaps by promoting a deeper understanding of the role of AI in SCM from a managerial and strategic perspective, with a strong theoretical focus. The aim is to shift the focus from a technological approach to a vision centered on decision-making processes, AI adoption strategies and the integration pathways of AI within SCM activities.

This editorial proposes a structured synthesis of the four papers included in the special issue. The discussion is guided by the objective of the special issue and describes the supply chain perspective considered in the study, the addressed gap, the adopted theoretical lens and the key results. These represent partial and complementary insights that characterize the current evolution of the AI adoption in SCM. Starting from this empirical grounding, this editorial proposes a future research agenda.

2. Synthesis of the special issue contributions

This section provides a synthesis of the four empirical studies included in this special issue. These studies offer valuable, context-specific insights into how AI is shaping SCM; the papers are summarized here to highlight how they contribute to addressing the aim of the special issue, with a focus on their application context, theoretical perspectives and methodological approaches and key findings. With this synthesis, we aim to provide a coherent understanding of their collective contribution in relation to the objectives of the special issue.

Canciglieri *et al.* (2026) examine the real-world case of AI implementation in *Operations and Supply Chain Management* (OSCM) at Robert Bosch GmbH within the paper *"Adaptive leadership in artificial intelligence solutions in operations and supply chain management projects: the Robert Bosch GmbH Case"*. The authors focus their investigation on the role of leadership in the technological adoption process. Implementing AI algorithms in OSCM

requires leadership commitment to avoid cost and inefficiencies; therefore, leaders can play a key role in a successful adoption process. According to the authors, the main part of the literature focuses on a static analysis of leadership in OSCM (e.g. AlNuaimi *et al.*, 2022; Dey *et al.*, 2024; Dubey *et al.*, 2024; Steiner *et al.*, 2026), hypothesizing a linear and direct relationship with the implementation of AI tools. This limitation is addressed by Canciglieri *et al.* (2026), who demonstrate the adaptive nature of leadership, which requires changes over time according to the maturity and evolving trajectory of AI solutions in OSCM. The study was conducted under the theoretical lens of adaptive leadership theory (Heifetz *et al.*, 2009), which conceptualizes leadership as a dynamic process capable of evolving in response to the emerging challenges in the business context. A qualitative longitudinal case study was employed to examine how leadership adapts to the implementation and scaling of AI solutions in OSCM projects (more than 30 projects over 6 years, from initial AI-enabled pilots to the scaling stage of AI options). The results confirm that the adoption of AI in OSCM follows an evolutionary path composed of different and progressive maturity stages (structuring, implementation and scaling), in which both technologies and organizations co-evolve. Contributing to this special issue, the empirical results of this study highlight that the success of AI in OSCM depends not only on technology but also on the ability of companies to evolve over time from pilot project to inter-functional integration and ultimately to full inter-organizational scalability. The main challenges of this process remain related to system fragmentation, the heterogeneity of digital maturity among supply chain actors and the continuous alignment between strategies, data and governance.

Focusing on supply chain cyber risks, Ciceri *et al.* (2026), in the paper *"Integrating artificial intelligence capabilities in supply chain cyber risk management,"* conduct an empirical study to understand how different AI capabilities (i.e. learning, perception, prediction, interaction, adaptation, reasoning and creativity) can improve the various phases of the supply chain cyber risk management (SCCRM) process (i.e. identification, assessment, treatment and monitoring of risk). This topic is highly relevant in contemporary supply chains, since cyber risks are associated with high costs for firms from economic, infrastructural and national security perspectives. These costs are amplified when considering the entire supply network: requiring a partner to comply with supply chain cybersecurity practices may lead to its withdrawal from the supply chain. While it is noted that AI can play an important role in cyber risk protection (such as Corbett and Sajal, 2023) and that a research stream has begun to theorize the benefits of AI applications in cybersecurity (such as Kaur *et al.*, 2023), the authors identify a gap in the literature at the intersection between AI and SCCRM, which appears scarce and largely conceptual, without empirical exploration of how AI could strengthen the SCCRM process. Conducting exploratory research, the study adopts a qualitative approach based on multiple case studies aimed at developing an in-depth understanding of AI applications in supply chain risk management. Data were collected from three cases of cybersecurity providers (vendor, system integrator and consultancies) through semi-structured interviews with experts, selecting Italian companies with high technological maturity. The results aim to summarize the AI's main capabilities relevant for each phase of the process, clarifying the type of possible support. Contributing to this special issue, the empirical results of this study highlight that the effectiveness of AI in SCCRM depends on the combination of several capabilities and on the role of supply chain actors, with an increased integration of generative AI into more proactive and automatized systems. The most widely used capabilities are learning, reasoning and adaptation, but the emergence of recent generative models of AI has increased the relevance of creativity, perception, interaction and prediction. Moreover, it emerged that vendors are more advanced in automation and predictive prevention, system integrators focus on adaptation, monitoring and interaction, and consultancies mainly work on supply risk assessment and strategic simulation. Responding to the need of a theoretical lens, the paper adopts the dynamic capabilities theory to develop a roadmap of implementation of AI in SCCRM, addressing connected capabilities to exploit in each phase of the process; the paper contributes to literature through the identification of five propositions that generate opportunities for further research in this domain.

Prataviera *et al.* (2026), in the paper *"Exploring artificial intelligence opportunities for third-party logistics service providers: a dynamic capabilities perspective,"* focusing on the logistics domain, explore the adoption of AI in third-party logistics service providers (3PLs). Given its potential to improve efficiency and inventory management, AI is increasingly considered a transformative driver in the logistics industry. The introduction of AI into logistics operations can lead to cost reduction, and, in this context, many companies have been outsourcing their logistics operations to 3PLs, which are increasingly adopting AI tools to improve decision-making, optimize operations and adapt service to the complex and volatile supply chain environments. However, the authors highlight that academic literature reveals a limited understanding of how 3PLs address the opportunities offered by AI. Indeed, despite several logistics companies discussing the use of AI, very few studies developed a concrete approach to AI adoption. With the aim of fulfilling this emerging gap, the authors investigate how 3PLs can approach AI-drive opportunities and successfully navigate AI adoption. The study is conducted under the lens of dynamic capability theory (Teece, 2009), which is used to understand how companies adapt to technological change and specifically to the adoption of AI in logistics processes. The study adopts a qualitative approach based on a single case study: a British 3PL provider that has launched several AI-based projects, such as labor demand forecasting, employee planning and distribution network optimization. The empirical evidence shows that the adoption of AI in 3PLs is a gradual and strategic process implemented over the long term. The company considers AI a transformative technology but still in an exploratory phase; therefore, it is applied through a test-and-learn approach guided by top management. An interesting finding of this study is the presence of a circular relationship between dynamic capabilities: sensing enables seizing and seizing stimulates reconfiguration. However, reconfiguration, especially in relation to improvements in data, also enhances sensing, creating a virtuous cycle in the evolution of dynamic capabilities driven by AI. Therefore, this study contributes to this special issue by offering empirical evidence of how AI adoption in 3PLs reshapes company dynamic capabilities across sensing, seizing and reconfiguring, clarifying the intertwined role of technologies, clients and data infrastructure in guiding the transformation of SCM processes.

Focusing on manufacturing demand forecasting, Scarton *et al.* (2026) in the paper *"AI-enhanced demand forecasting: an organizational information processing view"* examine how AI reshapes organizational processes, addressing both the enablers and the challenges of its implementation. Demand forecasting is essential for organizational planning; however, achieving accurate forecasting using conventional methodologies is challenging in today's complex and dynamic business environments. AI, by learning from historical data, offers valuable support for generating intelligent predictions. According to the authors, the literature is mainly focused on a downstream perspective (e.g. Dieudonné *et al.*, 2023; Mediavilla *et al.*, 2022), while upstream levels of the supply chain, such as the manufacturing, are only marginally considered. Positioning their study within this research stream, the authors investigate how the AI implementation process affects information processing in achieving a fit between requirements and capabilities in manufacturing demand forecasting. The theoretical lens adopted is the organizational information processing theory (OIPT), which interprets organizational performance as the alignment between informative requirements (e.g. complexity and quantity of information) and the company's capability to process such information. Adopting an action research approach, the authors analyze the development of an AI-based forecasting system in an Italian manufacturing company, examining its impact on organizational processes. The empirical evidence highlights that the adoption of AI in demand forecasting is an evolutionary process articulated across three phases. In the first iteration, the introduction of machine learning models improves technological data processing capabilities but also increases complexity and dependence on high-quality data, posing initial limitations to accuracy and operational implementation. In the second phase, it emerged that AI is not only a technological chance but also requires organizational transformation, particularly a higher level of communication across functions. In the final iteration, the need to extend beyond company boundaries emerges, involving suppliers. In this context, AI shows strong predictive

performance, outperforming human forecasting; however, information sharing across the supply chain requires trust and the capabilities to interpret data also at the inter-organizational level. Therefore, this study contributes to our special issue by showing that the success of AI in demand forecasting depends not only on technological assets and capabilities but also on organizational and relational mechanisms. Collaboration among actors, data quality and interpretability and the development of trust are key elements in enabling effective uncertainty management.

Overall, a comparison among the four studies underlines some common patterns.

Firstly, AI emerges as an enabler of progressive transformation in SCM processes, which develop along evolutionary and non-linear trajectories. The evolution could differ according to the process considered, but it requires an evolution in terms of either capabilities or information to tackle in an evolutionary and recursive approach.

Secondly, almost all studies underline that the success of AI depends not only, and often to a very limited extent, on technological performance but also on its integration with organizational and relational factors. Changes in leadership across the phases of the AI adoption process, the dependence of AI adoption on organizational dynamic capabilities and the need for organizational transformation focused on improving inter-functional communication show the need for a co-evolution between technological and organizational assets.

Finally, the evidence shows an increasing extension of AI from function-oriented through intra-organizational to inter-organizational levels, with relevant implications for coordination, trust and integration along the supply chain.

3. Future research agenda: challenges and opportunities

Starting from the empirical evidence collected in this special issue, it is possible to identify some future research routes. Rather than proposing a broad research agenda, we outline a set of research streams reflecting the main challenges and opportunities arising in the study of the role of AI in SCM.

The first emerging gap is still oriented to the current shift from a technology-driven process to a decision-making process. Current papers address the importance of integrating AI in the decision-making process across different SCM processes, but the real way to realize this change is still underexplored. Future research may investigate how AI concretely reshapes decision-making processes and managerial practices in the supply chain in terms of decisions, methods, actors and tools. Although there is high attention on the technological capabilities of AI, the understanding of how AI is integrated in planning, coordination and control processes and how AI affects the managers' behavior and choices remain limited. This analysis should not be performed just at the company level but also at the supply chain level. Although supply chains are taken into consideration and SCM processes are the focus of the analyses of the studies, much of the current literature focuses on single companies. There is a need to develop studies that analyze AI adoption at the inter-organizational level, considering the dynamics between the supply chain partners, the challenges related to trust and the implications from data sharing across the network.

A second fundamental point addressed by the papers of the special issue pertains to the fundamental interaction between technological, organizational and relational dimensions. The importance of these three components, to be analyzed jointly and not in silos, is reported and addressed. Anyhow, it is still unclear how this could happen and how this could be implemented. Future research may further investigate the role of inter-functional collaboration, leadership, trust and governance mechanisms as drivers, enablers, barriers or challenges to AI implementation in SCM.

This socio-technical perspective could be further reinforced at both the social and the technical perspectives. For the former, in the analysis of these three components, the current studies adopt the firm perspective: moving to AI, there is also a fundamental perspective at the

human and individual side. Literature in SCM tends to often neglect the perspective of the single decision-maker, but an important avenue for future research could investigate this fundamental perspective.

For the latter, a focus on the use of data embedded in AI could be considered. Data emerge not only as a technical asset but also as a socio-organizational resource. Future studies should explore issues related to data quality, data perception and data-sharing dynamics (both across supply chain actors and organizational levels), analyzing how these factors affect the effectiveness of AI tools.

Finally, it is important to consider that AI is a technology in a continuous and rapid evolution, with several companies still adopting the technology at pilot tests but also with new avenues allowed by the specific technology. This requires a continuous analysis of the phenomenon to tackle the *dynamic and evolutionary nature of AI adoption in SCM*. The contributions of this special issue clearly show that AI adoption in SCM is an evolutionary and non-linear process. Future studies could adopt longitudinal perspectives to analyze how companies shift from pilot or testing projects to scalability phases and how technologies and organizational capabilities co-evolve over time. Moreover, AI is often treated as a monolithic concept. New phenomena are emerging now, and "traditional" AI differs significantly, for example, from generative AI or agentic AI. Future research should distinguish between these different technologies to have a more precise analysis of the specific impacts of each technology on different processes and of supply chain contexts.

4. Closing remarks

This editorial proposes the synthesis of the four contributions accepted in the special issue "*Theorizing the role of artificial intelligence in supply chain management: unveiling managerial perspectives and strategic applications.*" The special issue aims to contribute to a more integrated and realistic understanding of the interplay between AI and SCM, offering new theoretical and managerial insights to interpret the increasing role of AI in decision-making, as well as operational and strategic processes in modern supply chains.

Specifically, the empirical insights from the contributions are summarized in order to highlight how the studies are guided by the objective of the special issue, the supply chain perspective considered, the addressed gap, the adopted theoretical lens and the key results. These represent partial and complementary insights that characterize the current evolution of AI adoption in SCM. Starting from this empirical grounding, this editorial proposes several research routes, highlighting how future research in the field of AI in SCM requires an integrated approach, capable of connecting technologies, organizations and inter-organizational relationships to fully understand the impact of AI in real business contexts.

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