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EDITORIAL

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Artificial intelligence in logistics and supply chain management: A primer and roadmap for research

Abstract

The dawn of generative artificial intelligence (AI) has the potential to transform logistics and supply chain management radically. However, this promising innovation is met with a scholarly discourse grappling with an interplay between the promising capabilities and potential drawbacks. This conversation frequently includes dystopian forecasts of mass unemployment and detrimental repercussions concerning academic research integrity. Despite the current hype, existing research exploring the intersection between AI and the logistics and supply chain management (L&SCM) sector remains limited. Therefore, this editorial seeks to fill this void, synthesizing the potential applications of AI within the L&SCM domain alongside an analysis of the implementation challenges. In doing so, we propose a robust research framework as a primer and roadmap for future research. This will give researchers and organizations comprehensive insights and strategies to navigate the complex yet promising landscape of AI integration within the L&SCM domain.

Generative artificial intelligence (hereafter referred to as AI) is high on the Gartner hype cycle concerning logistics and supply chain management (L&SCM)-related technologies. Various AI manifestations, including robotic process automation (e.g., collaborative robots or "cobots"), techniques in computer vision, speech recognition, machine and deep learning, and natural language processing, have opened new pathways to efficiently and effectively manage complex decision making and operations (Pessot et al., 2023). Figure 1 illustrates the capabilities of existing AI applications in the business ecosystem. These cutting-edge resources can potentially develop dynamic capabilities, enabling organizations to reinvent structures, flex policies, innovate processes, and offer novel improvisations toward value creation (Richey et al., 2022). L&SCM managers now hope for exceptionally rapid data-driven and objective decision making (Brau et al., 2023).

However, we have all experienced this hype before, haven't we? Only a few years ago, stock prices were exploding at (soon to be) overvalued corporations claiming significant investments in blockchain technology (Gligor et al., 2022; Treiblmaier & Garaus, 2023; Treiblmaier & Rejeb, 2023). Hype-laden speculation is common in L&SCM practice and research because technology is vital to moving goods, information, finances, and people. Nevertheless, AI feels different from previous technological advancements. AI has already demonstrated varying degrees of success. Individuals—like editors—are taking immediate notice of AI's ability to accumulate "plausible" written text (Boston Consulting Group, 2023). Robots show remarkable dexterity, causing the uninitiated to reflect on some of Arnold Schwarzenegger's movies. All humor aside, our research question at the *Journal of Business Logistics* (*JBL*) should center on what, when, how, and why AI truly adds value. Still, AI presents a paradox as it reduces human involvement in simplifying tasks while simultaneously burdening humans with new decision-making responsibilities arising from the information it generates.

Generative AI refers to integrating machine learning models to fabricate novel content. This encompasses text, audio, video, imagery, software code, and simulations based on large datasets that train the generative model (Dwivedi, Kshetri, et al., 2023). This subset of AI technologies includes algorithms like generative adversarial networks (GANs), large language models (LLMs), and reinforcement learning with human feedback (RLHF) techniques (Budhwar et al., 2023; Dwivedi, Kshetri, et al., 2023). The output quality hinges on the quality of its input, considering both the training data and the prompts provided by users to define the desired task. The authenticity of responses from generative AI models such as GPT4 is constrained, given that these algorithms are "opaque" in their methodology, not illuminating how the responses were generated. There is concern about these algorithms generating spurious information, euphemistically termed "hallucinations," and stoking considerable concerns regarding trustworthiness. This carries significant ethical and reputational risks for supply chain planning. For example, Google

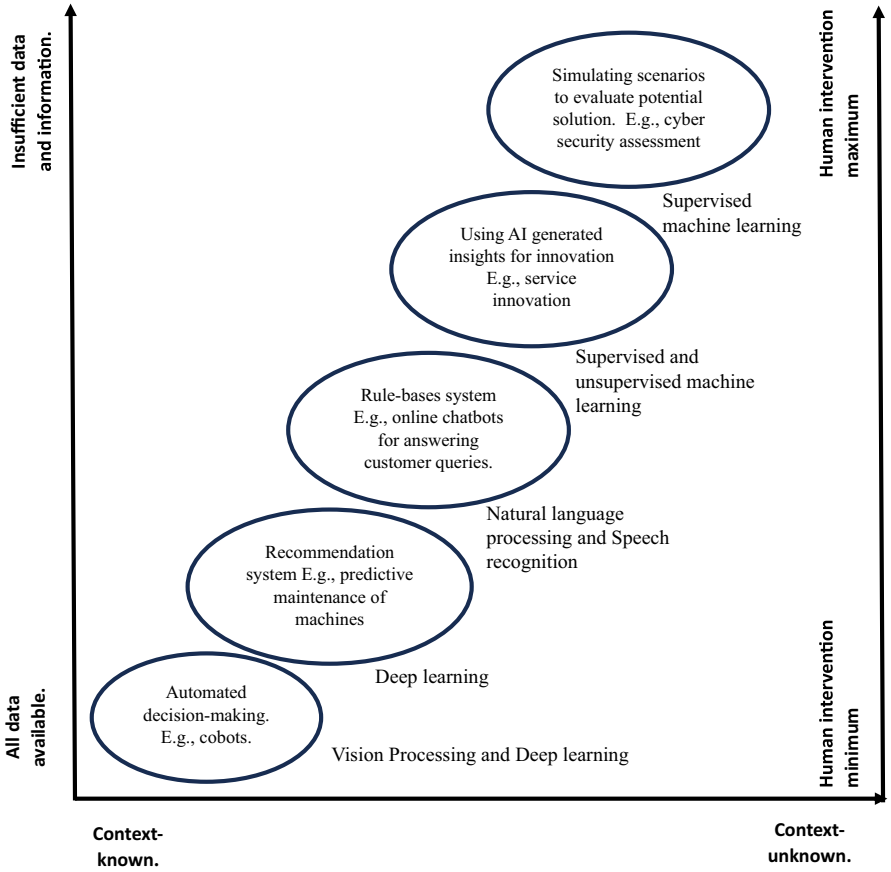

FIGURE 1 AI capabilities in existing business applications.

lost $100 billion in shares due to an inaccurate response from its AI chatbot on Twitter during a demonstration in February 2023 (Thorbecke, 2023).

The emergence of ChatGPT in the public sphere has ignited a surge of interest within the AI chatbot market (Davenport, 2023). Microsoft's announcement of a $10 billion investment in OpenAI has galvanized this trend, impelling other technology providers to join the race. Google recently unveiled an experimental service named "Bard" and "Project Magi," aimed at revolutionizing web search experiences (Data Scientist, 2023), while Meta introduced LLaMA, a language model comprising 65 billion parameters (Meta, 2023). Similarly, Baidu launched a ChatGPT-style service named "Wenxin Yiyan" in Chinese or "Ernie Bot" in English. Additional entrants include Character.ai, an AI chatbot capable of impersonating famous individuals or fictional characters. South Korean search engine firm Naver has rolled out its own AI tool, HyperCLOVAX, which has been incorporated into its search engine and can analyze and generate text, images, videos, and audio. Similarly, in the L&SCM domain, Microsoft has unveiled a novel feature called Dynamics 365 Copilot as a part of its supply chain management platform (Microsoft Dynamics 365, 2023). The feature leverages AI to assist businesses in monitoring and reacting promptly to disruptions that might affect their supply chains. Following the identification of a possible risk, the system can automatically craft a message and send it to the concerned suppliers. Through this AI application, Microsoft aims to enhance the resilience of supply chains, promoting a more efficient and informed business operation strategy.

We anticipate that as new players continue to enter the AI market, the technology will grow more powerful and sophisticated, extending its business applications and potential business risks. In this context, integrating *liquid neural networks* with GPTs will allow the AI models to learn more effectively after the initial training and automatically, with minimal human interventions (Heater, 2023). Contrary to the hype surrounding generative AI systems like GPT-4, organizations face a Herculean task in training and operationalizing these systems within their existing business processes. This has profound implications for organizations planning to implement and use AI (Rese & Tränkner, 2024). The training process is labor-intensive and must align with organizational strategy. This raises issues of the type of training; there is a difference between technical mastery of an AI system and functional knowledge of the area of management or operations it is intended to facilitate.

In contrast, traditional AI methods typically exhibit a more reactive approach, utilizing data for predictions but not necessarily creating anything new. For instance, regression analysis, a form of predictive AI, can forecast demand based on historical sales and logistics data. However, it does not fabricate new scenarios or the impact of strategic supply chain alternatives. AI could predict demand and formulate a comprehensive strategy for meeting that demand, including sourcing, production, distribution, and customer service activities. It might also extend alternative strategies, providing a range of options for decision makers. AI introduces an element of creativity and the capacity to generate fresh ideas (Dwivedi, Pandey, et al., 2023). For L&SCM, this could entail devising entirely new sourcing, procurement, and inventory management strategies. It enables dynamism and responsiveness typically not associated with more traditional, rule-based AI systems.

In the dynamic ecosystem of L&SCM, the integration of AI promises a seismic shift in operational paradigms, fundamentally reshaping practices both upstream, encompassing raw material acquisition, manufacturing intricacies, and supplier relations, as well as downstream, embodying distribution strategies, customer engagement, and after-sales services (IBM, 2023). As organizations navigate this complex transformation, it becomes imperative to decipher how AI can be a catalyst for innovation without succumbing to potential pitfalls. Upstream, AI can transform supplier relationships and inventory management through predictive analytics and real-time data processing. However, this transition necessitates a robust examination of data security and privacy concerns, ensuring the integrity and confidentiality of sensitive information. Furthermore, an over-reliance on AI algorithms might potentially eclipse human expertise, creating a delicate balance to maintain.

Simultaneously, the downstream supply chain benefits from enhanced customer experiences facilitated by AI-driven insights and personalization. However, this should be navigated with a conscientious approach to avoid potential ethical dilemmas, such as biased algorithms or misinformation, which might inadvertently arise during AI deployment (Ashok et al., 2022). Therefore, as organizations contemplate integrating AI, it is vital to foster an open and proactive approach to policy formulation and process implementation. This includes crafting well-rounded structural adjustments that capitalize on the efficiencies and innovations brought about by AI and preemptively address potential challenges, creating a resilient, ethical, and sustainable trajectory for the evolution of the L&SCM sector. This includes developing a multifaceted strategy that engages stakeholders at all levels and encourages collaborative efforts to navigate the complex yet promising terrain that AI presents. Future research in L&SCM may look to understand how AI can transform practices both upstream and downstream, avoiding potential pitfalls that need to be considered before structural, policy, and process implementation adjustments plans are made concrete.

APPLICATIONS: IN PURSUIT OF DR. JEKYLL

Sourcing assessment and procurement

The application of generative AI in evaluating and choosing suppliers offers a revolutionary approach, surpassing conventional methods that typically involve manual analysis and decision making. AI's ability to swiftly scrutinize vast amounts of data from many prospective suppliers while considering a diverse range of parameters, including cost-effectiveness, product quality, reliability, operational efficiency, and sustainability, enables the generation of an optimal supplier portfolio. Furthermore, AI extends its inclusivity and equality promotion by proactively suggesting strategies to integrate minority-owned, women-owned, or veteran-owned enterprises within the supply chain. Enhanced by its text generation capacity, AI can provide in-depth descriptions of each supplier's advantages and drawbacks. Additionally, it can facilitate the creation of various negotiation tactics and contractual terms predicated on historical data and predicted supplier behavior.

Supply chain risk mitigation

Generative AI's utility extends to the domain of risk management (e.g., political, economic, cultural, and partner), where it assists in scenario-based risk assessment by generating potential disruption models, including instances like supplier insolvency, strikes, natural calamities, pandemics, and more. Through a detailed and ongoing analysis of potential disruptions and danger points, companies can devise resilient strategies to ensure business continuity. For example, in a supply chain disruption, AI can generate viable alternatives based on several factors tied to our traditional logistics service quality metrics (Mentzer et al., 2021), thereby maintaining customer service trade-off targets. These sophisticated models can also develop contingency plans for various disruptions, incorporating all input from managerial prompts.

Procurement and inventory accuracy

Generative AI's predictive powers facilitate more accurate demand and sales forecasts, enabling companies to schedule their orders and quantities from suppliers optimally. This allows for lean management practices, mitigating waste and amplifying resource and process efficiency. In addition to demand prediction—a traditional application of the AI model, generative AI can craft flexible inventory policies, optimizing the costs of overstocking or understocking. For instance, it can formulate strategies for just-in-time inventory management, potentially decreasing storage costs and enhancing cash flow.

Distribution, transportation, and logistics coordination

Generative AI can formulate effective distribution strategies and logistic pathways, considering constraints and objectives, such as cost reduction, service level maximization, routing disruptions, weather conditions, and environmental considerations. Additionally, AI can develop backup plans in the event of disruptions such as traffic jams or severe weather. With the ability to analyze vast amounts of diverse, real-time data—including traffic, weather, vehicle specifications, and fuel costs—the AI can devise the most efficient transportation routes. For instance, the AI system can design a route for a delivery truck making several stops within a city that minimizes travel time or fuel usage. Furthermore, the AI can provide textual justifications for the selected routes, offering logistics managers a broader range of options and facilitating superior decision making. Given explicit constraints and stipulations as inputs, generative AI can architect ideal layouts for storage and picking activities within warehouses. Factors such as item-specific demand frequency, merchandise's physical dimensions, and various storage and handling apparatus capacities are integral to this algorithmic design.

Customer relations

Generative AI can be leveraged as chatbots within the consumer sector to automate interaction with clientele. This involves providing bespoke updates on order statuses, estimated delivery times and addressing inquiries or grievances. The upshot is enhancing customer satisfaction, overall experience, service quality, and client retention. In this context, these intricate models can aid in creating tailored marketing and sales strategies for distinct customer demographics, products, or regions based on predictive analysis of consumer data and market trends.

Sustainable and ethically conscious practices

By optimizing logistical routes, minimizing warehousing necessities, and bolstering resource utilization, AI can aid companies in diminishing their carbon footprint and promoting sustainability. AI can architect models to discern and evaluate the societal and environmental implications of sourcing from varied suppliers, thus aiding businesses in prioritizing fair trade and ethical sourcing practices. Moreover, these models could be deployed to strategize distribution efforts (particularly in sectors like health and food supply) to ensure adequate accessibility for underserved communities under regular conditions and during crises or disasters. For example, a corporation might employ generative AI to ensure diligent supply chain operations. The AI could scrutinize data from supplier audits, regulatory filings, and media reports to pinpoint potential compliance risks. Upon detecting a risk, such as a supplier contravening labor laws, the AI could suggest a spectrum of responses, including detailed audits, scouting alternative suppliers, or collaborating with suppliers to address the issue (Pan & Nishant, 2023).

CHALLENGES: CONTAINING MR. HYDE

In the current L&SCM landscape, the integration of AI promises unprecedented potential for innovation and efficiency. However, it is not devoid of substantial challenges. The adoption and integration of AI within existing frameworks propel a complex array of hurdles spanning ethical considerations, data privacy, transparency, and visibility (Morgan et al., 2023), copyright issues, the lack of regulatory templates, and workforce adaptability (Budhwar et al., 2023; Dwivedi, Kshetri, et al., 2023). Moreover, the sector establishes robust strategies to safeguard against potential misuse and security breaches inherent with AI technologies and their variants, all while nurturing a synergy between human expertise and automated intelligence. As the L&SCM sector traverses this transformative journey, exploring these challenges is vital to creating a pathway that can harness the full potential of AI while mitigating the associated risks, fostering a SCM&L sector that is not only technologically advanced but also productive, resilient, and sustainable. In this context, we outline vital challenges below.

Training AI

Training AI applications and their variants, like ChatGPT, presents significant challenges when integrating them into any domain, including L&SCM. These applications require vast amounts of data to function optimally, and acquiring or generating these data can be resource-intensive. While data are one of the critical ingredients to operationalize AI within any business application, organizations, especially supply chain small and medium-sized enterprise (SME) partners, usually lack robust data management processes, policies, and technical infrastructure, which can significantly impede their ability to leverage AI applications within various business operations successfully rations. For AI systems like ChatGPT, high-quality, diverse, and representative data are imperative to ensure that the systems can generate meaningful and insightful outputs, depending on the context of use. Any gaps, inaccuracies, or corruption in the data can lead to AI models that are ineffective or even counterproductive, producing erroneous insights or perpetuating existing biases. Furthermore, organizations may find it challenging to comply with regulatory requirements surrounding data privacy and security without established data management processes. The absence of stringent data governmentally exposes an organization to legal ramifications, as they may unintentionally violate laws surrounding the use and handling of data, especially personal or sensitive information. This aspect becomes increasingly critical considering the global emphasis on data protection, as seen with regulations like the GDPR in Europe, new copyright rules for AI proposed by the European Commission, and a recent landmark judgment on images created by AI not eligible for copyright protection in the USA. Moreover, an inadequate data management policy can hinder scalability and usefulness. As businesses evolve, the volume and complexity of data they handle often grow exponentially. Without structured processes to manage these data effectively, organizations might be overwhelmed and unable to leverage the full potential of AI applications, which thrive on big data environments to offer deeper insights and analysis.

Issue of biases

The training process itself is susceptible to incorporating biases present in the training data, which can lead to biased outputs and potentially flawed decision-making processes. Media reports and academic research have highlighted numerous instances where AI systems have exhibited biased behavior. Reports have showcased AI systems displaying racial, gender, or age biases in various applications like recruitment, credit scoring, and law enforcement. This undermines the credibility and reliability of AI systems and raises serious ethical concerns. The primary reason behind the incorporation of biases in any AI model is the presence of biased data used during the training phase. These biases can occur due to various factors, including the historical data containing prejudices, lack of representation of minority groups, and the perspectives of the creators influencing the data collection process. When AI models are trained on such data, they naturally absorb these biases, influencing their decision-making process. Implications of such biases can be manifold. In the context of L&SCM, this could mean that the AI system might unjustly prioritize certain suppliers, products, or regions, possibly leading to unequal opportunities and systemic discrimination. It can also result in flawed forecasting and suboptimal decision making, significantly affecting an organization's efficiency and effectiveness.

Operationalization

Operationalizing AI applications, especially in L&SCM, can be a complex and nuanced endeavor. AI's reinforcement learning process demands data consolidation, human expertise, and technological acumen. In reinforcement learning, a model learns to interact with an environment to achieve some goal or maximize some notion of cumulative reward. The model learns through trial and error, effectively learning the best actions to take in various states. While powerful, this approach requires considerable computational resources, and the learning process can sometimes be somewhat opaque, making it difficult to fully predict or understand the model's decisions. In the context of AI, “hallucinations” refer to instances where the model generates outputs that are not based on actual data or factual information but are fabricated or distorted by the model itself. These hallucinations can be a significant problem in L&SCM, where accuracy and reliability are paramount.

In logistics management, incorrect predictions or decisions by an AI system can have substantial economic repercussions. For instance, an AI system incorrectly predicting a surge in demand for a particular product can result in overstocking, increased carrying costs, and potential obsolescence. Conversely, underestimating demand can result in stockouts, lost sales, and damaged customer relationships. In the L&SCM domain, the insights and expertise of seasoned professionals are often indispensable. These professionals can provide nuanced inputs to guide the reinforcement learning process, helping fine-tune the model to reflect real-world complexities relevant to the logistics manager. Output could provide

insights into managing supply chain disruptions, which can be incorporated into the AI system to make it more robust and adaptable (Johnson et al., 2022). Developing and maintaining an AI application requires a team with expertise in data science, machine learning, software development, and other technical areas, which is also capital-intensive and often difficult to contemplate for smaller businesses. For instance, integrating AI capabilities into a warehouse management system might require technical expertise to ensure seamless integration with existing IT infrastructure, real-time data processing capabilities, and the development of user-friendly interfaces for end-users.

Cyber resilience

AI-related data breaches are a growing concern, particularly in L&SCM, where a vast amount of sensitive information is handled regularly. Data breaches can occur as a result of insufficiently secured databases or networks, which malicious actors can exploit to gain unauthorized access to sensitive information, phishing schemes, targeting weak links in the supply chain, like a smaller supplier with lesser security protocols, to make their way into larger companies' databases, and poorly secured APIs (used to collect data, feed into AI model and access AI output), which can be exploited to extract data or introduce malicious code into the AI system. For example, the SolarWinds cyber-attack (2020) stood out as a significant incident not solely due to the compromise of one firm but because it initiated a far-reaching supply chain disruption impacting numerous entities, including the U.S. government. Recently, in March 2023, the developers of ChatGPT reported a technical glitch that inadvertently allowed some users to access the chat histories of others, exposing sensitive personal information, such as the last four digits of credit card numbers and their respective expiration dates.

A data breach can result in losing business opportunities, as customers and partners might choose to dissociate from a compromised organization. Following a breach, organizations must invest heavily in upgrading their security infrastructure and protocols. Organizations might face increased scrutiny from regulators, including potential audits and stricter regulatory requirements. Organizations might face legal actions from affected parties, including customers, suppliers, or shareholders. Given the increasing reliance on AI systems in supply chain and logistics management, organizations must be cognizant of the heightened risks of data breaches. Proactive measures, including securing networks, safeguarding data, and fostering a culture of cybersecurity awareness, can go a long way in protecting organizations from the significant threats posed by data breaches. However, they are resource and capital-intensive and require human skills.

Business models and strategies

Implementing AI applications within the intricate spheres of L&SCM requires a monumental shift in the organizational frameworks and business operations. These transformations will likely influence the supply chain configuration, revamp decision-making protocols, and initiate substantial shifts in the organizational structure. However, this is largely uncharted and unexplored territory, especially when considering the capabilities and limitations of AI models compared with existing AI systems. In the contemporary scenario, organizations find themselves navigating a business landscape that is dynamic, volatile, crisis-driven, uncertain, and deeply influenced by rapidly evolving technology. They are caught in a complex scenario of escalating their sustainability initiatives while advancing their digital infrastructure to retain a competitive edge. These twin imperatives necessitate a deep and thoughtful recalibration of their existing business models, urging them to innovate and evolve.

However, business model innovation is a formidable challenge for any organization. It demands substantial resources and capital and involves a level of risk, given that the returns on investment are not guaranteed and are seldom realized in the short term. For instance, a wealth of data is available on circular economy business models and cases, which can serve as a training ground for AI models. These AI systems can subsequently assist in devising robust change management strategies, a critical component in any re-engineering and innovation endeavors. However, the practical implementation of these recommendations remains a complex domain where the expertise of L&SCM professionals is indispensable. Their years of hands-on experience, deep-rooted tacit knowledge, and keen understanding of the current organizational structures will play a decisive role in evaluating the feasibility of the proposed changes.

Furthermore, we encounter a significant gap when we explore emerging concepts like regenerative business models (Konietzko et al., 2023), which build upon and extend the principles of circular economy models. In their current stage of development, AI applications might fall short in offering organizations a comprehensive blueprint to revamp existing business processes and supply chain configurations. The limited data on successful regenerative business models and cognitive barriers, such as a lack of consensus on their potential to enhance sustainable business performance, pose significant challenges.

Moreover, suppose organizations contemplate integrating diverse business models, such as servitization and regenerative frameworks. In that case, they might find that AI models fail to offer a clear pathway for successful implementation despite being fed with abundant data. This limitation arises from a few fundamental factors: (a) AI's constrained ability to critically analyze the benefits and drawbacks of integrating two distinct business models; (b) its lack of depth in understanding the nuances of supply chain configurations, stakeholder relationships, and cultural dynamics, which is often developed through years of industry experience; (c) its limited comprehension of human cognition, organizational culture, and the multifaceted intricacies that govern business ecosystems. Therefore, while the journey toward integrating AI in restructuring business operations holds promise, it is filled with complexities and challenges that necessitate a collaborative, thoughtful, and adaptive approach.

Workforce dynamics

The infiltration of AI applications within the L&SCM sector embodies a potent force capable of comprehensively reshaping the industry's employment dynamics. This signals a transformative shift that promises to redefine the contours of work dynamics, employment landscapes, and the nature of jobs within the sector, which has been widely discussed in the existing literature (Klumpp & Ruiner, 2022).

Goldman Sachs research indicates that approximately 300 million full-time positions globally, including two-thirds in the U.S. and Europe, face the potential of being replaced by AI (Vallance, 2023). Concurrently, recent data from the OECD suggest that AI could readily automate nearly 27% of roles in OECD nations that predominantly rely on human expertise (OECD Employment Outlook, 2023). Additionally, a separate study by the Pew Research Center revealed that one out of every five American workers occupy a position susceptible to AI substitution (Kochhar, 2023). While the influence of AI-driven digitalization on the low-skilled workforce is well documented in the existing literature (Duan et al., 2019; Dwivedi et al., 2021), recent events have underscored its growing impact on high-skilled professions that have traditionally depended on human intelligence, creativity, higher-order thinking, and tacit intuitive experience (Budhwar et al., 2023; Grennan & Michaely, 2020; The White House, 2022). Notable examples include Hollywood writers and actors striking for stricter regulations on studios' AI usage to protect human jobs and Harvard University's controversial decision to replace human teachers with an AI chatbot for coding lessons this fall. These incidents highlight the urgent need to re-evaluate and adapt to the evolving dynamics of AI in the professional landscape.

Therefore, the impact on the nature of jobs will likely be profound. Tasks that were once manual and time-consuming might soon be automated, enabling a more streamlined and efficient workflow (Loske, 2022). This automation, while boosting productivity, which is debatable, may also engender a shift in the skill sets demanded in the workplace. Employees might need to adapt by fostering skills that complement the capabilities of AI, focusing on areas where human intelligence holds a distinctive edge, such as strategic thinking, problem solving, persuasion, negotiation, and interpersonal relations.

Job replacement and displacement are likely consequential outcomes of this technological adoption. Routine tasks, particularly those that are repetitive and require minimal human intervention, are poised to be the first to be displaced. This shift can potentially disrupt existing job structures, possibly leading to the displacement of workers in specific roles. However, it is crucial to note that the emergence of AI may also lead to new job opportunities. These jobs might involve managing, maintaining, and optimizing AI systems, necessitating a workforce adept at navigating advanced technology's nuances. Simultaneously, the employment landscape within the L&SCM sector is slated to undergo significant transformations. Organizations might increasingly lean toward a workforce that can collaborate seamlessly with AI systems, fostering a symbiotic relationship that leverages the strengths of both humans and machines, that is, collaborative intelligence (Chowdhury et al., 2022; Peng et al., 2022). Organizations must proactively plan and formulate strategies considering these developments. This includes investment in training and reskilling programs, fostering a culture of continuous learning, and developing frameworks that facilitate smooth transitions and adaptations to the changing job landscapes.

AN ONGOING CALL FOR FUTURE RESEARCH

Considering the evolving landscape of AI applications, a comprehensive examination of its implications and challenges is critical, particularly within the L&SCM sector. We have developed a research framework illustrated in Figure 2 to facilitate this.

This framework aims to serve as a navigational chart steering future research direction, revealing the interaction between the attributes of AI and the organizational outcomes that are highly valued within the L&SCM sector. At the core of our proposed framework is the understanding that the inherent technical aspects of AI, that is,

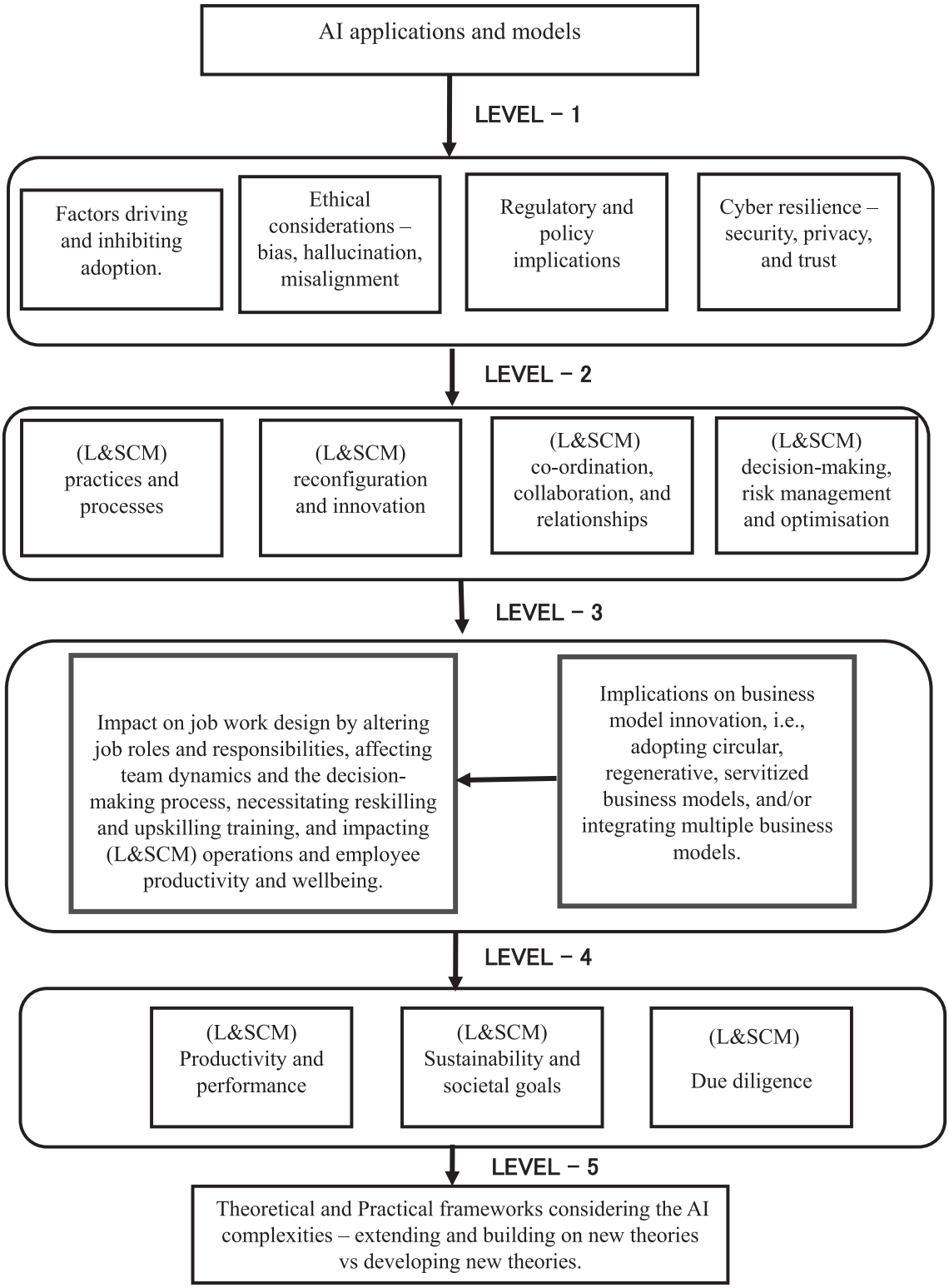

FIGURE 2 Research framework.

capabilities and limitations, are fundamentally influential in fostering its acceptance and integration. These intrinsic features simplify integrating AI into existing L&SCM systems and introduce potential hurdles. Consequently, these aspects are vital in establishing legal, ethical, and policy frameworks that govern its application. Organizations operating in the L&SCM sector will gradually face the complex potentials and obstacles associated with adopting AI. In response, they will modify their strategies to encapsulate the strengths and opportunities AI presents. This strategic

shift has implications on various facets of L&SCM operations, including process re-engineering, transforming practices, coordination, and decision-making protocols. Subsequently, this propels a transformation in L&SCM processes, paving the way for innovative business models. Furthermore, this transition is not confined to altering job availability or the nature of existing roles. It permeates deeper, influencing how individuals view their positions within the professional sphere. This shift is apparent in the evolving preferences for skill development, where there is a growing emphasis on continuous learning to maintain relevance in a swiftly changing environment. Finally, this leads to a transformation in the L&SCM sector, particularly concerning productivity, sustainability, and corporate responsibility outcomes. Through the integration of AI, we anticipate a substantial evolution in the L&SCM sector, which promises to steer it toward a future characterized by heightened efficiency, resilience, and responsiveness to emerging global demands and challenges.

LEVEL 1: FACTORS CONTRIBUTING TO THE AI ADOPTION

In the rapidly evolving landscape of AI, the exploration of factors both propelling and hindering the adoption of emerging technologies forms a critical frontier for future research (Duan et al., 2019; Hasija & Esper, 2022). Scholars and practitioners alike stand to benefit significantly from comprehensive studies that dig deep into the intricate elements driving the rapid adoption of AI innovations, as well as the potential barriers that might slow this process (Hendriksen, 2023). In this venture, research could be channelized to address a spectrum of nuanced questions such as:

- What socioeconomic factors foster a conducive environment for the smooth integration of AI?
- How do organizational cultures and structures influence the speed and extent of technology adoption?
- What role does government policy and regulation play in either advancing or restricting the permeation of innovative solutions in various sectors?
- How do ethical considerations, including data privacy and security, influence the adoption rate?
- Moreover, understanding the psychological aspects tied to technology adoption, including user resistance and the skill gap, is vital.

There is a pressing need to research the ethical dimensions governing AI adoption (Dwivedi, Kshetri, et al., 2023; von Krogh et al., 2023). The emergent nature of this technology has opened a Pandora's box of ethical dilemmas and considerations that necessitate a rigorous scholarly inquiry to foster responsible and equitable use. In this landscape, future research should focus on posing critical questions such as:

- What potential biases are embedded in AI systems, and how might they influence the spread of misinformation or reinforce existing societal prejudices?
- What measures can be implemented to ensure the responsible deployment of AI, thereby preventing misuse or exploitation? How can the development and operation of AI be directed to prioritize protecting user privacy and data security?
- Moreover, as these systems increasingly mimic human-like interactions, how might this blur the lines between human and AI communications, and what implications might this have for individual psychological well-being and societal dynamics?

Research should also focus on developing ethical frameworks that can guide the creation and deployment of AI systems. Such studies could explore establishing guidelines that promote transparency, accountability, and inclusivity (Dwivedi et al., 2021) in AI L&SCM operations. This might involve collaborative efforts, bringing together experts from the fields of technology, ethics, law, sociology, and psychology to build a cohesive and comprehensive blueprint for ethical or responsible AI use (Ashok et al., 2022; Dwivedi et al., 2021).

Furthermore, as AI evolves, studies should continually reassess and adapt these ethical frameworks to ensure their relevance and efficacy in mitigating emerging challenges. This dynamic field necessitates ongoing research to keep pace with the rapid developments and to foster a technology ecosystem that prioritizes the welfare and ethical treatment of all its stakeholders. In essence, future research trajectories should aim to create a landscape where a conscientious approach marks the adoption of AI systems like ChatGPT, one that balances the pursuit of innovation with a steadfast commitment to upholding the ethical principles that govern society. This would contribute significantly toward carving a future where technology serves as a promoter of progress without compromising the foundational ethical tenets that hold the fabric of society together.

Future research ought to dissect and evaluate the existing legal frameworks, identifying potential gaps and nuances that may arise specifically in the context of AI applications. Key questions to consider could include:

- What are the implications of AI adoption on contracts and liabilities within the supply chain?

- How can regulatory policies be structured to ensure data privacy and security, particularly in cross-border logistics operations?
- What legal safeguards are necessary to prevent potential misuse of AI technology in the sector, including data manipulation or unfair competitive practices?

Furthermore, exploring policy dynamics should facilitate the formulation of guidelines that can foster responsible innovation, safeguarding against potential disruptions or exploitation (Richey & Davis-Sramek, 2022c). It might be pertinent to study how policies can be structured to encourage transparency and accountability in AI operations within the sector, facilitating an environment of trust and collaboration (Clayton, 2023). Research could also delve into the implications of AI on employment laws, investigating how the evolving nature of work and roles within the supply chain could be accommodated within legal frameworks. Another significant area of study pertains to the international dimension of regulatory requirements. Given the global nature of supply chains, research should explore how international cooperation and harmonization of regulations can be facilitated to ensure a smooth and compliant operation of AI-integrated supply networks. This includes studying the mechanisms for cross-border data transfers and establishing international standards for AI ethics and operations in the logistics sector.

LEVEL 2: L&SCM PRACTICES AND PROCESSES

As we venture deeper into the digital age, the supply chain and logistics stands on the brink of a significant technological upheaval facilitated by AI applications like ChatGPT. Uncharted territory of research opportunities unfolds, beckoning scholarly exploration into various facets of supply chain processes, practices, reconfiguration, coordination, and innovation.

Future research endeavors should keenly investigate how AI can transform supply chain processes. Key questions in this realm might encompass:

- How can AI facilitate dynamic reconfiguration of supply chain structures to respond swiftly to market demands and disruptions?
- What novel practices can be envisioned in logistics management, leveraging AI's predictive and analytical capabilities?
- Furthermore, the study should extend to understanding how coordination between various stakeholders in the supply chain can be enhanced through AI-enabled communication and data-sharing platforms.

In relation to the aspect of innovation, research should delve into the exploration of new business models that AI can foster within this sector. Questions to be considered include:

- How can AI foster innovation in product design and development through its analytical capabilities?
- What roles can AI play in fostering sustainable and environmentally friendly supply chain practices?
- Additionally, an analysis of case studies where AI has successfully driven innovation could serve as a learning platform, offering insights and strategies for wider adoption.

An integral part of AI adoption is the potential reconfiguration of supply chain structures, characterized by enhanced efficiency, adaptability, and innovation in digital L&SCM. This new frontier calls for extensive research, mapping out the potential avenues and ramifications of integrating AI technology in supply chain operations. We must rigorously examine the dynamics of supply chain reconfiguration in the context of AI adoption. Central to this investigation would be questions such as:

- How can AI contribute to creating more responsive, resilient, and adaptable supply chain networks?
- What are the strategies to leverage AI for optimizing inventory management, demand forecasting, and logistics planning?
- Furthermore, the research should explore the possibilities of creating intelligent supply networks that can autonomously adapt to changing market dynamics and customer preferences, leveraging AI's content creation, predictive analytics, and heterogeneous data processing capabilities.

Additionally, studies must probe into the organizational changes that might accompany this reconfiguration. Key research questions could include: How can organizations foster a continuous learning and adaptation culture to keep pace with the rapid technical advancements? Moreover, a significant aspect to consider is the potential change management strategies, examining how organizations can smoothly transition to AI-enabled operations while mitigating resistance and fostering stakeholder buy-in.

Integrating AI systems opens novel pathways for transforming decision-making processes (Kumar

et al., 2023). Future research in this domain must undertake a multifaceted approach, comprehensively understanding various dimensions that encompass the opportunities and challenges of the AI integrations sector. Consider:

- How can AI contribute to improving demand forecasting accuracy in the supply chain?
- What role can AI play in predictive maintenance and inventory optimization?
- How might AI systems aid in real-time tracking and adjustment of logistics operations?
- How can AI systems serve as decision support tools for L&SCM managers?
- What frameworks can be established to integrate AI insights into strategic planning seamlessly?
- What are the ethical implications of relying on AI for critical decision making in L&SCM?
- What are the potential ROI and cost–benefit analyses of implementing AI in L&SCM decision making?
- How can organizations measure the success of AI integration in their supply chain operations?

The future research landscape should aim at fostering an ecosystem where AI integrates seamlessly into the supply chain decision making, enhancing efficiency while adhering to ethical norms and regulatory standards. The focus should be on creating frameworks and methodologies that enable organizations to fully leverage AI's potential while navigating this technological shift's complexities and challenges.

LEVEL 3: WORK, EMPLOYMENT, AND BUSINESS MODEL INNOVATION

AI applications such as ChatGPT in the L&SCM sector promise to bring significant shifts in the labor market dynamics, influencing work design, organizational dynamics, employment patterns, job roles, and career trajectories (Zagorin, 2023). This phenomenon necessitates comprehensive research to understand the nuances of these transitions and equip stakeholders with the knowledge and strategies to navigate them successfully. Here, we provide a roadmap for future research in this area:

- What new roles and responsibilities are expected to emerge with the integration of AI in the L&SCM sector?
- How will the skill requirements evolve for professionals in this sector by adopting AI-enabled technologies?
- Which strategies can be implemented to facilitate a smooth workforce transition into AI-integrated environments?
- How can training programs be designed to upskill and reskill existing employees for new roles generated due to AI adoption across different generations?
- How is AI integration expected to influence career development and progression patterns in the L&SCM sector?
- What new opportunities and challenges might professionals encounter in their career paths with the evolution of AI?
- What are the implications of AI adoption on job security, worker rights, and labor market dynamics? The aim should be to study changing employment patterns, including contractual arrangements, freelance opportunities, wage structures, employment rates, and job security.
- What ethical considerations are associated with AI-induced transitions in the job market?
- How can organizations ensure inclusivity and fairness in AI-driven job environments?
- How can policymakers foster a conducive environment for AI integration while safeguarding employee interests?

Therefore, future research should focus on developing a balanced pathway that maximizes the benefits of AI integration while mitigating potential adverse impacts on the workforce. Through empirical analysis, researchers can help forge a future where AI transforms the sector and fosters an environment characterized by growth, opportunity, and inclusivity along the key tenets of Industry 5.0.

AI is a promising catalyst for fostering regenerative and servitization business models in the L&SCM sector. On one hand, the regenerative model emphasizes restoring, renewing, and revitalizing one's sources of energy and materials, creating sustainable systems that integrate the community and environment at their core (Hahn & Tampe, 2021). AI can facilitate this by optimizing resource allocation, predicting material life cycles, and helping to create closed-loop systems that minimize waste and nurture the natural environment. On the other hand, the servitization model is centered on transitioning from selling products to delivering comprehensive services that offer higher value to customers. AI can play a pivotal role by analyzing customer data to craft personalized service offerings, predicting product maintenance needs before issues arise, and fostering dynamic and responsive service delivery channels. Through the adept analysis and utilization of heterogeneous big data, AI can thus aid in constructing innovative business models

that drive economic growth and promote environmental rejuvenation and a more customer-centric approach, paving the way toward a more sustainable and service-oriented business landscape. This would pave the way for a new era where business models are characterized by innovation, inclusivity, and value creation. Several research questions that are critical to fostering a more profound comprehension and facilitating successful adaptation to the evolving business environment are as follows:

- How can AI enhance service delivery and customer experience in the L&SCM sector?
- What novel business models can emerge to leverage AI capabilities in enhancing customer engagement and satisfaction?
- How can AI facilitate the integration of sustainable practices and circular economy principles into business models?
- What role can AI play in fostering business models that promote resource efficiency and waste reduction?
- How can AI contribute to enhancing transparency and traceability in supply chains?
- What innovative business models can be developed to leverage AI for real-time tracking and reporting in supply chains?
- How can AI aid in developing business models that enhance risk management and resilience in supply chains?
- What are the prospects for AI in facilitating predictive analytics for proactive risk mitigation?
- How can AI contribute to developing regenerative business models in the L&SCM sector focusing on societal benefits and ecological restoration?
- What innovative strategies can be formulated using AI to foster business models that promote environmental regeneration and social equity?
- How can organizations ensure compliance with regulatory requirements while adopting AI-driven business models?

The future research landscape should shed light on AI's transformative potential in shaping innovative business models within the L&SCM sector. By exploring the complex implications of AI integration, researchers can contribute to the evolution of business strategies that not only leverage the capabilities of AI but also foster sustainability, efficiency, and resilience in the industry.

LEVEL 4: L&SCM OUTCOMES

The future research landscape examining the impact of implementing AI applications, particularly focusing on productivity and performance enhancements, is vast and promising (Wamba et al., 2023). Several questions that researchers could explore to deepen the understanding in this area are outlined below.

- How can AI systems streamline operations in the L&SCM sector?
- What are the specific areas within supply chain operations where the application of AI can markedly enhance productivity?
- How can AI transform customer service, supply chain, and logistics engagement? What innovations can AI bring in personalizing customer experiences and fostering stronger relationships?
- What are the prospects for AI in fostering innovations that promote resource optimization and environmental sustainability?
- How can AI facilitate better knowledge management and foster innovation in supply chain operations?
- What avenues can AI open for creating knowledge repositories and facilitating organizational learning and innovation?
- What opportunities can emerge from successfully integrating AI technologies in enhancing supply chain performance?

The research should involve understanding the potential enhancements in productivity and performance and exploring innovative strategies and models that can redefine the sector's trajectory. Through rigorous studies, researchers can foster a knowledge base that guides organizations in leveraging AI to craft a more efficient, sustainable, and responsive supply chain landscape.

Future research should prioritize an interdisciplinary approach, drawing from fields such as environmental science, data science, and L&SCM management, to holistically study the potential of AI in fostering a more sustainable L&SCM management. This includes analyzing the direct impacts on environmental and social sustainability and examining the broader implications for industry practices, policies, and governance structures. The key research questions that emerge are outlined below.

- How can AI facilitate the development of more sustainable supply chain networks?
- In what ways can AI enhance transparency and traceability within the supply chain to promote sustainability?
- Can AI play a pivotal role in enhancing energy efficiency and reducing the carbon footprint of supply chain operations?
- How can AI-driven analytics assist in crafting sustainable transportation and logistics strategies?

- How can AI facilitate the design and development of sustainable products and services?
- How can AI assist organizations in fulfilling their corporate social responsibility (CSR) commitments?
- In what ways can AI enhance stakeholder engagement and collaboration to promote sustainability?
- How can AI assist organizations in complying with sustainability-related regulations and policies?
- What role can AI play in enhancing governance structures to promote sustainability in supply chain operations?
- Which sustainability development goals will benefit from adopting AI applications in the L&SCM sector?

Investigating the ramifications of incorporating AI technologies in enhancing due diligence within the L&SCM sector offers a novel frontier that warrants a detailed exploration of how AI can facilitate risk mitigation, compliance, and transparency. Potential research avenues and critical questions that might shape future scholarly efforts in this area are outlined below.

- How can AI aid in identifying and mitigating risks at various stages of the supply chain?
- To what extent can AI technologies provide predictive insights into potential disruptions and vulnerabilities in the supply chain?
- How can AI streamline and enhance the supplier evaluation process?
- Can AI applications provide more comprehensive insights into supplier performance and reliability?
- How can AI facilitate compliance with ever-evolving regulatory requirements within the supply chain sector?
- Can AI tools assist organizations in maintaining adherence to environmental, social, and governance (ESG) standards?
- In what ways can AI technologies enhance financial due diligence processes in the L&SCM sector?
- Can AI provide more sophisticated tools for financial analysis and forecasting?
- To what extent can AI technologies provide real-time insights into product journeys and supply chain operations?
- Can AI foster ethical procurement and sourcing practices?

Integrating AI technologies in the L&SCM sector promises a transformation with several implications. As we forge ahead into this new frontier, the necessity for robust research into the legal, policy, and regulatory landscapes governing this adoption becomes paramount. In an inherently complex and globally interconnected sector, jurisdiction, compliance, and enforcement questions arise as critical areas of study.

LEVEL 5: THEORETICAL AND PRACTICAL FRAMEWORKS

At its core, AI stands apart from previous technological advancements owing to its inherent ability to recommend decisions, adapt based on learning experiences, and progressively enhance interactions based on acquired knowledge (Haenlein & Kaplan, 2019). This evolutionary process is markedly distinct from earlier technological transitions, primarily focused on altering or replacing manual tasks with automated processes. Moreover, current AI applications like ChatGPT and Bard excel at understanding the nuances of natural language through patterns and sequences and possess a remarkable ability to comprehend and contextually generate text, offering more sophisticated and coherent responses over extended interactions.

Therefore, AI possesses an array of complex layers that redefine its integration into various sectors (Makarius et al., 2020). These complexities can be categorized into various dimensions, including cognitive aspects that relate to the capabilities and limitations of AI systems and relational facets, which encompass the several factors that come into play during the AI adoption process. Furthermore, the structural dimension encapsulates AI's extensive impact on work patterns, organizational structures, the interaction between AI and employees, and regulatory complexity, underscoring the imperative need for ethical considerations and fostering sustainable AI utilization. This transition has precipitated blurred boundaries between human roles and machine functionalities, fostering a paradigm where automated decision-making processes are increasingly intertwined with contextual complexities. Given this backdrop, it becomes apparent that the existing theoretical frameworks may fall short of capturing the depth and breadth of transformations resulting from AI in the L&SCM sector. The disruptions and evolutions caused by AI are profound and unprecedented, often bypassing the boundaries established by traditional theories.

Thus, navigating the nuanced landscape created by AI requires the development of a more sophisticated theoretical lens. This lens should be capable of comprehending the multifaceted complexities introduced by AI, offering a dynamic and adaptive blueprint to study and understand the radical shifts occurring in the L&SCM sector. As we stand on the cusp of this transformation, it is incumbent upon us to foster a theoretical approach that resonates with the dynamism and innovation due to AI, thereby facilitating a seamless integration and application of AI into the L&SCM landscape, which will lead to productivity, sustainability, and resilience, and

synergizing with human expertise. The key research questions that might help with these dimensions are outlined below.

- To what extent can existing theories in the L&SCM sector comprehensively address the implications and integration of AI?
- What notable gaps and limitations are present in current theories when examining the phenomena of AI integration in the L&SCM sector, and how might these be addressed to foster a deeper understanding?
- How might synthesizing existing theories and insights from interdisciplinary studies enhance the comprehension and explanation of AI's potential impact on the L&SCM sector?
- What novel theories can or should be formulated to holistically understand the AI phenomena within the L&SCM sector, and what rationale underpins the necessity for such theoretical development?

Methodological approaches

The research issues and agenda presented in the section above clearly suggest that the domain is complex, necessitating the use of several established and emerging methods to address the research questions mentioned earlier. In other words, a rigorous examination of the application of AI in L&SCM demands a multi- or mixed-method research approach. Below, we outline a few quantitative and qualitative methods suitable for conducting rigorous research in this domain.

Beginning with the experimental research method, it stands as a pivotal tool in evaluating the effectiveness of AI applications within a controlled environment. Researchers have the latitude to create AI system prototypes and subject them to diverse simulated conditions to gauge their performance. This could encompass tasks such as leveraging AI for demand forecasting—with generative models trained to anticipate future demand trends based on past data—or utilizing AI for route optimization to devise the most time and cost-efficient transportation routes. Furthermore, experiential research may facilitate a detailed comparison of the efficiency and efficacy of AI tools against outputs derived from traditional methods, including manual approaches. Survey-based theory testing can be employed to delve into issues surrounding the adoption and utilization of AI, especially at an individual level. In addition, methodologies such as regression analysis and time-series forecasting can be applied to scrutinize extensive datasets and further the development of predictive models. Machine learning and deep learning techniques can be leveraged to empower AI systems to autonomously formulate solutions based on data analysis.

Qualitative research can complement quantitative methods, allowing for a deeper understanding through interviews and focus groups involving industry stakeholders. This method is instrumental in exploring the practical challenges and opportunities of implementing AI in logistics and supply chain management, thus guiding the AI systems to align with end-user requirements and preferences. The case study method offers a fertile ground for understanding individual or comparative scenarios, providing a rich narrative of AI deployment in various logistical contexts. For instance, case studies might explore the enhancements AI can bring to warehouse management through optimal storage and retrieval strategies. The approach is equally potent in examining the usage and impact of AI at both organizational and team levels. Additionally, grounded theory methodology can be utilized to build theories closely tied to the data accumulated during research, supporting the creation of AI systems grounded in empirical evidence.

Action research can be employed as an iterative method, promoting a cycle of planning, action, observation, and reflection, thereby aiding the development of adaptive and optimized AI systems. This approach welcomes real-time adjustments to AI systems, reflecting feedback acquired during the testing phases. Similar outcomes can be achieved through Action Design Research. By harnessing a blend of qualitative and quantitative research methods, researchers can forge a substantial understanding of the potential and constraints of AI in L&SCM, guiding the way to innovative and pragmatic solutions in this arena. The essential research questions that are relevant to methodologies for examining the impact of AI in L&SCM are outlined below:

- What are the appropriate research designs and methods to investigate the impact of AI at micro, macro, and meso levels in L&SCM?
- What methodologies can be applied to study the potential biases and inequalities introduced by the integration of AI in L&SCM?
- What are the appropriate metrics and evaluation techniques to measure the impact of AI on supply chain efficiency and productivity?
- How can mixed methods be used to understand the human experience and perspectives on the increasing role of AI in logistics?

  How do existing and new research methodologies assist in identifying and understanding potential innovations in L&SCM through the lens of AI development?

CONCLUSION AND PAPERS IN THIS ISSUE

JBL has a long history of supporting research connected to and advancing the practice of L&SCM. While this generative AI discussion opens the door to an ongoing call for related research in L&SCM, this journal always supports technology-oriented research. The first three papers in this issue continue our 45-year tradition of examining emerging tech-based topics like Blockchain, e-fulfillment systems, and Industry 4.0 trends. In "Exploring Blockchain for Disaster Prevention and Relief: A Comprehensive Framework Based on Industry Case Studies," Treiblmaier and Rejeb employ a group of case studies to investigate how Blockchain solutions can be implemented in disaster prevention and relief scenarios. Examining the roles of key stakeholders, the authors illustrate firm motivations in deploying blockchain technology, listing the relevant properties and highlighting contingency factors. Findings demonstrate blockchain opportunities for streamlining information flows and augmenting stakeholder capabilities. Using L&SCM technology to save lives is a priority for our research. Expect to see growing attention to humanitarian logistics in *JBL* soon!

In the second paper, "Modularization of the Front-End Logistics Services in e-Fulfillment," Yurt et al. (2023) explore the context of service modularity in customer-facing logistics for e-fulfillment. We were happy to receive this paper as we continue to call for more consumer logistics work. Expect a special topic forum in early 2024. These authors used an online survey of customers to extract data and identify clusters (multichannel shoppers, infrequent shoppers, and online fans), providing preliminary evidence on how commonality and variability aspects of service modularity optimize the number of service options and related performance levels. Pessot et al. (2023) move up to the industry level by "Empowering supply chains with Industry 4.0 technologies to face megatrends." They leverage focus group interviews to investigate how megatrends impact the supply chain landscape and the role of technology in supporting supply chain alignment. Five supply chain capabilities are identified as prevalent and fitting external contingencies. The study also highlights and compares the potential of I4.0 technologies and their applications in supporting specific supply chain capabilities. This is a paper that should open minds to future research ideas.

Following the first three technology-oriented articles in this issue, we continue to work to push more papers into every annual volume of *JBL*. There is no cap on the number of papers we will publish. If we can get 100 quality papers, we will publish 100 quality papers. The remaining five papers in this final issue are top quality and cover diverse topics, bringing us to 32 citable papers for the year. From the world of transportation, Balthrop et al. (2023) bring us "How do trucking companies respond to announced versus unannounced safety crackdowns? The case of government inspection blitzes." This paper embraces our ongoing call for policy research (see: Richey & Davis-Sramek, 2022a, 2022b). The authors investigate how motor carriers respond to changes in the likelihood of regulation via inspections. Using a longitudinal dataset, they find that firms with lower compliance costs and higher costs of avoiding inspections improve compliance before and during announced "blitzes." Small firms with lower avoidance costs tend to avoid announced blitzes, whereas unannounced blitzes result in no changes in compliance or avoidance.

We also continue to call for work on last-mile delivery. The last mile is where research and reviewers are in short supply. In "You're Driving Me Crazy! How Emotions Elicited by Negative Driver Behaviors Impact Customer Outcomes in Last Mile Delivery," Masorgo et al. (2023) run a scenario-based experiment examining—who is at the door with a package? As delivery drivers increasingly act as e-tailers' frontline employees via home deliveries, negative driver behaviors increasingly impact customer satisfaction and repurchase intentions. Driver affiliation is altering the magnitude of customer responses. Results show that the adverse effects of driver-inappropriate behavior on customer outcomes are mediated by anger and that the effects of driver inflexibility are mediated by sadness. Additionally, the negative effect of driver inflexibility on customer outcomes is weaker for outsourced logistics than for private fleet drivers. Driver-inappropriate behavior exhibits similar adverse effects on customer outcomes for both driver affiliations.

The final three papers examine classic strategic issues of postponement, relationship-based sourcing, and inventory substitution. These issues deserve additional attention as we move through a postpandemic paradigm shift. In a much-needed study titled "Revisiting postponement: Boundary-crossing problems and tax implications for global supply chains of integrated solutions," Norrman and Prataviera (2023) examine postponement decision making for global supply chains. This one-to-four case study approach explores decisions, related fiscal and legal implications, and cross-functional integration at a global high-tech enterprise. The authors detail the contextual drivers of increased postponement boundary complexity to illustrate changes in its decision making.

In "Competitive actions and supply chain relationships: How suppliers' value-diminishing actions affect buyers' procurement decisions." Hofer et al. (2023) use econometric and panel data-based analysis to span the

effects of competitive actions in the context of vertical buyer–supplier relationships, explicitly examining how a supplier firm's value-diminishing competitive actions lead to subsequent reductions in the buyer's procurement allocations and how contextual factors moderate such effects. Findings show that a supplier's value-diminishing actions are associated with decreases in buyer purchases from the supplier, as well as the supplier's downstream vertical relatedness and the degree to which rival suppliers pursue value-diminishing actions moderate this effect.

Finally, Pritchard et al. (2023) examine a classic logistics problem related to fill rates and stockouts. This study is an excellent example of how even our neo-classical expectations from Deming and other JIT and lean experts are no longer generally accepted, nor should they be if we indeed are focused on the customer. In "The impact of stockout-based switching on fill rates," the authors examine how customer substitution behavior can influence customer service measures. The authors find that item fill rate is primarily a function of the target service level of the focal item and the willingness to switch from an alternate item to the focal item. Category fill rate is influenced by the target service level of both items, with a willingness to switch amplifying their effect. However, the decision tree approach can overestimate the item fill rate when the willingness to substitute from the alternate item increases and accurately predicts category fill rates outside of scenarios with asymmetric substitutability.

We hope volume 44 of *JBL* has been informative and impactful. We also hope this perspective editorial helps guide future research and encourages the field to send important work to the journal. Thanks for supporting the *Journal of Business Logistics*.

KEYWORDS

ChatGPT, generative AI, generative artificial intelligence, large language models, LLMs, logistics management, supply chain management

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