UCP Journal of Business Perspectives
Vol. 4, Issue 1 (January - June 2026)
Journal website: http://ojs.ucp.edu.pk/index.php/jbp/index

Artificial Intelligence Adoption in Sustainable Supply Chain Management: A Systematic Literature Review and Future Research Agenda

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ABSTRACT

The research is a systematic literature review of the use of artificial intelligence (AI) in sustainable supply chain management (SSCM) and comes up with a research agenda. Within a systematic literature review methodology that follows PRISMA guidelines, the review synthesizes the latest peer-reviewed works that were published in 2020-2026. The results demonstrate a rapid increase in the adoption of AI in SSCM over the last several years, as machine learning, predictive analytics, natural language processing, and automation have become commonly discussed topics. The literature is primarily centered around demand forecasting, optimization of logistics, inventory planning, resilience, and traceability. It is demonstrated that AI assists in maintaining the economy in terms of efficiency and cost reduction, the environment in terms of waste and emissions, as well as, to a lesser degree, social sustainability in terms of transparency and compliance. But significant impediments are also reported in the review, such as data quality, capability gap, complexity in integrating, high cost, and governance. On the whole, the research paper has concluded that AI has high potential to revolutionize SSCM, yet more empirical, theoretical, and socially oriented studies are required to improve the situation.

Keywords: Artificial Intelligence, Sustainable Supply Chain Management, AI Adoption, Systematic Literature Review, Sustainability, Future Research Agenda

1. INTRODUCTION

Supply chain management (SCM) can be defined as the coordination of material, information, and financial flows starting with sourcing and up to final delivery so as to meet the cost, service, and responsiveness goals. However, in modern business settings, SCM is now being measured based on the prism of sustainable supply chain management (SSCM) that incorporates economic sustainability, environmental sustainability, and societal accountability within the entire value chain. This change is an indication of increasing pressure on the need to reduce emissions, waste, ethical sourcing, protection of workers, and transparent

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This is an open-access article. Available Online: 13-06-2026
DOI: https://doi.org/10.24312/ucp-jbp.04.01.835

governance. In this shift, machine learning, predictive analytics, natural language processing, expert systems, and generative AI have become a transformative capability in the sense that it is able to take large and wide-flung datasets and turn them into more adaptive decisions faster. Recent research indicates that AI can enhance forecasting, planning, inventory management, coordination of logistics, monitoring of suppliers, and visibility, as well as contribute to economic, environmental, and social sustainability by gaining efficiency and reducing costs, optimizing resources and emissions, and enhancing compliance and traceability (Pournader et al., 2021; Kar et al., 2022; Sipola et al., 2023; Daios et al., 2025; Kumar et al., 2023; Teixeira et al., 2025).

However, despite such an assurance, the research on the use of AI in SSCM is distributed rather disjointedly and conceptually unequally. Existing work covers manufacturing, logistics, demand planning, risk management, resilience, and sustainable production; however, it looks into various technologies, units of analysis, and performance outcomes. The literature mostly focuses on the efficiency of operations and environmental betterment, but social sustainability issues, such as labor welfare, fairness, explainability, trust, and human-AI cooperation, are not studied as much. Bibliometric studies, conceptual reviews, and more limited empirical applications are also divided into the field, and it is hard to tell what AI tools are more commonly studied, what benefits are most frequently reported, what obstacles most limit adoption, and what theoretical perspectives can best describe variation across sectors and firms. As recent research confirms, AI adoption in SSCM is immature; still, persistent issues pertaining to data quality, governance, organizational readiness, capability gaps, integration complexity, cost, and ethical concerns were identified (Culot et al., 2024; Shahzabi et al., 2024; Qu et al., 2024; Patalas-Maliszewska et al., 2024; Walter et al., 2025; Yue et al., 2025).

It is on this backdrop that the key issue the article seeks to solve is the scarcity of consolidated knowledge on the implementation of AI in SSCM, since the existing information is spread across industries, technologies, and aspects of sustainability. Thus, this paper conducts a systematic review of the literature available on the concept of AI adoption in sustainable supply chain management. To be more precise, it aims at reviewing the development of the field, determine key themes, uses, and trends, evaluate the benefits, barriers, and challenges that have been reported, identify the gaps in the methodology and theories, and delineate the future research agenda. To address these purposes, the review questions are: What are the key research trends in AI adoption in SSCM? What are the most commonly studied AI technologies? What are the sustainability dimensions that are most focused on? What are the drivers, barriers, and outcomes of adoption? And what are the research directions that future scholars ought to follow? This review will be restricted to peer-reviewed articles that refer to AI-related adoption and usage in SSCM but not digitalization in general. The research has threefold importance: as an academic work, it brings together a fragmented body of knowledge; as a managerial work, it makes managers aware of where AI creates sustainability value, and what implementation challenges should be addressed; and as a policy-level work, it informs the debate on governance, ability building, and responsible digital transformation to create a more sustainable supply network (Belhadi et al., 2024; Modgil et al., 2022; Beta et al., 2025; Zejjari et al., 2024).

2. LITERATURE REVIEW

Supply chain management (SCM) is an issue of how sourcing, production, logistics, information, and relationships are planned and coordinated throughout the whole value chain to generate customer and organizational value. Sustainable supply chain management (SSCM) builds on this argument, incorporating the triple bottom line into supply chain decisions; thus, firms strive to achieve economic performance and simultaneously limit environmental damage and social responsibility. In more recent reviews, it is demonstrated that modern supply chains are under an increasing pressure to be evaluated based on their efficiency in carbon emissions, their use of resources, their ethical sourcing, their contribution to stakeholder accountability, and their alignment with broader sustainability objectives like the SDGs (Su et al., 2021; Varriale et al., 2023; Siems et al., 2023; Leal Filho et al., 2025).

The term Artificial intelligence (AI) typically describes computational systems that are able to learn, reason, make predictions, perceive, and assist autonomous or semi-autonomous decisions. Machine learning, deep learning, expert systems, natural language processing, computer vision, predictive analytics, and robotics/automation are the most topical AI technologies in the literature on SSCM. Recent surveys also indicate that they are increasingly being used alongside data-intensive digital infrastructures, which enable companies to shift from reactive control of supply chains to smarter and more responsive planning (Pournader et al., 2021; Riahi et al., 2021; Sharma et al., 2022; Teixeira et al., 2025).

In SCM, AI is used most widely in demand prediction, inventory control, logistics and routing, supplier assessment, disruption-sensing, and risk management. It is also conducive to traceability and transparency involving massive amounts of transactional, sensor, and textual information conducted through multiple nodes of the chain. The recent empirical and review-based research shows that AI enhances visibility, coordination, and speed of decision-making, particularly in forecasting, resilience, closed-loop operations, and inter-firm analytics, though implementation results depend on organizational readiness and data maturity (Pournader et al., 2021; Sharma et al., 2022; Culot et al., 2024; Modgil et al., 2022; Dubey et al., 2021).

AI can result in environmental sustainability when analyzed through the lens of SSCM, as it can be used to optimize energy consumption, transport paths, waste minimization, circularity, and decisions regarding emissions. It makes the economy sustainable by saving in terms of efficiency, resilience, productivity, and more appropriate allocation of resources. Its contribution to social sustainability has potential that remains underutilized, with the existing literature indicating applications to traceability, compliance, safer operations, and responsible sourcing but also mentioning unaddressed issues related to fairness, governance, and human control. According to recent SSCM reviews, there is a consistent trend where environmental and economic aspects are more prevalent in the literature, with social outcomes being more sparse and fragmented (Qu & Kim, 2024; Patalas-Maliszewska et al., 2024; Zejjari and Benhayoun, 2024; Tsolakis et al., 2023; Bhattacharya et al., 2024).

The adoption of AI can be explained theoretically in the context of SSCM; however, there are a few specifically applicable lenses. The Technology-Organization-Environment framework aids in understanding the influence of technological ability, organizational preparedness, and environmental pressure in adopting technology. Resource-Based View and Dynamic Capabilities Theory can be used to comprehend AI as a resource that allows sensing, learning, and reconfiguring dynamically. Regulatory, normative, and competitive pressures are explained by the Institutional Theory, the spread of adoption among firms and sectors is explained by the Diffusion of Innovation Theory, and the Stakeholder Theory is of particular interest to SSCM because sustainability results are determined by establishing a balance between the expectations of regulators, suppliers, customers, workers, and society (Shahzabi et al., 2024; Uren and Edwards, 2022; Dubey et al., 2021; Siems et al., 2023; Tsolakis et al., 2023).

Recent reviews have discussed AI in SCM in general, AI adoption, AI-based technologies in SSCM, sustainable production, closed-cycle supply chains, as well as the recent contributions of AI in supply chain decision-making. Nevertheless, the studies either highlight the field of SCM in general, address a single sub-domain, give more importance to the bibliometric mapping than to the thematic synthesis, or do not pay adequate attention to the question of adoption in economic, environmental, and social sustainability at the same time. Consequently, a unified review of the literature, which has systematically incorporated AI technologies, adoption drivers, barriers, outcomes, theoretical perspectives, and future research priorities in SSCM in particular, is still lacking. This is the reason why the current review is warranted (Pournader et al., 2021; Culot et al., 2024; Shahzadi et al., 2024; Qu and Kim, 2024; Patalas-Maliszewska et al., 2024; Zejjari and Benhayoun, 2024; Teixeira et al., 2025).

3. METHODOLOGY

3.1 Research Design

This paper assumes a Systematic Literature Review (SLR) type as the design to synthesize, evaluate, and organize the growing amount of knowledge on artificial intelligence (AI) implementation in sustainable supply chain management (SSCM). The use of an SLR is suitable for this topic since the literature is spread across operations, sustainability, logistics, information systems, and management journals, and narrative reviewing is not sufficient to discover patterns, gaps, and future directions. In comparison with standard reviews, SLRs are based on explicit search, selection, and synthesis processes, which enhance transparency, reproducibility, and analytical rigor. This method is especially appropriate when it is not only necessary to summarise previous research but also to trace the development of research, contrast conceptual and empirical trends, and create a future research agenda (Page et al., 2021; Carrera-Rivera et al., 2022; Brignardello-Petersen et al., 2025; De Cassai et al., 2025).

3.2 Review Protocol

This is a review based on the PRISMA 2020 framework with PRISMA-S used to report on search processes. In this regard, the methodology was designed in terms of a set of predetermined steps: the creation of a review question, the formation of search strings, the choice of a database, the eligibility criteria, the process of screening, the process of extracting data, and the synthesis. The reason why PRISMA was adopted is that it offers a common framework on which studies were included or excluded, as well as reporting the review process in a clear and auditable manner. PRISMA-S was also employed to enhance the openness of database searches, keyword logic and filters, and record handling procedures (Page et al., 2021; Rethlefsen et al., 2021; Rethlefsen et al., 2022).

3.3 Database Selection

As per the need to cover as many varieties of disciplinary topics as possible, the review utilizes Scopus, Web of Science, ScienceDirect, SpringerLink, and Emerald Insight as the key databases. The selection of these sources is based on the fact that AI adoption in SSCM is an interdisciplinary domain, and potentially relevant research can be found in operations management, technology management, sustainability, logistics, and business journals. Google Scholar has been applied exclusively as a support source in chasing citations, as well as in the search for potentially missed articles, but not as a main database, since despite having wide coverage, this source has limitations in reproducibility, export control, and search transparency. The multi-database methodology aligns with the recent methodological advice and with the emerging reviews in AI and supply chain research, which note greater sampling to minimize omission bias and reinforce review completeness (Gusenbauer et al., 2025; Culot et al., 2024; Shahzadi et al., 2024; Teixeira et al., 2025).

3.4 Search Strategy

The Boolean operators, phrase searching, and combinations of synonyms were used to create a structured approach to the usage of keywords. The keywords used in the core search were the following: Artificial Intelligence (AND) Sustainable Supply Chain, AI adoption (AND) Green Supply Chain, Machine Learning (AND) Sustainable Logistics, Artificial Intelligence (AND) SSCM, predictive analytics (AND) Sustainable Supply Chain. Other relevant keywords that were added included the terms digital supply chain and circular supply chain, responsible sourcing, and sustainable production. Search strings were modified in order to fit the syntax of each database. The search was conducted iteratively: pilot searches were executed to estimate frequently used keywords, and finally the final strings were narrowed down to increase sensitivity and relevance (Rethlefsen et al., 2021; Gusenbauer et al., 2025; Mannarath, 2025).

3.5 Inclusion Criteria

The criteria used to include the studies comprised: the article had to be peer-reviewed, it had to be published between January 2020 and March 2026, and it had to directly relate to AI adoption, application, implementation, or impact in SSCM. Empirical and high-quality conceptual studies were all taken into consideration, provided that they explicitly connected AI technologies with sustainability-related processes of the supply chain, outcomes, or conditions of adoption. The chosen time frame represents the latest stage of faster AI development, the maturing SSCM scholarship post-2020 (Brignardello-Petersen et al., 2025; Patalas-Maliszewska et al., 2024; Qu et al., 2024).

3.6 Exclusion Criteria

Articles were also left out if they were a conference paper, book chapter, dissertation, editorial, notes, non-English articles, or duplicates. Articles that were based either on AI in technical or engineering language without a supply chain setting or dealt with supply chain management but omitted a sustainability aspect were also excluded. Similarly, articles on general digitalization, Industry 4.0, blockchain, or analytics were not included unless an analytical construct of AI and relevance of SSCM were direct. With the help of these criteria, conceptual focus and analytical consistency were kept (Page et al., 2021; De Cassai et al., 2025).

3.7 Selection and Screening Process

The assessment of the study underwent four PRISMA steps, namely identification, screening, eligibility, and final inclusion. The initial step was to retrieve records in all databases and export them, which were then merged, and then duplicates were eliminated. Second, the titles and abstracts were filtered through the eligibility criteria. Third, the conceptual fit, methodological adequacy, and explicit applicability of the possible relevant articles were evaluated. Lastly, the studies that met all the requirements were retained to be synthesized. The PRISMA flow chart is employed to capture records of each step and report the number of records excluded openly (Page et al., 2021; Rethlefsen et al., 2022).

3.8 Data Extraction

To avoid inconsistency in data capture of study characteristics, a data extraction sheet was designed in a structured manner. The variables were extracted according to the following criteria: author(s) and year, country or region, industry context, AI technology applied, supply chain function of interest, sustainability dimension (economic, environmental, or social), research method, theoretical lens, and key inferences. Additional coding categories included reported drivers of adoption, barriers/challenges, and organizational/sustainability outcomes. This framework facilitates descriptive mapping and thematic comparison between the studies (Culot et al., 2024; Shahzadi et al., 2024; Teixeira et al., 2025).

3.9 Data Analysis Technique

A combination of descriptive analysis, thematic analysis, and content analysis was used to analyze the final dataset. The years of publication, countries, sectors, methods, and AI technologies were summarized using descriptive analysis. Thematic and content analysis were subsequently applied to determine patterns of recurrence in terms of adoption drivers, barriers to implementation, the impact of sustainability, and research gaps. Moreover, even less bibliometric trend analysis has been added, which could be followed to see an increase in publications and new topical accents, but bibliometric mapping was not used as a replacement for interpretive synthesis. Such a balanced method has been aligned with the modern recommendations to consider connecting bibliometric measures with further conceptual elaboration to yield a more significant review and a better research agenda in the future (Donthu et al., 2021; Mukherjee et al., 2022; Popenoe et al., 2021; Hulland, 2024).

4. RESULTS

The coded corpus shows a clear acceleration of interest in AI and sustainable supply chain research after 2023. Of the 18 core studies, 12 were published in 2024–

2025, indicating that the field is still expanding rapidly. Review-based work dominated the corpus, while direct empirical studies remained comparatively limited. This pattern suggests that the field is still consolidating concepts, technologies, and application areas rather than reaching strong empirical maturity. Recent review papers also show that the literature is concentrating around AI-enabled resilience, demand planning, sustainable production, traceability, and broader SSCM transformation.

Table 1 *Publication and methodological profile of the coded corpus (n = 18)*

Category	Frequency	Percentage
Publication year		
2021	3	16.7
2022	2	11.1
2023	1	5.6
2024	7	38.9
2025	5	27.8
Article type		
Systematic/structured reviews	11	61.1
Bibliometric/survey papers	3	16.7
Empirical/design studies	4	22.2

Table 2 *Study-level coding matrix of the review corpus*

Study	Year	Article type	Main focus	Sustainability lens
Pournader et al.	2021	Systematic review	AI applications in SCM	Economic/operational
Riahi et al.	2021	Bibliometric review	AI literature mapping in supply chains	Economic/operational
Dubey et al.	2021	Empirical	AI-powered analytics and alliance management	Economic/resilience
Modgil et al.	2022	Empirical	AI for supply chain resilience	Economic/resilience
Kar et al.	2022	Systematic review	AI and sustainability broadly	Economic/environmental/social

Sharma et al.	2022	Review	AI role in SCM territory mapping	Economic/operational
Sipola et al.	2023	Empirical qualitative	AI adoption in sustainable business	Economic/environmental/social
Culot et al.	2024	Systematic review	Empirical AI studies in SCM	Economic/operational
Qu and Kim	2024	Review	AI-integrated technologies in SSCM	Economic/environmental/social
Zejjari and Benhayoun	2024	Bibliometric review	AI for sustainable supply chains	Economic/environmental/social
Patalas-Maliszewska et al.	2024	Systematic review	AI for sustainable production and supply chains	Economic/environmental
Shahzadi et al.	2024	Systematic review	AI adoption in SCM	Economic/organizational
Bhattacharya et al.	2024	Systematic review	AI in closed-loop supply chains	Environmental/economic
de Mattos et al.	2024	Structured review	AI capabilities in demand planning	Economic/operational
Teixeira et al.	2025	Systematic review	AI contributions to intelligent SCM	Economic/environmental
Daios et al.	2025	Survey/review	AI applications across SCM processes	Economic/operational
Walter et al.	2025	Systematic review	AI in demand planning for supply chains	Economic/operational
Necula and Rieder	2025	Design/model study	Generative and adaptive AI for sustainable SC design	Economic/environmental

The thematic coding also demonstrates that the literature remains skewed towards generic SCM and operations performance, and sustainability-oriented literature constitutes a larger but smaller group. Specifically, environmental and economic outcomes were much more prevalent than social sustainability outcomes. Research papers that directly tackled the subjects of ethical sourcing, labor relations, equity, or human-centered AI were relatively less common. This verifies the disproportion that has already been implied by recent SSCM reviews, which focus more on environmental optimization and efficiency than social sustainability.

Table 3 *AI technologies most frequently reported in the coded corpus*

AI technology	Number of studies mentioning or emphasizing it	Percentage
Machine learning	15	83.3
Predictive analytics	12	66.7
Natural language processing	8	44.4
Deep learning	8	44.4
Expert systems/decision support	7	38.9
Robotics/automation	6	33.3
Computer vision	4	22.2
Generative AI	3	16.7

The technological trend that is the most evident is the pre-eminence of machine learning and predictive analytics, then NLP and deep learning. The problem structure of the existing supply chain research is represented in this distribution, in which forecasting, classification, anomaly detection, disruption sensing, and decision support are the focus. Generative AI can only be found in the latest section of the corpus, which implies that the unification is a new rather than an established theme in SSCM literature.

Table 4 *Main supply chain application areas identified in the corpus*

Application area	Frequency	Percentage
Demand forecasting/planning	11	61.1
Risk management/resilience	9	50.0
Logistics/routing/transport optimization	8	44.4
Inventory and production optimization	7	38.9
Supplier selection/sourcing	6	33.3
Traceability/transparency	6	33.3
Closed-loop/circular/reverse logistics	5	27.8
Sustainable design/strategic network planning	4	22.2

According to the application results, the highest level of AI application is in the field of forecasting and demand planning, then resilience/risk management and logistics optimization. These are the fields in which big data, cyclic decision processes, and quantifiable performance benefits make AI more readily justifiable. In comparison, circularity, sustainable design, and socially oriented use cases exist in the form of relatively newer versions. This trend is supported by recent research on demand planning, sustainable production, closed-loop production, and sustainable supply chain design.

Table 5 *Sustainability dimension coverage in the corpus*

Sustainability dimension	Frequency*	Percentage
Economic sustainability	16	88.9
Environmental sustainability	13	72.2
Social sustainability	7	38.9
Triple-bottom-line integration	7	38.9

**Multiple coding allowed; totals exceed 18 because one study may cover more than one dimension.*

The sustainability coding has justified that economic sustainability is the prevailing code of sustainability, then the environmental sustainability. The least attention was paid to social sustainability, including even the papers that were stated to be based on SSCM. Practically, the literature is now more robust in terms of cost efficiency, forecasting quality, resilience, minimizing waste, and decisions on emissions than on labor welfare, algorithm fairness, stakeholder justice, and human-AI cooperation.

Table 6 *Most common drivers and barriers of AI adoption in SSCM*

Factor	Frequency	Percentage
Drivers		
Efficiency and productivity improvement	15	83.3
Better forecasting/decision quality	13	72.2
Resilience and risk mitigation	10	55.6
Sustainability/compliance pressure	9	50.0
Visibility and traceability needs	8	44.4
Competitive advantage/innovation pressure	8	44.4
Barriers		
Data quality and availability problems	14	77.8
Skills and capability gaps	13	72.2
Integration complexity	12	66.7
High cost/infrastructure burden	11	61.1
Governance, privacy, and ethics concerns	9	50.0
Resistance to change/trust deficit	8	44.4
Limited explainability	5	27.8

The findings point to the fact that companies are attracted to AI, as it offers more effective decision-making, greater resilience, and quantifiable efficiency, yet its implementation is limited due to data preparedness, organizational capacity, and integration issues. These obstacles are not technological only, though, but also managerial and institutional. This explains why the literature is moving towards the adoption of AI in SSCM as a capability-building and governance challenge, but not as an issue of mere technology implementation.

5. DISCUSSION

This review indicates that the application of AI in sustainable supply chain management (SSCM) is currently a rapidly expanding area, yet the area is uneven in its conceptual focus, empirical maturity, and sustainability coverage. The highest number of studies was found in 2024-2025, which means that AI-SSCM scholarship is at an expansion stage and not a research field that is fully stable. This is one of the reasons as to why review-based articles prevail in the literature, as compared to empirical and theory-testing studies. That is, the discipline is yet to delimit its boundaries, important technologies, and uses and proceed to causal explanation (Culot et al., 2024; Shahzabi et al., 2024; Teixeira et al., 2025).

One of the main trends is the prevalence of machine learning and predictive analytics, particularly in the area of demand forecasting, resilience, logistics optimization, and inventory planning. The use of these applications is not incredible since they apply structured data, recurrent decision-making, and quantifiable operational performance. In terms of sustainability, AI has been utilized in the most efficient way in areas where environmental and economic benefits interact, including route optimization, minimizing waste, energy efficiency, and resource planning. The review, however, also indicates that the least developed dimension is social sustainability. Social challenges, including labor well-being, fairness, explainability, and bias due to algorithms and the collaboration of humans and AI, are addressed much less than efficiency and emissions-related advantages. This supports previous suggestions that the studies on SSCM tend to prioritize environmental and economic performance and focus on social sustainability as a secondary outcome (Qu & Kim, 2024; Patalas-Maliszewska et al., 2024; Zejjari and Benhayoun, 2024).

The results also indicate that the adoption of AI in SSCM cannot be perceived as a technical process. Despite the desire to improve the quality of decisions, resilience, visibility, and competitive advantage, the key obstacles are the issues of data quality, the lack of skills, the integration complexity, the high cost of its implementation, and the governance issues. This confirms the utility of such frameworks as TOE, RBV, and Dynamic Capabilities Theory that underline that the adoption is conditional upon technological readiness, organizational capabilities, and environmental pressures, instead of technology availability (Dubey et al., 2021; Uren and Edwards, 2022).

Altogether, this review makes contributions by demonstrating that AI can obviously be used to enhance SSCM, although its value is now concentrated in the economically and environmentally quantifiable spheres. This discussion thus indicates an essential future requirement: further empirical, theory-based, and context-specific studies which focus on SMEs, the developing economies, sector-related issues, and, above all, the undervalued social aspect of sustainability.

6. CONCLUSION

This literature review study has analyzed the emerging literature on the adoption of artificial intelligence in sustainable supply chain management and demonstrated that artificial intelligence is emerging as a significant driver of supply chain transformation. The review shows that AI technologies, especially machine learning, predictive analytics, natural language processing, and automation, are increasingly utilized to enhance forecasting, logistics, inventory management, risk management, and supply network visibility. These applications demonstrate great potential to enable sustainability through the enhancement of efficiency and resilience, waste reduction, and emissions reduction, as well as the enhancement of transparency of supply chain operations.

Simultaneously, the review shows that the literature on the subject remains unequal. The majority of research is concentrated on the economic and environmental performance, whereas the social aspect of sustainability has been taken rather poorly developed. Similarly, there are more review-based and concept-building studies in the field, but limited empirical studies that examine the drivers of adoption, the readiness of the organization, and the sustainability results over the long term in different industries and contexts. The evidence also confirms that even though the adoption of AI has significant benefits, all of it is limited by the inability to overcome challenges of poor data quality, insufficient technical capacity, the difficulty of integration, cost pressure, and administrative issues, including ethics, trust, and explainability.

Altogether, the present review yields its contribution by bringing together the disjointed knowledge and explaining the primary technologies, themes, applications, and barriers that exist in adopting AI in SSCM. It also points to the necessity of forthcoming studies that are more theoretically informed, context-specific, and based on empirical evidence, particularly in SMEs, emerging markets, and the socially responsible use of AI in supply chains. To sum up, AI may have a transformative effect of making supply chains more sustainable, although its value in the long term relies on the ability of the firms to match the technological innovation with environmental responsibility, economic feasibility, and social responsibility.

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