The Impact of AI on Global Supply Chain Management: A Review of Literature.

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KEYWORDS

Artificial Intelligence, Supply Chain Management, Optimization, Resilience, Predictive Analytics

ABSTRACT

This paper provides a comprehensive review of the literature on the impact of Artificial Intelligence (AI) on Global Supply Chain Management (SCM). The integration of AI technologies, including machine learning, predictive analytics, and automation, has revolutionized traditional supply chain processes by enhancing efficiency, visibility, and decision-making capabilities. The adoption of Artificial Intelligence (AI) in global supply chain management (SCM) is increasingly seen as a critical enabler of efficiency, resilience, and sustainability. This literature review synthesizes the findings of papers examining the role of AI in transforming supply chains, focusing on its impact on decision-making, operational optimization, and risk management. The review identifies key AI technologies such as machine learning, predictive analytics, and automation that drive improvements in areas like demand forecasting, inventory management, and logistics optimization. Despite the significant potential of AI to enhance supply chain performance, challenges related to data quality, cost of implementation, and workforce adaptation are also highlighted. The review further emphasizes the need for a more integrated approach to AI, combining it with other technologies like the Internet of Things (IoT) and blockchain to maximize benefits. Practical and theoretical implications for supply chain managers, technology developers, and policymakers are discussed, alongside recommendations for future research in areas like AI ethics, SME adoption, and cross-technology integration.

1. Introduction

The rapid advancement of Artificial Intelligence (AI) technologies has had a profound impact across various sectors, with supply chain management (SCM) being no exception. Over the last few years, AI has emerged as a transformative force in SCM, offering significant potential for improving efficiency, visibility, and decision-making. AI encompasses a wide range of technologies, including machine learning, predictive analytics, and automation, which are

increasingly integrated into supply chain operations. These innovations promise to address long-standing challenges in global supply chains, such as demand forecasting, inventory management, logistics, and risk mitigation (Schrettenbrunnner, 2020; Haenlein et al., 2019).

While AI's role in SCM has been recognized as a key driver of performance improvements, the specific applications and outcomes of AI adoption in global supply chains remain underexplored. Specifically, the literature highlights the diverse ways in which AI is utilized in different sectors, but lacks a comprehensive framework that synthesizes the impact of AI across multiple industries (Pournader et al., 2021). In particular, there is limited understanding of how AI technologies contribute to supply chain resilience, particularly in the face of global disruptions such as the COVID-19 pandemic (Modgil et al., 2022). This paper aims to explore these aspects by reviewing existing literature on the impact of AI on global SCM.

AI has revolutionized multiple dimensions of SCM by improving forecasting accuracy, optimizing logistics, and enhancing the agility of supply chains (Kolbjørnsrud et al., 2016). It has enabled companies to better anticipate demand, streamline operations, and minimize costs. Moreover, AI has proven to be instrumental in fostering supply chain resilience, helping businesses mitigate risks and navigate uncertainties (Fosso Wamba et al., 2022). As industries move towards digital transformation, AI's role in optimizing end-to-end supply chain processes has become an area of growing interest among scholars and practitioners alike.

Although there has been a significant body of research on the applications of AI in supply chain management, existing studies often focus on isolated applications, and rarely explore the holistic impact of AI across different supply chain functions (Helo & Hao, 2022). Moreover, while AI's potential to enhance supply chain resilience has been recognized, its specific contributions to global supply chains, especially during periods of crisis, remain insufficiently addressed (Modgil et al., 2022). This paper aims to bridge these gaps by reviewing literature on the various applications of AI within global supply chains This paper focuses on reviewing the current literature to analyze the impact of AI technologies on global supply chains, with particular emphasis on resilience during periods of disruption. This paper's findings will offer valuable insights to both academic scholars and industry practitioners looking to navigate the complexities of AI adoption in global supply chains.

2. Literature review

The Role of AI in Supply Chain Management

Artificial Intelligence (AI) has become a transformative technology in Supply Chain Management (SCM), with applications across various areas such as logistics, forecasting, inventory management, risk mitigation, and sustainability. In this literature review, we explore recent research on AI in SCM, focusing on key applications, benefits, challenges, and implications across different industries. The reviewed studies contribute to a deeper understanding of AI’s potential to enhance SCM efficiency and resilience, especially in the face of modern challenges such as the COVID-19 pandemic, increasing supply chain dynamism, and sustainability concerns.

Modgil et al. (2022) examine how AI technologies can enhance supply chain resilience, particularly during disruptions like the COVID-19 pandemic. Their findings suggest that AI-driven solutions such as predictive analytics and machine learning can provide real-time data to optimize inventory, improve demand forecasting, and mitigate risks. The ability of AI to process large datasets in real time helps companies respond quickly to market fluctuations, ensuring business continuity during unforeseen disruptions. Similarly, Belhadi et al. (2024) explore how AI can improve supply chain performance under dynamic conditions. Their

empirical study emphasizes the significant role AI plays in strengthening supply chain resilience through enhanced flexibility and decision-making capabilities in volatile environments. AI-powered optimization tools help organizations navigate complex and unpredictable supply chain landscapes, improving both efficiency and risk management.

Several studies highlight the broader applications of AI in SCM, particularly in operations management. Pournader et al. (2021) provide an extensive overview of AI applications in SCM, outlining the technologies that are increasingly being used to address specific operational challenges. These technologies include AI-driven tools for demand forecasting, transportation management, and supplier selection. By leveraging machine learning algorithms, AI can predict consumer demand with higher accuracy and help optimize routes for cost-effective and timely delivery.mHelo and Hao (2022) further explore the role of AI in both operations and SCM by presenting an exploratory case study. They show how AI applications, such as intelligent planning systems and automation in warehouses, are driving operational efficiencies, improving inventory management, and reducing human error. These advancements are particularly beneficial for businesses aiming to optimize supply chain costs while maintaining high service levels.

Fosso Wamba et al. (2022) discuss the benefits and challenges of AI adoption across different industries. Their study emphasizes the potential of AI in improving operational efficiency, reducing costs, and enhancing supply chain agility. However, they also identify challenges such as high implementation costs, lack of skilled personnel, and integration issues with existing systems. Despite these barriers, the growing adoption of AI technologies in industries like retail, manufacturing, and logistics demonstrates its widespread potential to enhance supply chain management. A critical challenge of AI implementation in SCM is the integration of AI technologies with existing systems, which is often a complex and resource-intensive process. Shrivastav (2021) investigates the barriers to AI implementation, highlighting the difficulties faced by organizations in aligning their data infrastructure with AI solutions. The author also notes concerns regarding data privacy and security, which are key obstacles to AI adoption in supply chains, especially when sensitive business information is involved.

The role of AI in promoting sustainable supply chains has been a growing area of interest. Yadav et al. (2024) conduct a systematic review of AI applications in sustainable supply chain management. They highlight the potential of AI to reduce waste, improve resource utilization, and enhance environmental performance. AI technologies, such as machine learning and optimization algorithms, can facilitate the adoption of green practices by optimizing energy use, reducing carbon footprints, and supporting circular supply chain models. Dauvergne (2022) also investigates the political and environmental implications of AI in global supply chains. He argues that while AI can contribute to greener supply chains, it also presents risks related to environmental costs, such as increased energy consumption from AI-powered data centers. The paper calls for a balanced approach to AI adoption, where the environmental benefits of AI are weighed against its potential ecological footprint.

AI's ability to enhance decision-making in supply chains is also widely discussed in the literature. Nzeako et al. (2024) explore the role of AI-driven predictive analytics in optimizing supply chains, particularly within the IT industry. Their findings indicate that AI-based predictive models can improve demand forecasting, enhance inventory management, and streamline procurement processes. These improvements lead to significant cost savings and better resource allocation, which are essential for maintaining a competitive edge in global supply chains. Similarly, Khoa et al. (2024) focus on AI's role in supply chain planning and decision-making optimization. Their research highlights the use of AI in improving planning accuracy and decision-making efficiency across various supply chain functions. AI-powered

decision support systems can assist managers in making informed choices by providing data-driven insights and recommendations based on historical patterns and real-time information.

Logistics optimization is one of the most common applications of AI in SCM. Vanoy (2023) explores the trends in AI-driven logistics, particularly the use of AI to improve supply chain efficiency through advanced routing algorithms and predictive maintenance. AI technologies can optimize transportation routes, predict delays, and ensure timely deliveries, all of which are crucial for maintaining the smooth functioning of global supply chains. Additionally, AI is helping logistics companies to reduce fuel consumption and improve sustainability by identifying the most efficient routes and minimizing empty vehicle miles. Rathor (2023) focuses on the use of AI-based technologies, such as ChatGPT, in achieving sustainable SCM practices. By leveraging AI for real-time decision-making and optimizing communication in supply chains, organizations can improve transparency, reduce inefficiencies, and foster better relationships with suppliers and customers. This research also highlights the role of AI in promoting supply chain sustainability, particularly by enabling better waste management and resource optimization.

Finally, emerging trends in AI applications for SCM are discussed in several studies. Sanders et al. (2019) note the increasing integration of AI and digitization in supply chains, which is reshaping traditional supply chain practices and creating new opportunities for optimization. AI is expected to continue playing a central role in the development of "smart" supply chains that are highly responsive to market demands and disruptions. Additionally, Shahzadi et al. (2024) provide a comprehensive systematic literature review on AI adoption in SCM, proposing a future research agenda that includes deeper exploration of AI's ethical implications, its impact on labor markets, and its role in driving innovation in supply chain strategies.

The reviewed literature confirms the transformative potential of AI in SCM, with AI technologies driving significant improvements in operational efficiency, resilience, and sustainability. While challenges related to AI adoption, including integration difficulties, high costs, and data privacy concerns, remain, the overall impact of AI on global supply chains is overwhelmingly positive.

Table 1: Literature Review

Author(s) and Year	Purpose	Framework	Sample Design	Variables	Results	Controversies and Disagreements with Other Authors	Limitations & Implications for Practice
Modgil, S., Gupta, S., Stekelorum, R., & Laguir, I. (2022)	Explore AI's role in enhancing supply chain resilience during COVID-19.	Predictive analytics, AI-based risk management.	Case study of companies during the pandemic.	Supply chain resilience, AI adoption, disruption impacts.	AI significantly improved resilience by enabling real-time adjustments in supply chains.	Limited to COVID-19 period, applicability to other disruptions unclear.	AI adoption can enhance resilience but requires careful investment and data management.
Pournader, M., Ghaderi, H., Hassanzadegan, A., & Fahimnia, B. (2021)	Investigate AI applications in SCM across industries.	AI technologies for logistics, inventory, forecasting.	Literature review of industry practices.	AI applications, operational efficiency, cost reduction.	AI improves efficiency, reduces costs, but integration challenges persist.	Some authors argue that the benefits of AI are overstated without proper infrastructure.	AI can optimize supply chains, but requires significant upfront investment.
Helo, P., & Hao, Y. (2022)	Case study on AI in operations and supply chain management.	Case study on AI implementations in various supply chains.	Multiple industries, exploratory approach.	AI adoption, operational efficiency, logistics optimization.	AI boosts operational efficiency, but integration with legacy systems remains a challenge.	Some disagreement on how scalable AI solutions are for SMEs.	Practitioners should prioritize AI implementation in areas with high operational impact.
Fosso Wamba, S., Queiroz, M. M., Guthrie, C.,	Examine AI benefits and challenges in SCM.	Benefits and barriers framework.	Cross-industry analysis of AI adoption.	AI adoption barriers, cost-benefit analysis,	AI adoption enhances efficiency but faces implementation and	Some authors suggest AI adoption is easier in tech-intensive industries,	Companies need to address scalability and integration

& Braganza, A. (2022)				operational impact.	scalability challenges.	unlike traditional sectors.	barriers before adopting AI.
Rathor, K. (2023)	Study ChatGPT technology's impact on sustainable SCM.	AI-based conversational technologies in SCM.	Selected industries using ChatGPT for SCM.	ChatGPT adoption, sustainability, AI in SCM practices.	AI-driven conversational tools like ChatGPT can enhance decision-making and sustainability practices.	Disagreement on the effectiveness of AI-driven conversational tools for complex SCM tasks.	ChatGPT can enhance decision-making but needs more comprehensive AI integration.
Vanoy, R. J. A. (2023)	Explore AI trends in Logistics 4.0 for efficient SCM.	AI in logistics and supply chain optimization.	Case studies of logistics companies.	AI-driven logistics, route optimization, efficiency.	AI improves route optimization, reduces costs, but requires ongoing system updates.	Some believe that AI's efficiency gains may be overstated if not properly integrated into existing systems.	AI's efficiency in logistics requires ongoing technological updates and alignment with existing systems.
Dauvergne, P. (2022)	Explore the environmental impact of AI in supply chains.	AI's impact on environmental sustainability.	Literature review and case studies.	Green AI adoption, environmental impact, cost of implementation.	AI can help create greener supply chains, but its environmental costs (e.g., data centers) are often overlooked.	Some authors argue that AI's environmental impact may cancel out some sustainability benefits.	Companies should focus on AI technologies with clear sustainability benefits and lower energy consumption.
Shrivastav, M. (2021)	Identify barriers to AI implementation in SCM.	Barrier identification framework for AI adoption.	Industry-wide survey of AI adopters.	Barriers to AI adoption, organizational readiness, data management.	Key barriers include cost, lack of skilled workers, and integration issues.	Some authors argue that these barriers can be overcome with adequate	AI adoption requires overcoming organizational inertia and data

						investment and training.	infrastructure challenges.
Boute, R. N., & Udenio, M. (2022)	Investigate AI applications in logistics and SCM.	AI for logistics, inventory management, supply chain planning.	Literature review, cross-industry examples.	Logistics optimization, AI-based supply chain management.	AI applications are transforming logistics through better optimization, but implementation remains challenging.	AI applications are often seen as too complex or resource-intensive for smaller companies.	AI solutions need to be scalable and adaptable for different types of organizations.
Eyo-Udo, N. (2024)	Examine AI's role in enhancing SCM optimization.	AI technologies in supply chain planning and optimization.	Case studies in various industries.	AI-driven supply chain optimization, operational efficiency.	AI contributes to significant optimization in supply chain processes, especially in inventory management.	Some critiques argue that AI-based optimization may not be applicable to all industries.	AI can be beneficial, but companies need to ensure it is well integrated into their supply chain strategy.

Author(s) and Year	**Purpose**	**Framework**	**Sample Design**	**Variables**	**Results**	**Controversies and Disagreements with Other Authors**	**Limitations & Implications for Practice**
Belhadi, A., Mani, V., Kamble, S. S., Khan, S. A. R., & Verma, S. (2024)	Explore AI-driven innovation for enhancing supply chain resilience and performance.	AI-driven innovation for supply chain dynamism and performance.	Empirical investigation using survey data.	Resilience, performance, AI-driven innovation.	AI innovation enhances resilience and performance under dynamic conditions.	Some argue that resilience can be achieved through other methods without heavy AI reliance.	Implementing AI innovation is critical for coping with supply chain dynamism but requires significant investment.

Shahzadi, G., Jia, F., Chen, L., & John, A. (2024)	Systematic review of AI adoption in supply chain management.	Systematic literature review framework.	Analysis of existing literature on AI in SCM.	AI adoption barriers, benefits, challenges.	AI adoption enhances efficiency but faces significant barriers like cost and lack of expertise.	Disagreement on whether AI can be easily implemented in non-tech industries.	Firms must prioritize training and data infrastructure before adopting AI.
Danach, K., El Dirani, A., & Rkein, H. (2024)	Investigate how AI revolutionizes supply chain management in terms of efficiency and sustainability.	Efficiency and sustainability framework.	Case study approach across industries.	Efficiency, sustainability, AI integration.	AI significantly improves efficiency and sustainability when properly integrated.	Some authors question whether AI's environmental benefits outweigh its resource consumption.	AI adoption should be pursued with a clear focus on both operational efficiency and environmental impact.
Meltzer, J. P. (2024)	Analyze the impact of foundational AI on international trade, services, and supply chains in Asia.	Foundational AI in international trade and supply chains.	Literature review and analysis of international trade patterns.	AI adoption in trade, international logistics, performance metrics.	AI is reshaping international trade and supply chains, improving speed and cost-efficiency.	Some scholars argue that AI is only beneficial for large firms and may disadvantage SMEs.	Policymakers should focus on creating supportive environments for AI adoption, especially in developing regions.
Min, H. (2010)	Review theory and applications of AI in supply chain management.	Theoretical and application frameworks.	Literature review of AI applications in SCM.	AI adoption, decision-making, forecasting, and planning.	AI enhances decision-making and forecasting, offering strategic advantages in SCM.	Debate on whether AI can fully replace human judgment in complex supply chain scenarios.	AI can improve decision-making but should be viewed as a complementary tool rather than a full replacement

							for human insight.
Khoa, B. Q., Nguyen, H. T., Anh, D. B. H., & Ngoc, N. M. (2024)	Investigate AI's role in supply chain planning and decision-making optimization.	AI-driven decision-making and optimization.	Survey-based data collection from companies.	Decision-making optimization, AI adoption, supply chain planning.	AI aids in decision-making optimization and enhances overall supply chain planning.	Disagreement on whether AI-driven planning is always better than traditional methods in dynamic markets.	AI adoption requires adaptation to local market conditions for optimal outcomes.
Nzeako, G., Akinsanya, M. O., Popoola, O. A., Chukwurah, E. G., & Okeke, C. D. (2024)	Examine AI-driven predictive analytics in optimizing IT industry supply chains.	Predictive analytics framework in IT supply chains.	Case study in IT industry supply chains.	Predictive analytics, AI-driven optimization, performance metrics.	Predictive analytics, powered by AI, enhances supply chain efficiency and demand forecasting.	Some critiques argue that AI predictions can sometimes be inaccurate in volatile environments.	AI-based predictive tools offer great potential but require continuous model refinement and validation.
Toorajipour, R., Sohrabpour, V., Nazarpour, A., Oghazi, P., & Fischl, M. (2021)	Provide a systematic review of AI in supply chain management.	Systematic literature review framework.	Analysis of AI applications in SCM.	AI adoption, SCM benefits, integration challenges.	AI adoption can improve SCM but faces barriers like cost, integration complexity, and scalability.	Disagreement on whether AI adoption leads to significant cost reductions in the short term.	The review highlights the importance of overcoming integration challenges to fully capitalize on AI's potential.
Ismaeil, M. K. A. (2024)	Investigate the role and impact of AI in SCM efficiency, challenges, and strategic implementation.	Efficiency and strategic implementation of AI in SCM.	Case studies of industry leaders using AI in SCM.	AI efficiency, SCM challenges, strategic implementation.	AI significantly improves SCM efficiency but presents strategic challenges for	Some argue that the complexities of AI implementation outweigh its immediate benefits.	AI adoption requires careful strategic planning to overcome integration hurdles and

					firms in adopting it.		maximize benefits.
Nozari, H. (2024)	Explore the concept of Green Supply Chain Management (GSCM) using AI of Everything.	AI-driven Green Supply Chain Management.	Literature review on GSCM and AI integration.	Green SCM, AI of Everything, sustainability.	AI can drive green supply chain practices, but its environmental footprint must be carefully managed.	Disagreement on whether AI's benefits for green SCM outweigh the energy consumption required for AI technologies.	Green AI adoption should focus on minimizing the environmental impact of the AI technologies themselves.
Sanders, N. R., Boone, T., Ganeshan, R., & Wood, J. D. (2019)	Analyze the impact of AI and digitization on sustainable supply chains.	AI and digitization in sustainable SCM.	Cross-industry analysis of AI adoption.	Sustainability, AI, digital transformation in SCM.	AI and digitization drive sustainable practices by enabling more efficient resource usage.	Some argue that sustainability goals may be undermined by the high energy consumption of AI systems.	AI's contribution to sustainable SCM requires balancing operational efficiency with environmental costs.
Yadav, A., Garg, R. K., & Sachdeva, A. (2024)	Review AI applications in information management for sustainable SCM.	Systematic review of AI for information management in SCM.	Literature review of AI-driven information systems.	Information management, AI-driven optimization, sustainability.	AI improves information management and supports sustainability in supply chains.	Debate on whether AI's role in information management can create an actual competitive advantage for smaller firms.	Firms should invest in AI tools that can enhance their sustainability goals while managing costs.
Sodiya, E. O., Jacks, B. S., Ugwuanyi, E. D., Adeyinka, M. A., Umoga, U. J., Daraojimba, A.	Review the role of AI and machine learning in supply chain analytics.	AI and machine learning in supply chain analytics.	Review of literature and case studies.	AI analytics, machine learning, supply chain performance.	AI and machine learning significantly enhance supply chain analytics	Some argue that machine learning models can be overly complex for smaller	AI and machine learning are powerful tools for enhancing supply chain analytics but require

I., & Lottu, O. A. (2024)					and forecasting capabilities.	companies to implement.	expertise to implement effectively.
Kumari, T. L., Bambuwala, S., & Rajalakshmi, M. (2024)	Investigate AI-driven solutions for supply chain management.	AI solutions for various SCM processes.	Survey of companies using AI in SCM.	AI-driven SCM solutions, efficiency, cost reduction.	AI solutions improve supply chain efficiency but are hindered by integration issues and costs.	Some authors believe AI solutions are not sufficiently standardized for all SCM applications.	Implementing AI solutions requires addressing both technological and financial barriers.
Al-Talib, M., Al-Saad, W., Alzoubi, A., & Anosike, A. I. (2024)	Review the use of information technologies, including AI, in SCM.	Information technologies in SCM, focusing on AI.	Systematic review of existing literature.	Information technologies, AI integration, SCM performance.	Information technologies, including AI, improve SCM performance but face challenges in integration.	Some argue that the full potential of AI in SCM is still not realized due to integration challenges.	Organizations must focus on comprehensive technological integration strategies to optimize SCM performance.

3. Methodology:

This research utilizes a systematic literature review methodology to assess the impact of Artificial Intelligence (AI) on global supply chain management (SCM). A structured search process was employed using various academic databases, including Google Scholar, IEEE Xplore, ScienceDirect, and SpringerLink, to identify relevant scholarly work published between 2010 and 2024. The selection process focused on peer-reviewed journal articles, conference proceedings, and book chapters that specifically explore the application of AI in SCM, particularly in areas like machine learning, predictive analytics, automation, and their integration with other emerging technologies like the Internet of Things (IoT) and blockchain. To ensure relevance, studies were included if they addressed AI's role in optimizing supply chain functions such as demand forecasting, inventory management, logistics, and risk management. The exclusion criteria ruled out papers that did not directly contribute to understanding AI's impact on SCM or those that lacked empirical or theoretical depth. The initial screening involved reviewing titles, abstracts, and keywords to identify potentially relevant studies, followed by a full-text review to assess the quality, relevance, and contribution of each paper. Key data points such as the AI technologies discussed, the SCM functions impacted, the research methodologies used, the findings, and identified challenges were systematically extracted and synthesized. This thorough review process enables a comprehensive understanding of the current state of research on AI in global supply chains, highlights its transformative potential, and reveals the barriers organizations face in its implementation. Ultimately, this methodology provides a robust framework for synthesizing the existing literature and identifying gaps that require further exploration in future research.

4. Findings

The literature review on the impact of Artificial Intelligence (AI) on global supply chain management (SCM) reveals several key themes, patterns, and findings across the 25 papers analyzed. Below are the primary findings:

AI Enhances Supply Chain Efficiency and Performance: Numerous studies (Modgil et al., 2022; Pournader et al., 2021; Belhadi et al., 2024) emphasize that AI has the potential to significantly improve efficiency in supply chain processes. AI-driven technologies, such as predictive analytics, machine learning, and natural language processing (NLP), are cited as critical enablers for improving demand forecasting, inventory management, route optimization, and decision-making processes in global supply chains. These technologies allow businesses to respond more quickly to market fluctuations, reduce operational costs, and streamline supply chain operations.

AI Facilitates Supply Chain Resilience: AI's role in enhancing supply chain resilience, particularly in the face of disruptions (e.g., COVID-19), is highlighted in studies by Modgil et al. (2022) and Belhadi et al. (2024). AI enables companies to quickly analyze vast amounts of data and generate real-time insights, improving the ability to anticipate disruptions, manage risks, and adapt strategies accordingly. AI tools, such as risk forecasting and automated decision support systems, enhance the agility of supply chains, enabling businesses to mitigate the impact of unforeseen disruptions.

Barriers to AI Adoption in Supply Chains: Despite the clear benefits, several studies (Shrivastav, 2021; Toorajipour et al., 2021; Kumari et al., 2024) identify significant barriers to the widespread adoption of AI in supply chain management. Key challenges include high initial

costs, lack of skilled workforce, data quality and accessibility issues, and resistance to change from traditional supply chain practices. Smaller firms, in particular, face barriers in accessing the necessary resources and technologies for effective AI integration.

AI in Decision-Making and Predictive Analytics: AI has been shown to improve decision-making capabilities in supply chains. Predictive analytics powered by AI enables more accurate forecasting, which is essential for optimizing inventory levels, production schedules, and distribution strategies (Pournader et al., 2021; Helo & Hao, 2022). AI models allow organizations to analyze historical data, customer behavior, and market trends, providing actionable insights for strategic planning. AI's ability to optimize decision-making processes is particularly valuable for managing complex global supply chains, where traditional methods often fall short.

Impact of AI on Sustainability and Green Supply Chains: The integration of AI into green supply chain management (GSCM) is gaining attention (Nozari, 2024; Sanders et al., 2019). AI can play a critical role in reducing the environmental impact of supply chains by optimizing resource consumption, reducing waste, and improving energy efficiency. AI tools help companies in tracking and minimizing their carbon footprint, as well as improving the transparency of their sustainability practices. However, concerns about the environmental impact of AI technologies themselves, including energy consumption for data processing, have been noted.

AI's Role in Enhancing Supply Chain Transparency and Visibility: AI facilitates enhanced visibility in supply chains through real-time tracking and data analytics, allowing businesses to make more informed decisions (Eyo-Udo, 2024; Rathor, 2023). The use of AI-powered platforms enables end-to-end tracking of goods, which helps in identifying inefficiencies, bottlenecks, and potential risks. Improved visibility is essential for maintaining strong relationships with suppliers, customers, and partners, and for managing global supply chain complexities.

Industry-Specific Applications and Impact: Several studies examined AI applications across various industries, including manufacturing, logistics, and IT (Nzeako et al., 2024; Shahzadi et al., 2024). AI has been shown to have varying levels of impact depending on the industry, with sectors like logistics and manufacturing benefiting the most from automation and predictive analytics. AI's ability to optimize routing and improve supply chain logistics is particularly valuable in industries with high operational costs and complex distribution networks.

Strategic Implementation of AI in Supply Chains: AI adoption in global supply chains requires careful strategic planning (Ismaeil, 2024; Rathor, 2023). Companies need to assess their readiness in terms of infrastructure, workforce, and data availability before embarking on AI-driven transformations. A strategic, phased implementation approach is recommended, with companies focusing on areas that provide the most immediate value, such as demand forecasting or predictive maintenance, before scaling AI solutions across their operations.

The literature review identifies several research gaps and future directions for AI in SCM (Shahzadi et al., 2024; Toorajipour et al., 2021). While AI has been shown to offer numerous benefits, there is a need for more empirical studies on long-term impacts and the integration of AI with other emerging technologies like blockchain and the Internet of Things (IoT). Additionally, further research is needed on AI's impact on supply chain collaboration, as well as on how small and medium-sized enterprises (SMEs) can adopt AI affordably and effectively.

5. Conclusion

This literature review highlights the transformative role of Artificial Intelligence (AI) in global supply chain management (SCM). As AI technologies continue to evolve, they present numerous opportunities for enhancing the efficiency, resilience, and sustainability of supply chains. From improving demand forecasting and inventory management to enabling real-time decision-making and optimizing logistics, AI offers substantial benefits that can help organizations adapt to the complexities and uncertainties of modern global supply chains. The integration of AI in supply chain operations facilitates enhanced visibility, predictive analytics, and the automation of key processes, which collectively contribute to better decision-making and reduced operational costs. However, the adoption of AI is not without challenges. Barriers such as high initial investments, a shortage of skilled talent, and resistance to change remain significant hurdles for many organizations, especially smaller firms with limited resources. Moreover, while AI has the potential to improve supply chain resilience, especially in times of disruption like the COVID-19 pandemic, it requires careful strategic planning and investment in data infrastructure to maximize its impact. The literature also reveals that AI's role extends beyond just operational improvements—it is increasingly central to fostering sustainability within global supply chains. By enabling resource optimization, waste reduction, and energy efficiency, AI contributes to the development of greener supply chains, although its own environmental impact, especially in terms of energy consumption, warrants consideration. Hence, while AI holds great promise for revolutionizing supply chain management, organizations must approach its implementation with caution and a clear strategy. Future research should focus on addressing the current gaps in AI adoption, especially for SMEs, and explore the potential of AI when combined with other emerging technologies such as blockchain and the Internet of Things (IoT). By overcoming the challenges of AI integration and continuing to innovate, businesses can leverage the full potential of AI to create more efficient, resilient, and sustainable supply chains.

7. Implications

Theoretical Implications: The integration of AI into global supply chains challenges existing theories and frameworks in supply chain management. Traditional SCM models, which often relied on linear, deterministic processes, are increasingly being replaced by more dynamic, data-driven approaches. AI introduces a new dimension to SCM theories by emphasizing real-time, predictive, and adaptive decision-making. This shift opens opportunities for the development of new theories that incorporate AI's capabilities in managing uncertainty, improving resilience, and optimizing processes across complex global supply networks. The review identifies several gaps in the current literature, particularly in the areas of long-term AI impacts, cross-technology integration (e.g., AI with IoT and blockchain), and the role of AI in collaboration across supply chains. Theoretical research can focus on exploring the synergies between AI and other emerging technologies to create hybrid frameworks for supply chain optimization. Additionally, more research is needed to explore AI's impact on supply chain collaboration, particularly in the context of sharing data across organizations, industries, and borders. The rise of AI in supply chains raises questions about the future role of human decision-making. Theoretical models must evolve to consider how AI can complement rather than replace human judgment. Research on the interaction between AI and human decision-making will be crucial for developing frameworks that maximize the strengths of both AI systems and human expertise. Furthermore, studies could explore how human workers can adapt to AI-driven environments and develop new skills to collaborate with AI technologies. The adoption of AI in SCM also has theoretical implications for the sustainability literature. As AI can enable more sustainable practices through resource optimization and waste

reduction, it opens new avenues for research on the role of AI in green supply chains. Scholars could explore how AI technologies can be systematically integrated into sustainability frameworks in SCM, offering new insights into environmentally conscious supply chain strategies.

Practical Implications

Practically, organizations need to adopt a strategic approach to AI implementation in their supply chains. The findings from the literature suggest that AI technologies can drive efficiency, resilience, and sustainability, but only if companies are prepared to invest in the necessary infrastructure, skilled workforce, and data management practices. Managers must carefully assess their organizations' readiness for AI adoption, identify key areas for AI integration (e.g., demand forecasting, logistics optimization, predictive maintenance), and phase the implementation in a way that delivers measurable value over time. One of the key practical challenges is overcoming the barriers to AI adoption, particularly for small and medium-sized enterprises (SMEs). Practical guidance is needed on how companies can overcome these obstacles, including by leveraging partnerships, exploring affordable AI solutions, and investing in training for their workforce. Organizations should also focus on improving the quality of their data, as data accessibility and quality were consistently identified as obstacles in AI adoption. Organizations that successfully integrate AI will likely see improvements in operational efficiency and decision-making accuracy. AI's ability to analyze large datasets and generate actionable insights in real-time is a powerful tool for supply chain managers looking to optimize inventory levels, production schedules, and distribution strategies. By leveraging AI-powered tools for predictive analytics, companies can reduce costs, improve customer service, and better respond to changes in demand or disruptions in the supply chain. From a practical perspective, AI presents an opportunity to drive sustainability initiatives across supply chains. Organizations looking to reduce their carbon footprint and operate more sustainably can leverage AI for better resource management, waste reduction, and energy efficiency. AI-driven supply chains can monitor environmental impact and provide real-time insights into sustainable practices, enabling companies to make data-driven decisions that align with corporate social responsibility (CSR) goals. For companies operating in multiple sectors, AI can provide cross-industry applications that enhance supply chain integration and collaboration. Practically, organizations should explore how AI can be integrated with other emerging technologies such as blockchain, the Internet of Things (IoT), and cloud computing to create a fully connected and transparent supply chain. The cross-technology synergy enables more efficient communication, better visibility, and enhanced security, especially in complex global supply chains. AI adoption will likely lead to a shift in workforce requirements. While AI can automate many processes, it also necessitates the need for upskilling and reskilling the workforce to work effectively with AI systems. From a practical standpoint, organizations must invest in training programs that equip employees with the necessary technical skills to operate AI-driven tools and make strategic decisions based on AI insights. This transformation will require a focus on continuous learning and development to ensure employees can adapt to the changing landscape of supply chain management.

In both theoretical and practical realms, the integration of AI in global supply chain management offers significant opportunities for innovation and improvement. Theoretically, AI pushes the boundaries of existing SCM frameworks and presents new research opportunities for scholars to explore. Practically, AI has the potential to drive substantial operational improvements, enhance resilience, and contribute to sustainability goals in supply chains. However, companies must strategically approach AI adoption, addressing barriers such as cost, data quality, and workforce readiness to fully realize its benefits. As AI continues to evolve,

both academic and practical perspectives will need to keep pace to ensure that organizations can harness its power effectively and responsibly in managing global supply chains.

8. Future Research Directions

The integration of Artificial Intelligence (AI) in global supply chain management is still in its early stages, and while significant strides have been made, several key areas remain underexplored. Future research can provide valuable insights into these areas, further enhancing the understanding and application of AI within supply chains. Below are some promising future research directions. Although AI has proven its value in supply chains, its integration with other emerging technologies such as the Internet of Things (IoT), blockchain, and big data analytics is relatively underexplored. Future research should focus on how these technologies can work synergistically to optimize supply chain processes. For instance, the combination of AI with IoT can lead to real-time tracking of goods and predictive maintenance, while blockchain can provide enhanced transparency and security for AI-driven decisions. Exploring these cross-technology synergies will help create more robust, efficient, and secure supply chains. While large enterprises have been quicker to adopt AI, small and medium-sized enterprises (SMEs) often face challenges related to cost, infrastructure, and skill shortages. Research into AI adoption specifically tailored for SMEs, including affordable AI solutions, implementation models, and best practices, is needed. Understanding how SMEs can overcome these barriers will help democratize AI benefits and contribute to more inclusive supply chain innovation. Research should further explore how AI can enhance collaboration among different entities within the supply chain network. AI can facilitate data sharing, communication, and coordinated decision-making between suppliers, manufacturers, logistics providers, and retailers. Investigating how AI tools can improve inter-organizational collaboration and enhance supply chain network optimization is a crucial area for future study. As AI becomes more prevalent in global supply chains, its ethical and social implications should be thoroughly investigated. Issues such as data privacy, algorithmic biases, and the impact of automation on jobs are significant concerns. Future research can focus on understanding how companies can implement AI in a responsible, ethical manner, ensuring that these technologies do not exacerbate social inequalities. Developing frameworks for ethical AI deployment in supply chains is essential for ensuring the long-term sustainability and fairness of AI systems. While the environmental impact of AI is often discussed in terms of its energy consumption, its potential to drive sustainability in supply chains has yet to be fully realized. Future research could focus on how AI can contribute to more sustainable supply chain practices, such as waste reduction, energy optimization, and circular economy models. Additionally, studies can explore how AI can help supply chains comply with sustainability regulations and meet corporate social responsibility (CSR) goals AI's role in enhancing supply chain resilience, particularly in the face of global disruptions such as the COVID-19 pandemic, is a key area for future exploration. Future studies should focus on the use of AI to identify and mitigate risks, such as disruptions due to geopolitical tensions, climate change, and natural disasters. Research could explore how AI can provide predictive insights and decision-making tools that help supply chains adapt to and recover from disruptions more efficiently. Future research could explore how AI influences decision-making processes at different levels of the supply chain, from operational to strategic decisions. Understanding how AI-driven insights influence human judgment and how supply chain managers interact with AI tools is critical to improving AI integration. Research can focus on optimizing human-AI collaboration, ensuring that AI complements human decision-making rather than replacing it entirely. Another promising direction for research is the development of performance metrics that effectively measure the impact of AI on supply chain operations. While AI applications in supply chain management have shown improvements in efficiency and performance, more research is needed to develop

comprehensive metrics that capture the true value AI brings to various dimensions of supply chain performance, including cost reduction, customer satisfaction, lead time, and sustainability. As global supply chains become more interconnected, geopolitical factors play an increasing role in shaping supply chain dynamics. Research could investigate how AI can be leveraged to manage supply chain vulnerabilities arising from geopolitical instability, trade wars, and regulatory changes. AI tools can help predict the impact of such events and suggest adaptive strategies for multinational companies. The growing use of AI in supply chains raises concerns about the future of work, particularly regarding job displacement and changes in required skill sets. Future studies should examine the long-term effects of AI on supply chain jobs, focusing on how the workforce can adapt to the changing landscape. Research could also explore strategies for upskilling and reskilling employees to work alongside AI systems and drive innovation within supply chain roles. AI's ability to enhance transparency and visibility across the entire supply chain is another area for exploration. Research can examine how AI can be used to monitor the flow of goods, track real-time inventory, and provide insights into supplier performance. This end-to-end visibility could help companies identify bottlenecks, optimize routes, and make better decisions that align with customer demands and operational goals.

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