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The Impact of Integration Artificial Intelligence into Supply Chain Management: A Scoping Review

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Abstract

Background: Artificial Intelligence is an implementation aimed at improving efficiency from various angles, particularly in terms of business competitiveness. Artificial Intelligence not only enhances operational efficiency and enables demand forecasting, but from other perspectives, it also has a positive impact on communication, organizational readiness, sustainability, collaboration, finance, transparency, and product quality. **Methodology:** This scoping review evaluates the effects of implementing Artificial Intelligence in supply chain management, providing insights into its viability and advantages. This study utilises two databases, Web of Science (WoS) and Scopus, to ascertain the characteristics of the published scientific literature on this subject and the growing topics associated with Artificial Intelligence in supply chain management. **Result:** Utilising Arksey and O'Malley's technique, the findings underscore the impact of Artificial Intelligence on improving organisational efficacy. This emphasises impact as a dominant subject. The study suggests that most of the studies aim to comprehend the impact of Artificial Intelligence on supply chain management. **Conclusion:** This study provides a comprehensive overview of how Artificial Intelligence is shaping the present and future of supply chain management. It offers essential insights for researchers, practitioners, and decision-makers engaged in this dynamic and rapidly evolving field.

Keyword: Artificial Intelligence, Adoption, Artificial Intelligence Technology, Supply Chain Management

Introduction

The incorporation of Artificial Intelligence technology into supply chain management has emerged as a revolutionary influence, altering organisational operations and reactions to market dynamics. Artificial Intelligence empowers supply chain managers to attain a holistic comprehension of system wide processes, resulting in enhanced decision making and

superior customer service. Since the early 2010, the proliferation of Artificial Intelligence applications has generated both hope and apprehension regarding their future effects on labour and corporate governance (Li, 2020).

While enterprises have commenced investments in Artificial Intelligence to improve comprehensive supply chain operations, scholarly research is only now starting to systematically investigate Artificial Intelligence function in supply chain management (Hartmann & Moeller, 2014). Companies are progressively embracing digital technologies to enhance supply chains, as demonstrated by global Artificial Intelligence adoption rates in manufacturing and supply chain operations. (Figure 1) (Statista, 2022). Research demonstrates that Artificial Intelligence improves organisational adaptability to demand variations, minimises waste, and promotes enhanced collaboration and customer happiness. There has been an increasing interest in utilising Artificial Intelligence to model and simulate intricate supply chain management systems, facilitating a more profound comprehension of system operations and enhancing decision-making (Chen et al. 2022).

Agent based computer techniques further elucidate component interactions within supply chain management, facilitating empirical performance analysis (Zamani et al. 2022). Moreover, the utilisation of Artificial Intelligence in Agile and Lean Supply Chain Management highlights its increasing significance in enhancing performance. Nonetheless, a considerable study gap persists, indicating the necessity for a cohesive taxonomy to assist researchers in examining the progression and prospective developments of Artificial Intelligence applications in supply chain management.

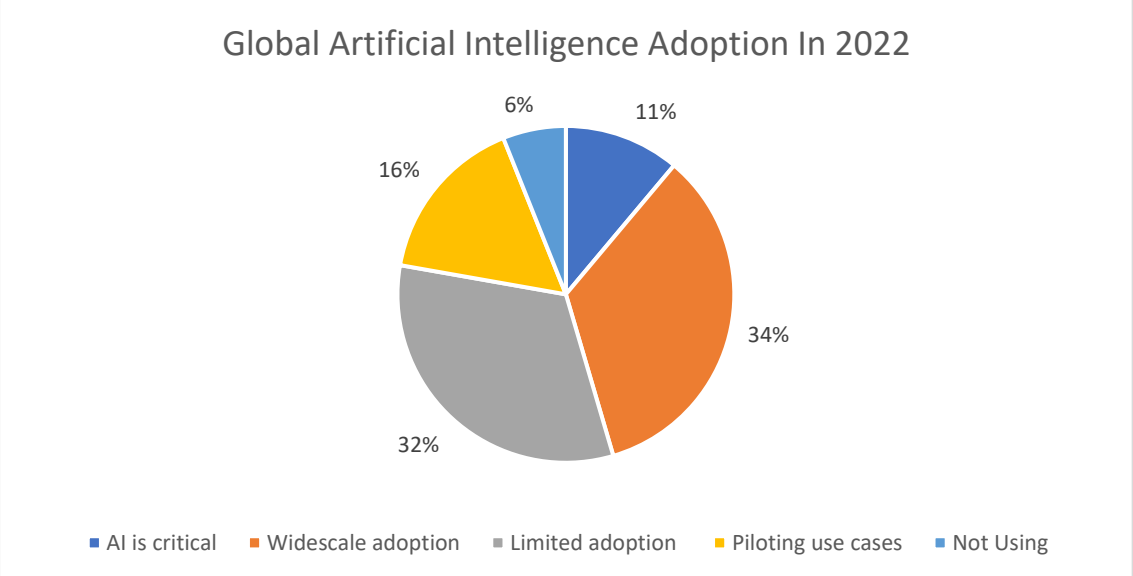

Figure 1: Percentage Global Artificial Intelligence Adoption 2022

Overview of Artificial Intelligence in Supply Chain Management

The application of Artificial Intelligence in supply chain management is gaining attention from organizations due to its proven ability to enhance operational efficiency and reduce risks. For example, Artificial Intelligence can improve supply chain efficiency while safeguarding against fraud and human error, highlighting the increasing importance of this technology in risk management (Lokanan & Maddhesia, 2022). Additionally, Artificial

Intelligence can optimize logistics through predictive analytics, which is essential for adapting to fluctuating market demand (Ekellem, 2023). This adaptability is critical in the context of global supply chains, where disruptions can arise from various sources, including geopolitical tensions and pandemics.

Big data analytics can boost supply chain resilience by fostering ambidexterity, balancing exploration and exploitation in supply chain operations (Xu, 2023). This capability is vital for organizations to respond effectively to disruptions, as demonstrated during the COVID-19 pandemic, when supply chains faced unprecedented challenges. Furthermore, the integration of big data analytics with Artificial Intelligence facilitates real-time monitoring and predictive capabilities, enabling firms to anticipate demand fluctuations and optimize inventory management (Patrick et al. 2022).

In conclusion, the integration of Artificial Intelligence in supply chain management is reshaping how organizations operate, enhancing efficiency, resilience, and decision-making capabilities. However, many scholars argue that Artificial Intelligence only increases efficiency in supply chain management, and for firms to navigate an increasingly complex global landscape, it is crucial to understand Artificial Intelligence impact on supply chain management components, such as communication, sustainability, and policy, which affect supply chain management performance.

Even though the implementation of Artificial Intelligence in supply chain management has garnered interest from researchers, further in-depth exploration of Artificial Intelligence specific impacts on supply chain management is still needed. This study will provide new possibilities for future research by analysing the sub-themes and primary themes of current studies on the impact of artificial intelligence on the supply chain and aims to contribute to the Artificial Intelligence literature by providing a comprehensive descriptive overview of the field and tracing the impact of related issues.

This work is structured as follows: Part 1 is the introduction and overview of Artificial Intelligence in supply chain management, followed by Part 2 that describes the scoping review procedure, and Part 3 discusses the outcomes. Part 4 will be the conclusion that includes the discussion of limitations, future research recommendations, implications, and conclusions.

Materials and Method

A scoping review is an optimal approach to delineate the extent of existing research, especially beneficial for assessing fresh information to identify areas warranting additional investigation. This methodology allows researchers to improve their research proposals by using previous findings and identifying uncharted areas in contemporary investigations (Peterson et al. 2016). A scoping review enables academics to understand the significance of a concept from several viewpoints, promoting more profound debates about the notion (Che Hassan & Osman 2024).

Unlike systematic literature reviews, which necessitate compliance with a rigid methodological framework, scoping studies exhibit flexibility and may employ diverse methodologies (Abd Aziz et al. 2020). This article adheres to the six-step process established by (Arksey and O'Malley 2005), as detailed in the subsequent section.

Step 1: Formulating the Research Question

This research primarily investigates the influence of Artificial Intelligence technologies on supply chain management. To enable a comprehensive literature assessment, the subsequent important questions are presented: What impact does Artificial Intelligence technology exert on supply chain management? What themes and sub-themes arise from the incorporation of Artificial Intelligence technology in supply chain management?

Step 2: Identifying Relevant Literature

To facilitate a thorough scoping assessment, appropriate search criteria were established to encompass relevant research. Two principal databases, Web of Science (WoS) and Scopus, were chosen for their comprehensive coverage of high-calibre publications in domains such as technology, management, and supply chain. A thematic search was performed across these databases, yielding a compilation of research on Artificial Intelligence application in operational and supply chain contexts, adhering to the predetermined themes and search terms (Table 1).

Step 3: Choosing Articles for Analysis.

This scoping study delineated explicit inclusion and exclusion criteria for the selection of publications appropriate for analysis. Initially, only papers pertaining to the domain of education were incorporated. Only peer-reviewed research publications were deemed eligible. thus, conference papers, book chapters, conference reviews, and books were eliminated. Finally, only English-language papers published from 2020 to 2024 were included (Table 2).

Step 4: Visualising the Data for Presentation.

Microsoft Excel was utilised to generate graphical representations of the data for thematic and comparative analysis. A detailed table was created to summarise findings and address research issues, detailing the author's name, publication year, study impact, key themes, and sub-themes.

Step 5: Compiling, Summarising, and Presenting the Data.

The analysis and discussion of the influence of Artificial Intelligence technology on supply chain management were structured by topic, with principal themes and sub-themes distinctly delineated. Each item was classified and analysed in accordance with these themes and sub-themes derived from the findings of the thematic and comparative analysis (refer to Table 3). Figures 2 and 3 present a summary of the attributes of the pertinent scientific literature.

Step 6: Analysis of the Findings.

The research results are analysed in connection with the aims of this work. This topic nascent status for organisations underscores its limitations and identifies prospective avenues for additional investigation, providing recommendations to further study on Artificial Intelligence influence in supply chain management. The concluding phase delineates the study's findings.

Table 1
The Search Strings

Database search string	
WOS	TS= “Artificial Intelligence" AND "supply chain management" AND " technology" AND " effect " AND “ adoption”
SCOPUS	TITLE-ABS-KEY(("Artificial Intelligence") AND (" supply chain management ") AND (" technology") AND ("effect ") AND ("adoption"))

Table 2
The Inclusion And Exclusion Criteria

Criterion	Eligibility	Exclusion
literature type	research articles	book series, book, chapter in book
Language	English	non-English
Timeline	2020-2024	<2020
Subject area	Business, Management and Accounting, Social Sciences, Economics, Econometrics and Finance	Computer Science, Decision Sciences, Engineering, Psychology, Energy, Medicine

Finding

A total of 259 papers were initially discovered from the database search for inclusion in this scoping review. After applying the inclusion criteria namely, empirical research, publications from 2020 to 2024, and studies centred on business, economics, and management within the social sciences 180 publications were deemed qualified. After the elimination of 23 duplicate papers, 58 distinct papers remained. After a thorough evaluation of their pertinence to the aims of this study, 40 papers were classified as irrelevant. In conclusion, only 18 papers employing quantitative methods were chosen due to their strong alignment with the research objectives for theme analysis, as depicted in Figure 2 (Moher et al., 2015).

The specified primary criteria for this scoping review directed the selection of papers. Initially, only journal papers were selected from accessible sources and databases, ignoring

other publishing categories. The WoS database comprises about 760 million references spanning multiple disciplines (Sánchez et al. 2017).This evaluation concentrated solely on studies utilising quantitative research methods, which are usually considered superior in educational research.

Third, only empirical research published in the English language were considered. English was selected as a universal intermediary language for researchers, while the inclination towards empirical research emerged due to its superior systematic rigour and transparency relative to proceedings (Hodgkinson et al., 2014).

Finally, only empirical articles published within the last five years were included, underscoring a focus on current research that exhibit both quality and relevance, particularly for scoping reviews (Kraus et al. 2020).

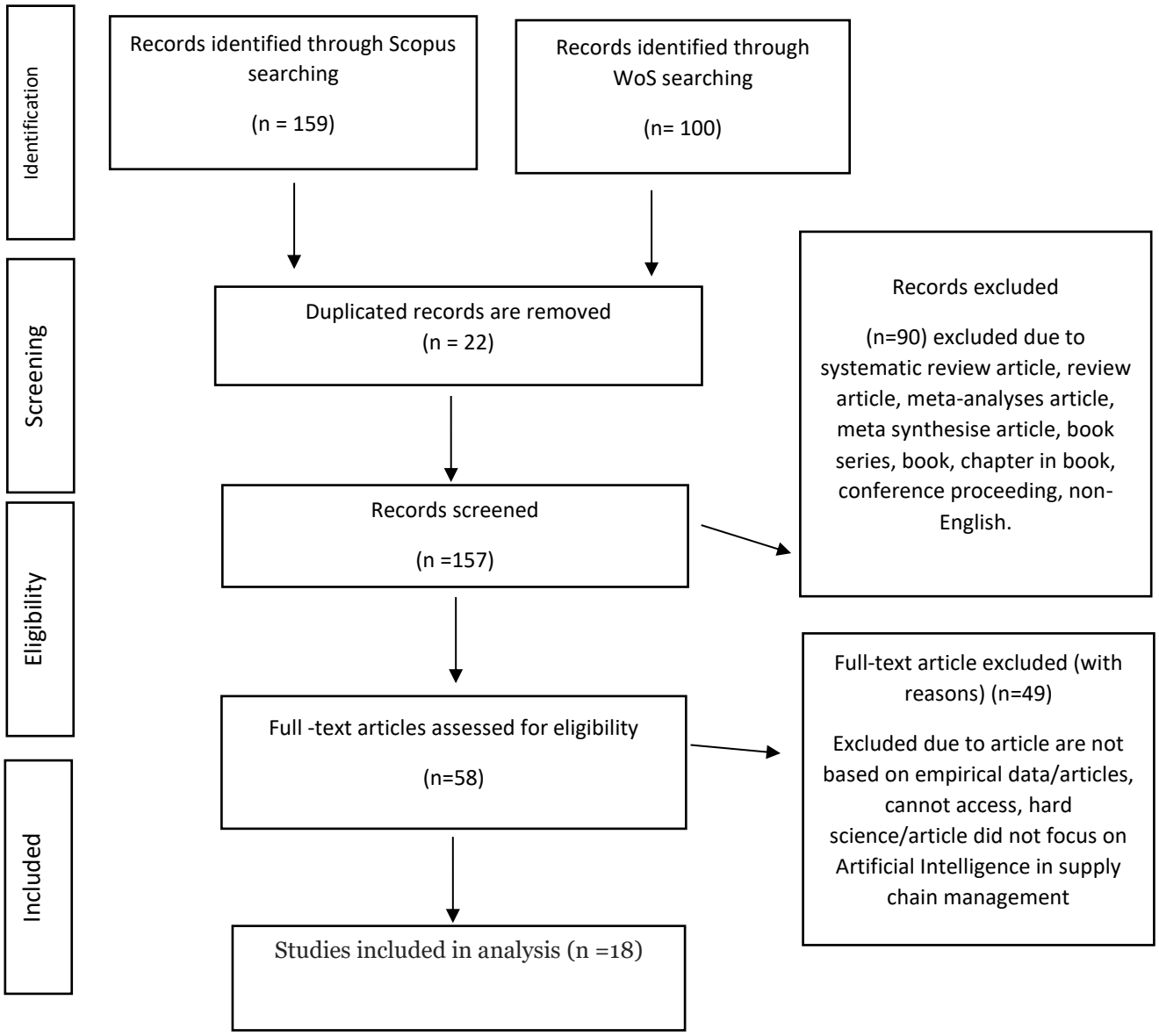

Figure 2: Flow diagram of research selection process using Preferred Reporting Items for Systematic Reviews (PRISMA)

Main Finding

The scoping review generate sub-theme and theme to answer the research question no two. There are seven major themes that are then divided into seventeen sub-themes. The first theme is Organization readiness (Resilience, Organization culture, Risk management, Collaboration and agility). To use Artificial Intelligence in supply chain management, organisations must be technologically, organisationally, and environmentally ready. Technological readiness requires advanced IT systems to manage large datasets and enable Artificial Intelligence technologies like machine learning and predictive analytics, which require high data quality and integration. Staff training, an adaptive culture, and ethical issues like algorithmic bias and data privacy must be addressed to build stakeholder confidence and organisational readiness. Organisations must also consider environmental preparation, which requires navigating complex legal and regulatory frameworks and adjusting Artificial Intelligence strategies to industry-specific factors like supply chain dynamics and market demands.

Second themes are Transparency (stakeholders, Accessibility and Cybersecurity) that describes through its integration with IoT and blockchain, Artificial Intelligence technology improves supply chain visibility, traceability, and decision-making at all levels. The Internet of Things allows real-time commodity monitoring, ensuring data continuity and proactive decision-making and compliance. Artificial Intelligence algorithms evaluate massive IoT-generated data, improve demand forecasts, and enable dynamic supply chain changes. Artificial Intelligence and blockchain ensure secure, unchangeable transaction records, encouraging transparency and ethics. This integration improves resource use, waste reduction, and sustainability and ethics in supply chain management.

The third themes are Efficiency (Performance, Lead time and Real-time Data Analysis). Artificial Intelligence helps supply chain efficiency by improving demand forecasting, inventory management, and logistics optimisation. Artificial Intelligence algorithms examine massive datasets including sales, consumer trends, and social media insights to improve demand projections, production planning, and customer service. Artificial Intelligence optimises inventory control by automating replenishment and reducing inventories. Artificial Intelligence optimises transportation routes, fuel use, and costs by assessing traffic and weather. Warehouse Artificial Intelligence driven automation enhances scheduling, processing, and operational efficiency.

The fourth themes are Sustainability (Green Practice) Artificial Intelligence increasingly plays a vital role in enhancing sustainability in supply chain management (SCM). Through the application of Artificial Intelligence driven predictive analytics, organisations may maximise resource efficiency, minimise environmental impact, and improve overall operational effectiveness Artificial Intelligence increasingly plays a vital role in enhancing sustainability in supply chain management (SCM). Through the application of Artificial Intelligence driven predictive analytics, organisations may maximise resource efficiency, minimise environmental impact, and improve overall operational effectiveness. Machine learning systems, such as Random Forest, may accurately estimate emission factors. These data allow firms to pinpoint high-emission sectors and execute focused measures to reduce their carbon footprint.

The fifth are Quality Assurance (standard of operation) Automation and enhancement of quality control methods are altering supply chain management quality assurance with Artificial Intelligence. Artificial Intelligence driven solutions use machine learning to find errors and ensure product quality, reducing human error and improving consistency. Automation speeds up and improves supply chain inspections, enhancing efficiency and dependability. Artificial Intelligence enabled quality assurance improves product standards and supply chain efficiency.

The sixth themes are Financial (reduce cost) Artificial Intelligence technology is essential for optimising working capital in supply chain management by analysing data related to inventory levels, order volumes, and payment conditions. This enables organisations to augment cash flow, secure more advantageous terms with suppliers, and ultimately enhance financial liquidity Moreover, Artificial Intelligence optimises operational procedures and diminishes expenses, hence enhancing financial performance and reinforcing a company market competitiveness.

The Seventh themes are Communication (clarity) Artificial Intelligence is profoundly altering communication in supply chain management, especially in improving supplier relationship management. Artificial intelligence enhances customised supplier interaction using tools such as sentiment analysis and real-time insights, promoting collaboration and trust among supply chain stakeholders. This results in enhanced communication, fortifying relationships. Moreover, Artificial Intelligence optimises supplier assessment procedures and improves demand forecasting precision, facilitating effective communication and operational efficiency. These advances enhance supplier interactions and improve the overall efficiency and responsiveness of the supply chain.

The Eighth themes are Competitive advantage (innovative) Artificial Intelligence technology driven predictive analytics in demand forecasting markedly improves the precision of future demand predictions by examining past sales data, market trends, and external influences such as weather and events. The incorporation of ERP systems and supply chain management confers a competitive edge by optimising inventory levels, minimising holding costs, and accurately fulfilling client demand. Artificial Intelligence promotes supply chain efficiency and improves customer satisfaction by enabling firms to make data-driven decisions, anticipate consumer demands, and manage risks more efficiently, hence contributing to overall organisational performance. The table below illustrates the research description along with the mapping of themes and sub-topics.

Table 3
Data Charting Form

No	Author & Year	Finding	Sub-themes	Theme
1	(Li et. al., 2022)	Internal capabilities and resources necessary for successful AI implementation. This includes aspects like technical readiness and security measures. Logistics firms should invest in big data technologies and strengthen supply chain integration to improve their resilience and disaster preparedness. Such investments not only enhance a firm ability to withstand and recover from disruptions but also enable them to maintain strong performance during crises, positioning them more effectively in challenging situations.	Resilience	Organization Readiness
2	(Hangl et. al., 2022)	The integration of AI in supply chain management offers significant potential to enhance productivity and efficiency through improved collaboration between humans and robots AI-driven robots can work alongside humans in warehousing and manufacturing environments, improving efficiency by taking on labour-intensive tasks helps identify trends, forecast demand, and prevent potential bottlenecks before they happen while humans handle more nuanced decisions that require creativity and critical thinking.	Real-Time Data Analysis	Efficiency
3	(Albaaji & Chandra 2024)	AI technology fosters a transparent food supply chain by enabling better tracking of agricultural products from farm to table, which is crucial for ensuring food safety and compliance with environmental and ethical standards. The integration of technologies like blockchain enhances data management, providing stakeholders with real-time, accurate information to support informed decision-making, ultimately improving both productivity and sustainability.	Accessibility	Transparency
s	(Sigh et al 2023)	Leveraging new technologies or processes to gain an edge, competitive pressure can drive organizations to adopt advanced technologies like AI. This theme reflects the importance of staying competitive in the market and how it influences decision-making in the food supply chain	Innovative	Competitive Advantage
5	(Dora et al. 2021)	The importance of artificial intelligence in enhancing supply chain resilience lies in its predictive analytics capabilities, which can identify potential disruptions and their impacts, allowing supply chains to adapt and recover more effectively. This insight is crucial in an era of increasing risks, including	Collaboration	Organization Readiness

		economic crises and natural disasters. Furthermore, collaboration among supply chain partners are key drivers of resilience, enabling them to navigate uncertainties with greater effectiveness		
6	(Sadeghi et al. 2024)	Artificial intelligence (AI) plays a crucial role in improving decision-making processes within supply chains by enhancing transparency and providing clear insights into AI-driven recommendations. This transparency enables decision-makers to respond more effectively and swiftly, particularly during cyberattacks. Consequently, AI strengthens an organization's ability to withstand and recover from cyber incidents, leading to more resilient and agile supply chain operations.	Cybersecurity	Transparency
7	(Cannavale et al. 2020)	AI facilitates improved communication and information sharing between buyers and suppliers, reducing information asymmetry by providing access to critical supplier details such as pricing, stock availability, and delivery status. This enhanced transparency not only improves decision-making processes but also strengthens knowledge transfer and acquisition. As a result, AI contributes to superior performance levels and fosters innovation within supply chain operations.	Clarity	Communication
8	(Chod et al. 2020)	Artificial intelligence can reduce the cost of debt financing for high-quality firms, improving their financial stability and operational efficiency. This reduction in financing costs enables these firms to allocate resources more effectively, further strengthening their overall performance and competitiveness	Cost Reduction	Financial
9	(Raja & Muthuswamy 2022).	Advanced technologies not only help businesses overcome supply chain challenges but also contribute to achieving sustainability goals, creating a vital balance between profitability and environmental responsibility. The adoption of these technologies enhances supply chain agility, enabling firms to respond more effectively to unpredictable global disruptions. Furthermore, by improving operational efficiency and competitiveness, businesses can thrive in today's volatile environment	Agility	Organization Readiness

10	(Wang et al. 2024)	Technology can significantly reduce transaction costs associated with logistics operations, addressing inefficiencies inherent in traditional logistics systems. In this context, a Fourth-Party Logistics (4PL) provider plays a crucial role by coordinating the activities of various Third-Party Logistics (3PL) providers that manage different aspects of the supply chain. By leveraging technology, a 4PL gains better control over the delivery process, which enhances service quality. This improved oversight is essential, as the absence of advanced technologies like blockchain can lead to quality losses, limiting the 4PL ability to fully manage and optimize the operations of its 3PL partners.	Standard Of Operation	Quality Assurance
11	(Rodríguez-Espíndola et al. 2020)	Implementing AI technology can drastically reduce lead times in delivering aid, which is especially critical in disaster scenarios where traditional supply chains may face disruptions. Additionally, integrating technologies like blockchain significantly enhances transparency and traceability of resources, ensuring that aid reaches those in need more efficiently and effectively."	Lead Time	Efficiency
12	(Jain et al. 2021)	In the SME sector, there is a significant relationship between AI adoption and operational efficiency. Implementing AI helps small and medium enterprises (SMEs) overcome existing inefficiencies, enhancing their overall performance. Moreover, AI enables these firms to improve supply chain resilience, integration, and transparency, further contributing to their competitiveness and long-term sustainability.	Performance	Efficiency
13	(Babaei et al. 2023)	The application of AI technologies in supply chains enhances transparency, which is crucial across various industries. This increased transparency fosters trust among stakeholders and leads to improved decision-making processes, greater efficiency, and cost reductions in supply chain management	Stakeholders	Transparency
14	(Shayganmehr et al. 2024)	Managers can leverage AI to provide real-time training, simulation models, and workshops. For example, Managers in aid organizations can create learning environments that continuously equip employees with the necessary skills to manage these rapidly changing circumstances. Training and workshops during non-crisis times can prepare them to act swiftly and efficiently during disasters.	Organization Culture	Organization Readiness

15	(Xia et al. 2023))	AI can optimize transportation routes, reducing fuel consumption and greenhouse gas emissions., improved sharing capabilities can lead to reduced environmental impacts. The findings show that better sharing ability not only lowers battery-related costs but also decreases total travelling costs, contributing to overall sustainability, By analysing traffic patterns, weather conditions, and fuel consumption, AI can suggest the most efficient routes and transport methods.	Green Practice	Sustainability
16	(Chang et al. 2024)	AI and machine learning can analyse historical data, assess the financial health of suppliers, and predict potential risks in the supply chain. This enables businesses and financial institutions to make informed decisions about extending credit or financing terms.	Risk Management	Organization Readiness
17	(Chaudhari et al. 2024)	Innovative blockchain and IoT integrated architectural solutions address the highlighted barriers. This integration improves supply chain transparency, traceability, and efficiency, increasing sustainability and decreasing environmental impact. Technology also help organization for real-time data exchange and automated transactions, which can boost stakeholder collaboration	Real-Time Data Sharing	Efficiency

In this section will answer the research question “what the impact Artificial Intelligence technology to supply chain?”. Data indicates that the use of Artificial Intelligence technology into supply chain management markedly improves operational efficiency and resilience by utilising enhanced skills and resources. Effective execution necessitates that companies engage in big data technology and enhance supply chain integration, so equipping them for disruptions and augmenting performance during crises. Artificial intelligence enhances collaboration between humans and robots in logistics, streamlining labour intensive operations and allowing humans to concentrate on essential decision-making. Furthermore, Artificial Intelligence augments supply chain transparency, essential for food safety and regulatory compliance, by facilitating enhanced tracking from farm to table and incorporating blockchain technology for real-time data management. This transparency improves communication between buyers and sellers, diminishes information asymmetry, and facilitates decision-making processes. Moreover, Artificial Intelligence predictive analytics empower organisations to anticipate disturbances and react promptly, so enhancing their resilience to economic recessions and natural calamities. Organisations that implement these technologies not only secure a competitive edge but also fulfil sustainability goals by harmonising profitability with environmental stewardship. Furthermore, AI diminishes transaction expenses and lead times, especially in logistics and emergency situations, while facilitating information transfer and fostering innovation. By cultivating a culture of perpetual learning and immediate training, Artificial Intelligence enables supply chain managers to adeptly manage uncertainties, resulting in enhanced performance and enduring sustainability.

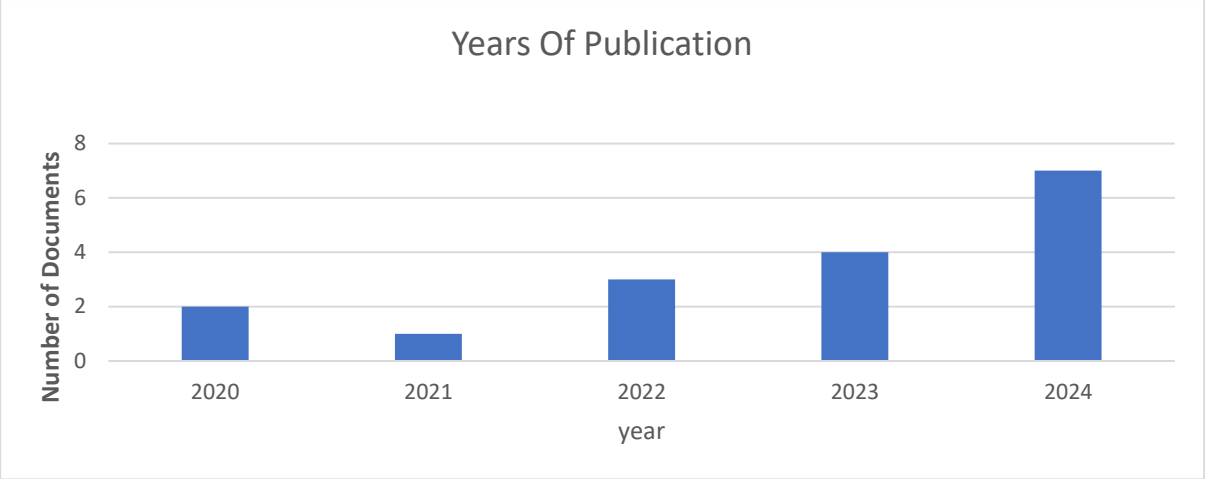

Figure 2: Number of articles published in Web of Science (WoS) and Scopus

Figure 2 shows the number of articles published in Web of Science (WoS) and Scopus per year during the period 2020 to 2024. In 2019 no article reported in this year. The number of published publications increased significantly between 2020 and 2024. In 2020, two article was published and in 2021 only one article was reported. However, there was a significant rise beginning in 2022, with three papers published in 2022, four in 2023, and the highest number in 2024 seven articles was reported.

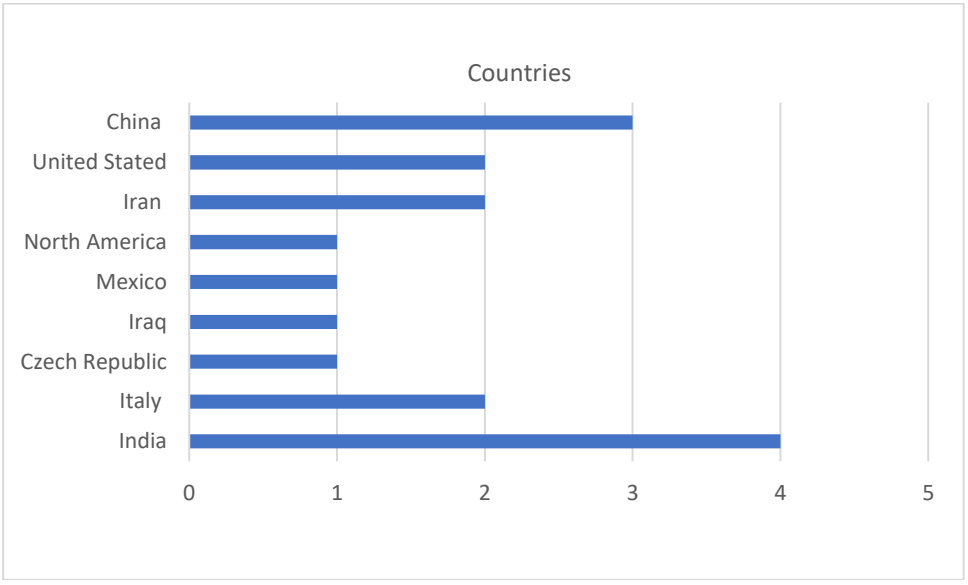

Figure 3: Number Of Research Based On Countries

Figure 3 shows the quantity of documents from the SCOPUS and WoS databases about AI in Supply Chain Management, classified by country of origin. The data indicates that research on this subject has been undertaken in nine countries. India ranks first in contributions, followed by China, the USA, Iran, Italy, North America, Mexico, Iraq, and the Czech Republic, with respective totals of 4, 3, 2, 2, 2, 1, 1, 1, and 1.

Discussion

In this section, we will have an in-depth discussion about the themes and sub-theme, based on the findings, we can conclude that Artificial Intelligence will have a substantial impact on the supply chain management

Resilience

Integrating Artificial Intelligence technologies, including machine learning and data analytics, significantly strengthens supply chain resilience by enabling real-time data collection and expert systems that mitigate risks during crises, such as the COVID-19 pandemic (Nayal et al. 2021). Studies highlight Artificial Intelligence role in expediting supply network recovery and enhancing operational continuity (Yamin, 2021). Furthermore, Artificial Intelligence driven demand forecasting and inventory management boost agility, allowing firms to manage demand fluctuations, reduce lead times, and lower costs (Krishnan, 2024). In volatile markets, combining Artificial Intelligence with IoT and blockchain enhances transparency and efficiency, supporting proactive responses to market changes. Additionally, Artificial Intelligence aids strategic decision-making by analysing large datasets, thereby identifying risks and opportunities to improve procurement transparency and resilience planning**.**

Organisational Culture

Artificial Intelligence profoundly impacts organisational culture, especially in human resource management (HRM), as organisations modify policies, strategies, and skill development to facilitate Artificial Intelligence integration, as detailed in the Artificial Intelligence Capability Framework (ACF) (Dyah et al. 2023). This cultural transformation, vital for aligning the workforce with technological advancements, improves flexibility and resilience amid disruptions, such as the COVID-19 pandemic (Gupta et al. 2024). A collaborative and knowledge sharing culture is essential for the implementation of Artificial Intelligence in supply chain management. Moreover, Artificial Intelligence cultivates a data driven decision making framework that enhances organisational openness and accountability by facilitating insights from extensive data analysis, hence strengthening a culture of evidence based practice (Chen, 2024). This transition not only improves operational efficiency but also equips employees with data-driven tools, hence enhancing job happiness and engagement.

Risk Management

Artificial Intelligence substantially improves risk management through real time data analysis and predictive functionalities, allowing organisations to foresee future disruptions and react proactively. Organisations can utilise Artificial Intelligence algorithms to analyse historical data for predicting demand changes, optimising inventories, and streamlining logistics, hence mitigating the effects of unforeseen events (Ellaturu, 2024). The capacity for prediction is essential for maintaining supply chain continuity in industries susceptible to market volatility, including agriculture and pharmaceuticals. Moreover, Artificial Intelligence systems enhance communication and collaboration among supply chain parties, facilitating efficient risk management.

Collaboration

Artificial Intelligence technologies, including machine learning and predictive analytics, are revolutionising logistical and operational procedures in supply chains. Through

the activation of advanced data analysis, Artificial Intelligence enhances logistics by improving communication and coordination among supply chain partners, hence augmenting operational performance via superior demand forecasting and strategic modifications (Siagia et al. 2021). The real time sharing and analysis of data via Artificial Intelligence enhances stakeholder engagement, as Artificial Intelligence ability to handle large volumes of data produces insights that guide strategic decisions. (Jiang et al. 2023) emphasise the influence of digital technologies, particularly Artificial Intelligence, on management efficacy and cooperative advancement among supply chain participants, which is essential in intricate supply chains with varied stakeholders. Moreover, the function of Artificial Intelligence in information dissemination augments transparency and trust, which are essential for effective collaboration.

Agility

Artificial intelligence augments supply chain agility by enhancing responsiveness and operational efficiency. The integration of Artificial Intelligence with strategic human resource management enhances agility and resilience, demonstrating a direct correlation between Artificial Intelligence adoption and agility measures (Yamin, 2024). (Pereira 2024) underscores the significance of Artificial Intelligence in humanitarian supply chains, enhancing agility via improved demand forecasting and resource allocation. Artificial Intelligence driven forecasting models enhance inventory management and refine logistics, crucial for a responsive supply chain. Organisations employing Artificial Intelligence for demand forecasting can markedly decrease lead times and enhance inventory turnover, fostering agility. Furthermore, Artificial Intelligence examines vast datasets to detect inefficiencies, facilitating swifter reactions to market fluctuations.

Stakeholders

The use of Artificial Intelligence into supply chain management significantly advantages stakeholders by improving efficiency via optimised inventory management and demand forecasting. Artificial Intelligence driven forecasting models enhance demand precision, minimising surplus inventory and stockouts, which is critical in sectors with variable demand. This synchronisation with current market conditions enables stakeholders to adjust activities efficiently. Furthermore, Artificial Intelligence streamlines repetitive processes, allowing human resources to focus on strategic decision-making and innovation.

Accessibility

In context accessibility in supply chain management through process optimisation and improved decision-making capabilities. Artificial Intelligence applications in demand forecasting and inventory management allow organisations to rapidly adapt to market fluctuations, thereby improving operational efficiency and customer happiness. Artificial Intelligence capacity to analyse extensive datasets enhances visibility throughout the supply chain, enabling real-time modifications and augmenting overall responsiveness (Petriashvili, 2024). Moreover, Artificial Intelligence driven analytics may detect inefficiencies and propose enhancements, which is essential for organisations seeking to sustain competitive advantages in a swiftly changing market.

Cybersecurity

In cybersecurity, Artificial Intelligence improves threat detection and response within supply chains. As cyber threats increase in complexity, Artificial Intelligence technologies, especially machine learning, play a crucial role in automating the identification of anomalies and potential breaches. Artificial Intelligence facilitates organisations in proactively addressing vulnerabilities by analysing extensive data volumes to discern patterns suggestive of cyber risks (Rizvi, 2023). Moreover, incorporating Artificial Intelligence into cybersecurity frameworks enhances security standards, crucial for protecting sensitive supply chain data from threats such as ransomware and phishing.

Performance

By refining demand forecasts, optimising inventory management, and boosting logistics, artificial intelligence improves the performance of supply chain operations. Artificial intelligence-driven forecasting models allow for accurate demand estimates, which in turn optimise inventories and reduce operating expenses. As a result of its ability to analyse massive data sets, artificial intelligence enables rapid and informed decision making, which in turn increases responsiveness to changes in the market and to the requirements of customers (Zeng, 2023). Additionally, the uses of artificial intelligence in supply chain management reduce the risks associated with fraud and human mistake, which ultimately results in an increase in the overall integrity of the supply chain.

Lead Time

Through the analysis of vast amounts of data, Artificial Intelligence improves demand forecasting, which is a crucial component in the process of reducing lead times in supply chains. The ability to make proactive adjustments in inventory and production schedules is made possible by accurate demand estimates, which in turn reduces the amount of time that products are kept in the supply chain. Not only does this reduce the expenses associated with inventory, but it also increases customer satisfaction by ensuring that deliveries are made on time (Olubunmi et al. 2024). Further facilitating lead time reductions is the application of artificial intelligence optimisation techniques in the logistics industry. These techniques include route optimisation and automated scheduling, which promote efficient transportation of goods.

Real Time Data

The operational efficiency of a supply chain can be considerably improved through the monitoring and analysis of data in real time. The use of artificial intelligence helps to optimise inventory management by predicting fluctuations in demand and adjusting stock levels accordingly. This helps to minimise excess inventory and decrease expenses. Furthermore, artificial intelligence driven analytics enhance decision-making processes by providing organisations with actionable insights derived from real-time data. This enables organisations to make educated choices in a more expedient manner. Artificial Intelligence systems may evaluate historical and real-time data to detect possible interruptions and vulnerabilities in the supply chain, enabling organisations to execute mitigation methods prior to the escalation of difficulties.

Green Practice

The contribution of Artificial Intelligence to the advancement of sustainable supply chain strategies is substantial. Artificial intelligence technologies optimise resource distribution and reduce waste, resulting in more sustainable practices. Artificial Intelligence enhances logistics efficiency by optimising routes and minimising fuel use, aligning with the growing emphasis on sustainability in supply chain management (Rickardo & Gladson, 2023). Furthermore, Artificial Intelligence ability to assess environmental effects and consumer behaviour assists organisations in making sustainable decisions across their supply chains. Artificial Intelligence driven predictive analytics improve the precision of demand forecasts, allowing organisations to synchronise production and inventory with genuine market requirements, thus minimising waste and surplus inventory. This skill is particularly essential in industries such as food and agriculture, where waste reduction is imperative for sustainability.

Standard of Operation

The incorporation of Artificial Intelligence in supply chain management (SCM) has markedly improved operational benchmarks across several sectors. Artificial Intelligence is essential for quality assurance as it detects possible disruptions and inefficiencies, prompting management to implement corrective measures before problems intensify. This proactive strategy reduces risks and upholds quality standards across the supply chain (Muhammad et al. 2024). Artificial Intelligence may identify irregularities in production processes that could lead to quality failures, facilitating prompt interventions to maintain product standards.

Reduce Cost

Artificial Intelligence algorithms can analyse large datasets to accurately predict demand, hence minimising surplus inventory and lowering holding costs. Through the application of predictive analytics, organisations can synchronise production schedules with genuine market demand, thus circumventing costs associated with overproduction or stockouts (Nsisong Louis Eyo-Udo, 2024). Moreover, Artificial Intelligence applications in logistics, including route optimisation, can substantially lower transportation costs by determining the most efficient delivery routes, hence minimising fuel usage and labour expenditures. Advanced inventory management systems can automate stock replenishment through predictive analytics, enabling organisations to sustain appropriate inventory levels while avoiding superfluous expenses. This automation decreases labour expenses and mitigates human mistake, leading to enhanced reliability in supply chain processes.

Clarity

Artificial intelligence technologies, encompassing machine learning (ML) and natural language processing (NLP), to increase communication in supply chains by automating and optimising the flow of information. These tools facilitate the extraction of useful insights from unstructured data, such as customer feedback and industry trends, hence enhancing supply chain strategy. The ability of Artificial Intelligence to analyse sentiment and trends enables organisations to proactively address market changes and customer requirements, hence enhancing stakeholder involvement and satisfaction Moreover, Artificial Intelligence simplifies supply chain procedures, facilitating more effective communication. Artificial Intelligence driven solutions enable firms to optimise operations like inventory management, demand forecasting, and logistics coordination, resulting in enhanced visibility into supply

chain status and performance metrics essential for informed decision making (Modgil et al. 2021). Artificial Intelligence can forecast future disruptions and offer actionable insights, facilitating effective communication among stakeholders about risks and mitigation plans.

Innovation

Through the implementation of Artificial Intelligence and supply chain analytics, organizations can enhance their capacity to explore and innovate, thereby enabling them to respond more quickly to market fluctuations and customer demand. In a highly competitive market, where continuous innovation is required to maintain market position, flexibility is crucial. (Mehregan et al. 2023). Competitive advantage can be achieved through the development of new business models and operational frameworks, enabled by the synergy between artificial intelligence and supply chain analytics. The integration of Artificial Intelligence in Supply Chain Management profoundly influences an organisation, particularly in the attainment of strategic goals. Figure 4 presents a summary of this theme, derived from the extensive findings given.

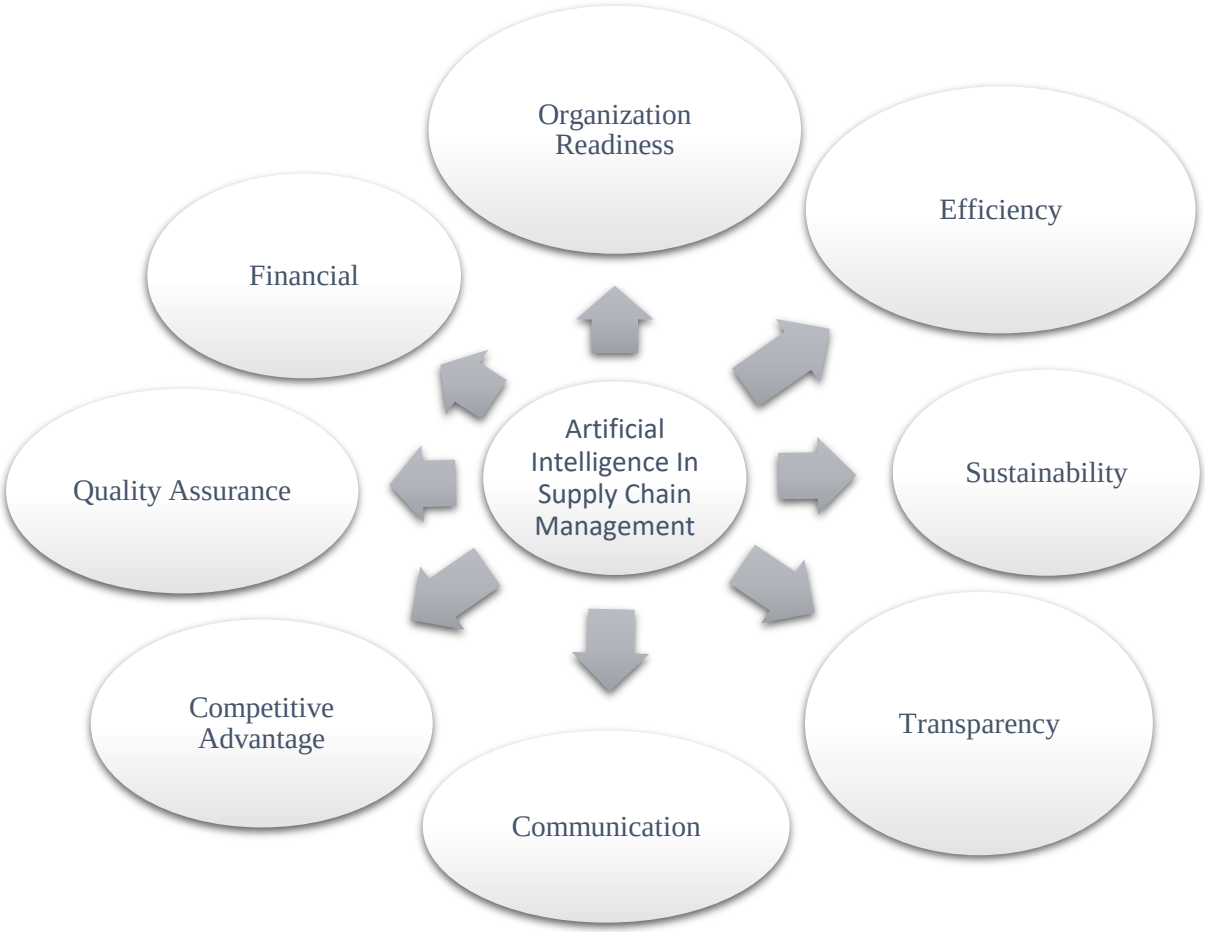

Figure 4: Framework Impact Artificial Intelligence In Supply Chain Management

Limitation and Recommendations

The main constraint of this study is that it only used two sources from the Scopus and WoS databases. Despite the inclusion of prominent publishers in these databases, the authors concede that the search process may have missed pertinent studies due to restricted access via the institutional portal. Subsequent research may investigate alternative databases, like

Wiley, ScienceDirect, and ProQuest, to juxtapose results. This emphasis initiates a broader discourse within academia, necessitating contemplation on the integration of supplementary databases to encompass a more comprehensive perspective on Artificial Intelligence research. It is crucial to emphasise that the inclusion of supplementary databases may enhance the quantity of pertinent articles.

The reviews of the current literature are carefully examined. This study primarily examines the implications associated with systematic reviews as discussed in the literature reviewed. This scenario encourages future researchers to utilise a systematic review methodology, enabling the extraction, integration, and thorough analysis of all available data, including both quantitative and qualitative aspects. Utilising this strategy may enhance and validate the results of this study. This rationale is relevant not only to the current area of inquiry but also across various disciplines, where the integration of methodological precision and contextual relevance necessitates that scholars carefully assess their research frameworks and aim for a comprehensive evaluation of available data.

Implications

The ability of an organisation to fulfil its objectives is no longer the only factor that determines its performance in today competitive environment; rather, the effectiveness of its supply chain management in meeting the requirements of its customers and making the most efficient use of its resources is becoming increasingly important. When conducting a thorough evaluation of the supply chain, the focus turns from the performance of individual companies to the interconnection of all of the organisations that are involved. This highlights the collaborative features that are the driving force behind overall success. It is necessary to take a nuanced managerial strategy in order to successfully integrate artificial intelligence into supply networks. This begins with doing a comprehensive analysis of existing procedures in order to find areas in which artificial intelligence can improve efficiency. To effectively capitalise on the promise of artificial intelligence, managers should adopt a staged approach that prioritises gradual deployment, places an emphasis on effective communication between departments, and places a strong emphasis on staff training and skill development. The adoption of artificial intelligence is supported by the establishment of a culture that places a high value on adaptation and continual improvement. This helps to facilitate smoother transitions and maximise benefits. In addition, politicians and decision makers play a significant role by establishing an atmosphere that is favourable to the incorporation of artificial intelligence. It is possible for them to create an environment that is conducive to the widespread and efficient use of artificial intelligence across supply chains by putting in place laws that are supportive, providing incentives for innovation, and investing in digital infrastructure systems.

Conclusion

Artificial Intelligence in Supply Chain Management (SCM) disrupts organisations worldwide. This scoping review highlights four primary themes Organization Readiness, Efficiency, Sustainability, and Transparency, Communication, and Competitive Advantage and seventeen sub-themes that show Artificial Intelligence considerable impact on SCM. For Artificial Intelligence adoption, organisations need technical infrastructure, workforce skills, leadership commitment, change management, and financial investment. Without these, they risk falling behind in the quickly changing digital landscape. Artificial Intelligence driven

process automation, demand forecasting, inventory optimisation, and resource allocation reduce costs, waste, and decision making, helping organisations optimise supply networks and respond to market demands. Through ethical sourcing, circular economy methods, carbon footprint reduction, and environmental impact mitigation, Artificial Intelligence aligns operations with global sustainability goals for ecological and economic benefits. Artificial Intelligence also improves transparency, communication, and competitive advantage by enabling real time tracking, data sharing, supplier collaboration, risk management, and customer experiences, strengthening stakeholder relationships, building trust, and giving a strategic edge in an interconnected economy. Artificial Intelligence has the potential to revolutionise SCM, but this analysis suggests further research on improving SMEs Artificial Intelligence readiness and adapting Artificial Intelligence solutions to varied industries and supply chains. Responsible Artificial Intelligence implementation requires data privacy and security ethics. As Artificial Intelligence shapes the future of SCM, academics and practitioners must be proactive. This analysis provides a solid foundation for comprehending Artificial Intelligence multidimensional influence and setting the way for further research in this quickly changing subject.

From the contribution to existing knowledge, provides a systematic framework that enhances theoretical comprehension beyond disjointed discoveries. The research advances ideas of technology adoption, innovation dissemination, and sustainable supply chains by incorporating technological, organisational, and environmental variables. Practical findings underscore the necessity for investment in artificial intelligence infrastructure, staff enhancement, and leadership dedication. Artificial intelligence driven solutions optimise processes, minimise expenses, and bolster sustainability objectives while improving real time data sharing and competitive strategies. This research assists practitioners in utilising Artificial Intelligence to enhance creativity and resilience in response to global supply chain concerns. It also exposes deficiencies, including industry specific artificial intelligence models, ethical deployment of artificial intelligence, and adoption by small and medium enterprises, establishing a basis for future research and providing significant consequences for organisations, governments, and academics.

Conflict of Interest

The Author affirms the absence of any conflict of interest.

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