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## Systematic review of artificial intelligence impact on supply chain management of small scale business

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**Abstract:** This in-depth research investigates how AI has changed supply chain management for small businesses, specifically examining how AI has improved the effectiveness of operations, decision-making, and cost-effectiveness. Limitations in resources, a lack of technical expertise, and problems with data accessibility are preventing small-scale supply chain management from using AI despite its disruptive potential. To determine how artificial intelligence might help small businesses gain an edge in the market, this study reviews existing literature and case studies to find relevant AI applications. These applications include demand forecasting, inventory management, and logistics optimization. According to studies, insights provided by AI improve inventory management, supplier relationship control, and quick adaptation to changes in the market. However, many problems prevent the widespread application of AI in small-scale supply chain management. These include high implementation costs, a lack of expertise, and privacy concerns.

This research determined to answer the question, "What are the primary AI applications in SCM for small businesses?" and "How does AI impact operational efficiency, cost savings, and decision-making?" by investigating relevant AI applications. The approach used in the present study is a systematic review. Researchers checked references from reputable internet sources including Research Gate, Google Scholar, MDPI, Science Direct, IEEE Xplore, and Academia.edu. Fifteen papers (N = fifteen) published between 2020 and 2024 were included in the research investigation. This study's findings highlight the need for affordable AI solutions tailored to SMBs and suggest future research directions, including the development of flexible artificial intelligence instruments and collaborative frameworks to ease their adoption. A comprehensive analysis of AI's potential to improve SME supply chain management is provided by this review, which also highlights critical success factors for AI deployment.

**Keywords-** artificial intelligence, supply chain management, small-scale business, small and medium-sized enterprises, AI adoption, demand forecasting, and inventory management.

### I. INTRODUCTION

Supply chain management is essential to small businesses' ability to compete in the ever-changing business climate of today (Castro, Jessie, 2022). Effective oversight of the supply chain is essential for small businesses, which often operate with limited resources and thin profit margins, to ensure operational effectiveness, save expenses, and raise customer satisfaction. However, small businesses have unique challenges when it comes to enhancing their supply chains, and they may lack the resources to use the advanced technology that larger firms employ to improve their operations. Artificial intelligence has become a powerful tool that can revolutionize supply chain management in many industries by offering solutions that improve automation, forecasting, and decision-making (Dwivedi, Yogesh K., et al. 2021). This comprehensive research examines how AI may impact supply chain management in small businesses, examining how AI

solutions might address the unique needs and challenges of these organizations. Even while AI has shown several benefits for large businesses in supply chain management, including the use of predictive analytics, automated inventory control, and logistics improvement, the particular needs of small businesses need a focused analysis (Toorajipour, Reza, et al. 2021). Small businesses, as opposed to large corporations, often operate with limited resources, have little exposure to technical expertise, and struggle to retain the large volumes of data required for AI-driven insights. However, by enabling more precise demand forecasting, increasing inventory levels, lowering operational costs, and bolstering supply chain resilience, AI presents opportunities for these companies (Madanchian, M., & Taherdoost, H. 2024).

This paper intends to summarize existing research on how AI affects supply chain management in small businesses, outline the useful applications and limitations of AI in these situations, and

provide insights into the immediate benefits and long-term problems of integrating AI. By looking at case studies, data from empirical research, and recent advancements in AI-enabled supply chain management technologies, this paper seeks to give a comprehensive analysis of AI's influence on small-scale supply chain management. It also makes recommendations for future research areas. The possibility of AI to level the playing field for small businesses is highlighted in this paper, along with the challenges that need to be overcome in order to successfully integrate AI into their supply-chain operations.

This comprehensive literature study intended to examine the following specific research questions:

1. What are the primary AI applications in SCM for small businesses?
2. How does AI impact operational efficiency, cost savings, and decision-making?
3. What are the barriers to AI adoption in SCM for small-scale businesses?

This systematic study examines the effect of artificial intelligence on supply chain management in small-scale enterprises, offering significant contributions and real-world consequences that might affect studies as well as practices in this domain. This paper elucidates how AI might enhance small-scale enterprises by providing data-driven decision-making skills, hence improving agility and responsiveness under variable market situations. Implementing AI-driven forecasting and predictive analytics enables small firms to improve inventory management, minimize stockouts, and optimize resources, resulting in cost reductions and increased customer satisfaction.

The results indicate that AI serves as a means for small enterprises, frequently constrained by resources, to compete more equitably with bigger rivals. AI solutions provide economical substitutes for conventional supply chain techniques, enabling firms to attain comparable efficiency and scalability advantages. The study elucidates pragmatic techniques for AI implementation, including collaboration with AI solution providers, use of cloud-based AI services, and application of open-source AI technologies. These insights may assist tiny enterprises in surmounting financial and technical expertise obstacles, rendering AI integration more attainable and effective. This assessment emphasizes the need for more research, particularly in the development of AI solutions tailored to the operational requirements and resource constraints of small-scale enterprises. This study identifies these limitations, urging the academic community to develop cost-efficient, scalable AI models specifically designed for SMEs. The results aid in the formulation of a conceptual framework for comprehending the efficient integration of AI in the supply chain management operations of small-scale enterprises. This methodology may provide a basis for future research focused on investigating AI's revolutionary impact on small-scale supply chains. The assessment advocates for the investigation of collaborative AI models, including shared AI resources and collective AI-driven data repositories among small enterprises, which might mitigate the substantial expenses and data constraints often encountered by

these organizations. This analysis provides insights that may assist policy-makers in understanding the hurdles encountered by small-scale enterprises in adopting AI, as well as the advantages that AI integration may provide to their supply chain management operations. Policy efforts providing financial incentives, training programs, or subsidies for AI adoption might assist SMEs in using AI more efficiently. AI technology developers may customize their solutions to be more accessible, economical, and user-friendly for this demographic by comprehending the distinct limitations and needs of small enterprises. Furthermore, software suppliers may focus on creating modular, cost-effective AI solutions that small enterprises may use with less technical proficiency.

## II. LITERATURE REVIEW

The deployment of artificial intelligence in supply chain management has been receiving heightened attention, with research emphasizing AI's capacity to enhance operational efficiency, cost control, and decision-making processes (Ganesh, A. D., & Kalpana, P. 2022). AI solutions have shown efficacy in work automation, logistics optimization, and sophisticated predictive analytics facilitation. Nonetheless, the particular ramifications of AI for small-scale companies are still inadequately examined in the literature. This study consolidates current research on AI in supply chain management, emphasizing small enterprises, and highlights the main themes and deficiencies in the literature.

### Artificial Intelligence in Supply Chain Management-

The use of AI in supply chain management includes demand forecasting, inventory optimization, logistics, and supplier relationship management (Gayam, Swaroop Reddy, et al. 2021). Conventional supply chain management is significantly dependent on manual procedures, rendering it susceptible to human error and inefficiency. In contrast, AI-driven supply chain management employs machine learning, natural language processing, and predictive analytics to optimize processes, minimize lead times, and enhance decision-making precision (Gedam, Vivek, et al. 2023). AI-driven demand forecasting is a prominent application in supply chain management, whereby machine learning algorithms evaluate past sales data, seasonal trends, and external variables to enhance the precision of demand predictions (Kharfan, Majd, et al. 2021). Research indicates that AI-driven forecasting lowers overstock and stockouts, which are particularly vital for small enterprises with constrained financial flows. AI-driven optimization models in logistics have shown substantial efficacy in minimizing route lengths, decreasing fuel consumption, and enhancing delivery times (Chen, Wenwen, et al. 2024). Improvements in logistics may elevate client happiness and diminish operating expenses, which are vital for small and medium-sized businesses.

### Obstacles to AI Implementation for Small Enterprises in Supply Chain Management-

Although the advantages of AI in supply chain management are clear, small enterprises have distinct obstacles that impede AI implementation. Kumar, Mukesh, et al. (2024), indicates that the application of AI requires significant investment in technology and qualified labor resources that most small enterprises do not possess.

Moreover, small enterprises often have challenges related to data accessibility, integrity, and quantity. AI models want substantial datasets to provide dependable insights, and small-scale enterprises, owing to their restricted activities, may lack the enormous data essential for the proper training of AI algorithms (Jagatheesaperumal, Senthil Kumar, et al. 2021).

A further difficulty is the disparity in skills. Small enterprises often lack internal technical teams proficient in AI or data science. Dependence on external providers for AI solutions may result in elevated expenses and security issues, particularly with sensitive supply chain information (Dutta, Pankaj, et al. 2020). Furthermore, the intricate technological infrastructure necessary for AI—such as cloud computing and extensive data storage—frequently exceeds the financial capabilities of small enterprises, leading to diminished adoption rates relative to bigger corporations.

#### Case Studies and Applications of Artificial Intelligence in Small Business Supply Chain Management-

Literature case studies provide useful insights into how small-scale enterprises might utilize AI. Research on AI-driven inventory management systems revealed that small merchants using automated reorder algorithms achieved enhanced inventory turnover and decreased stock expenses by as much as 20% (Narendran, V. C. G. 2023). Moreover, AI-driven predictive maintenance has shown potential in small manufacturing enterprises, where equipment downtime may constitute a considerable operational impediment. Through the analysis of machine performance data, AI models can forecast maintenance requirements, assisting small producers in averting expensive interruptions.

Research has examined cloud-based AI solutions that enable small enterprises to use advanced AI functionalities without significant initial infrastructure expenditure. These technologies have facilitated small companies in enhancing their supply chain management operations via real-time tracking and data analysis capabilities, which were once restricted to bigger enterprises with specialized IT infrastructures (De Vass, T., Shee, H., & Miah, S. 2021).

#### Research Gaps and Future Directions-

Notwithstanding encouraging results, the literature indicates significant deficiencies that need more investigation. Primarily, the majority of studies on AI in supply chain management focus on big firms, with fewer studies addressing the particular challenges faced by small-scale businesses. Subsequent research needs to concentrate on creating AI frameworks specifically designed to address the requirements and constraints of small and medium-sized businesses, including affordable and easily implementable AI solutions. Secondly, while several studies emphasize the promise of AI in supply chain management, there is a deficiency of longitudinal research examining the enduring effects of AI on the performance, profitability, and scalability of small-scale supply chain management. Assessing the ongoing advantages and emerging obstacles will be crucial for comprehending AI's genuine worth to small enterprises. Ultimately, investigations into collaborative AI models, whereby several small enterprises

exchange AI resources and data, may provide a cost-efficient resolution. Collaborative models might mitigate data and resource limitations, enabling small-scale enterprises to use AI capabilities that are often inaccessible singly (Burstrom, Thommie, et al. 2021).

### III. METHODOLOGY

This systematic study employs a structured approach to analyze the influence of artificial intelligence (AI) on supply chain management (SCM) in small enterprises. The aim is to discern essential AI applications, advantages, obstacles, and prospective trajectories pertinent to small enterprises inside the supply chain management framework. The approach consists of five primary stages: formulating research questions, completing a literature search and selection, extracting data, assessing quality, and synthesizing data.

#### Specific research questions were created to direct the review.

1. What are the primary AI applications in SCM for small businesses?
2. How does AI impact operational efficiency, cost savings, and decision-making?
3. What are the barriers to AI adoption in SCM for small-scale businesses?

These questions provide a structure for the methodical exploration, examination, and integration of the literature.

#### Selection Criteria-

A thorough literature review was performed using academic resources such as ResearchGate, Google Scholar, MDPI, ScienceDirect, IEEE Xplore, and Academia.edu. The keywords included comprised combinations of phrases like "artificial intelligence," "supply chain management," "small-scale business," "small and medium-sized enterprises," "AI adoption," "demand forecasting," and "inventory management."

- **Inclusion Criteria-** Research published in peer-reviewed publications or conference proceedings during the last decade. Research focused on AI applications in supply chain management for small-scale firms or medium-sized businesses. Empirical research, case studies, and reviews examining the influence of AI on supply chain management KPIs such as cost efficiency, management of inventories, and logistics.
- **Exclusion Criteria-** Studies only concentrate on major corporations. Articles that examine SCM or AI alone without exploring their intersection. Articles devoid of empirical evidence or case study implementations.

**Data Extraction-** Essential information was derived from each chosen article, encompassing.

- **Article Metadata-** Author(s), year, title, and journal.
- **Study Design-** Research approach (e.g., empirical investigation, case analysis, or literature review).
- **AI Applications-** Discussed AI approaches or technologies, including machine learning, predictive



analytics, and automation in supply chain management operations (e.g., demand forecasting, logistics, and supplier management).

- **Findings-** Principal results include the influence of AI on supply chain management efficiency, cost reductions, and operational difficulties.
- **Challenges-** Obstacles to AI implementation unique to small enterprises, including financial constraints, talent deficiencies, and data inadequacies.
- **Future Directions-** Identification of research deficiencies and recommendations for further investigations.

#### Evaluation of Quality -

Each publication was assessed for scientific accuracy and significance using a quality evaluation checklist, ensuring that the chosen research adhered to quality requirements for a systematic review. The checklist criteria encompassed:

- **Relevance-** Direct pertinence to small-scale enterprises and supply chain management.
- **Methodological Rigor-** Explicit research technique and validity of results.
- **Analytical Depth-** The profundity and pertinence of discoveries about AI applications in supply chain management.
- **Source Credibility-** Peer-reviewed journal or esteemed conference.

Only studies that met a high-quality standard were included to verify the dependability of the review's results.

#### Data Integration-

The retrieved data was synthesized using a thematic analysis technique, categorizing results into principal topics and sub-themes about AI's influence on supply chain management. Thematic groups encompassed:

- **AI Applications in Supply Chain Management-** Examination of AI tools and technologies used in supply chain management activities, including inventory management, logistics, and demand forecasting.
- **Benefits of AI for Supply Chain Management in Small Enterprises-** Assessment of AI's impact on improving operational efficiency, cost control, and decision-making skills.
- **Obstacles to AI Implementation-** Typical impediments encountered by small enterprises, such as fiscal limitations, insufficient data, and expertise deficiencies.
- **Future Research Directions-** Identification of deficiencies and prospective domains for further investigation, such collaborative AI models or cost-effective AI solutions.

Each theme area was examined thoroughly to provide a detailed picture of the present condition of AI in supply chain management for small enterprises.

#### Limitations-

The review recognizes limitations, such as possible publication bias, due to its dependence on peer-reviewed sources that may preferentially highlight research with favourable results. The search was confined to English-language literature, perhaps excluding pertinent results from other locations. This methodical methodology guarantees a thorough examination of AI's influence on supply chain management in small enterprises, establishing a robust basis for comprehending existing practices, obstacles, and prospective prospects in this domain.

### IV.RESULT AND DISCUSSION

This systematic review offers a thorough examination of the literature about the influence of artificial intelligence on supply chain management in small enterprises. The results provide insights into applications for artificial intelligence, operational advantages, acceptance obstacles, and prospective future directions. This section consolidates these results into topical categories, presenting significance that applies to small business entrepreneurs and researchers.

#### Artificial Intelligence Applications in Supply Chain Management for Small Enterprises-

Demand forecasting is a vital domain in which AI has shown significant utility in small-scale supply chain management. Umeorah, Stanley Chidozie, et al. (2024), indicate that machine learning and predictive analytics significantly enhance demand precision, hence decreasing instances of overstock and stock outs. Automated inventory management solutions, often driven by AI, allow small enterprises to sustain ideal inventory levels, hence minimizing carrying costs and improving cash flow. These systems are especially advantageous for small enterprises, which often function with restricted storage capacity and financial limitations. AI's responsibilities in logistics include improving routes and real-time tracking, assisting small enterprises in minimizing fuel use, enhancing delivery efficiency, and elevating client happiness. AI-driven models that enhance last-mile delivery have significantly influenced small businesses, enabling them to compete with bigger companies by offering quicker and more dependable deliveries (Krishnan, Ravishankar, et al. 2024). AI applications in supplier control enhance negotiating and risk management via the analysis of supplier performance, price patterns, and market fluctuations. Small-scale enterprises, which often depend significantly on a limited number of primary suppliers, get advantages from these insights, enabling them to sustain consistent supply levels and mitigate risks linked to single-sourcing methods (Pournader, Mehrdokht, et al 2021).

#### Advantages of Artificial Intelligence for Supply Chain Management in Small Enterprises-

AI solutions in supply chain management have shown a quantifiable enhancement to operational efficiency, enabling small enterprises to automate laborious processes and concentrate on

strategic initiatives. AI-driven data analytics can optimize inventory inspections and reorder procedures, minimizing mistakes and labour expenses (Sydoriuk, Yaroslav. 2024). AI-driven supply chain management strategies help small enterprises minimize waste, enhance the distribution of resources, and manage expenses efficiently. Predictive analytics diminishes surplus inventory expenditures, whilst route optimization curtails transportation prices. These characteristics may together result in substantial cost reductions and revenue enhancement, which is especially advantageous for small enterprises with constrained margins (Brandy, Susan 2023). Real-time data analysis enables small enterprises to make proactive choices informed by market trends, customer preferences, and operational performance. This agility enables businesses to adapt more swiftly to market fluctuations, sustain a competitive advantage, and improve customer satisfaction (Elali, Wajeeh, 2021).

### **Obstacles to AI Implementation in Small-Scale Supply Chain Management-**

A significant obstacle to AI implementation in small enterprises is the expense related to AI technology, which includes hardware, software, and continuous maintenance. Restricted budgets hinder several small enterprises from investing in premium AI solutions, compelling them to depend on more economical nevertheless less sophisticated technology. Artificial intelligence models require extensive, high-caliber datasets to operate efficiently (Budhwar, Pawan, et al. 2022). Small enterprises often lack access to the requisite amount and quality of data essential for precise predictive analytics, especially in applications such as demand forecasting and logistics management. Moreover, the expenses associated with data storage and maintenance might be excessive. Numerous small enterprises lack internal data science and machine learning proficiency, hindering the implementation and management of AI systems. A gap in skills constrains AI implementation and compels small enterprises to depend on external suppliers or consultants, hence increasing total expenses and raising possible data security issues (Tarr, Mayeadeh. 2021). Due to the delicate character of supply chain data, small enterprises have apprehensions about data privacy and cyber security while using AI systems. External AI suppliers may present data security threats, potentially dissuading small firms from fully using AI in their supply chain processes.

### **Future Research Directions and Practical Implications-**

The results highlight the need for cost-effective, scalable AI solutions tailored for small enterprises. Future research may concentrate on creating economical, cloud-based AI models that small enterprises may use with less technical knowledge and infrastructure. Research opportunities exist for collaborative AI models that enable small enterprises to aggregate data and resources, hence developing shared AI solutions that lower individual expenses and improve data quality. Policymakers may facilitate AI adoption in small enterprises by offering financial assistance, tax advantages, or training initiatives to bridge skill deficiencies. Additional studies on policy effects might provide significant insights into successful governmental actions to facilitate AI in small-scale supply chain management. Most

research in the study provides a glimpse of AI's influence on supply chain management, although few examine the long-term impacts on the performance of small enterprises. Longitudinal studies might investigate the impact of AI on growth, profitability, and competitive positioning over time, offering a comprehensive picture of its enduring advantages and problems for small enterprises.

### **V.DISCUSSION AND IMPLICATION**

The findings indicate that AI may substantially improve supply chain management in small enterprises by automating processes, maximizing resources, and facilitating real-time decision-making. Nevertheless, practical obstacles such as exorbitant expenses, insufficient data, and deficiencies in technical expertise hinder the full realization of AI's promise in this environment. Resolving these difficulties may provide new possibilities for small enterprises to use AI, hence enhancing their competitiveness against bigger corporations. The results underscore the need for small-scale business practitioners to prioritize cost-efficient, cloud-based AI technologies that demand minimum internal knowledge. By concentrating on certain applications that provide immediate advantages, such as demand forecasting and logistics optimization, small enterprises may gradually integrate AI into their supply chain management operations.

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