

THE ROLE OF ARTIFICIAL INTELLIGENCE IN SUPPLY CHAIN OPTIMIZATION

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ABSTRACT

Artificial Intelligence (AI) is transforming supply chain management by enabling organizations to improve efficiency, reduce costs, and respond quickly to market changes. AI-powered tools such as predictive analytics, machine learning, and robotic process automation enhance decision-making in inventory management, demand forecasting, logistics, and procurement. This article examines how AI supports supply chain optimization, highlights key implementation strategies, and explores the benefits and challenges of adopting AI technologies. The findings indicate that integrating AI into supply chains leads to operational resilience, cost savings, and competitive advantage.

Keywords: Artificial Intelligence, Supply Chain Optimization, Predictive Analytics, Machine Learning, Logistics, Inventory Management, Operational Efficiency.

INTRODUCTION

Global supply chains face increasing complexity due to market volatility, customer demand fluctuations, and logistical challenges (Choi et al., 2018). Advances in big data and digital technologies have significantly enhanced supply chain capabilities and decision-making processes (Wamba et al., 2015). AI offers solutions that enhance visibility, forecasting, and decision-making across the supply chain, enabling organizations to improve efficiency and competitiveness (Gottlieb et al., 2019).

Key AI Applications in Supply Chain Optimization

Predictive Analytics

Predictive analytics uses historical data and machine learning algorithms to forecast demand, optimize inventory, and prevent stockouts (Waller & Fawcett, 2013; Dubey et al., 2019). These approaches also contribute to improved inventory management effectiveness in organizations (Ali et al., 2024). Accurate demand forecasting reduces holding costs and improves service levels.

Machine Learning and Automation

Machine learning algorithms enable real-time decision-making in logistics, production scheduling, and risk management. Robotic process automation streamlines repetitive tasks, enhancing operational efficiency (Kache & Seuring, 2017; Wamba et al., 2015). These technologies are central to modern digital supply chain transformations (Hofmann & Rüscher, 2017).

AI in Procurement and Supplier Management

AI supports supplier selection, performance monitoring, and contract management. Automated systems analyze supplier performance metrics, predict disruptions, and recommend optimal procurement strategies (Choi et al., 2018; Queiroz et al., 2020). Additionally, digital technologies improve risk management in supply chain disruptions.

Benefits of AI-Driven Supply Chains

Operational Efficiency

AI reduces lead times, optimizes routes, and minimizes errors, resulting in cost savings and enhanced operational performance (Wamba et al., 2015). These improvements are strongly linked to better inventory and operational outcomes (Ali et al., 2024).

Risk Management and Resilience

AI enhances supply chain resilience by predicting disruptions, identifying risks, and enabling proactive mitigation strategies (Tiwari et al., 2018). Big data analytics plays a crucial role in strengthening supply chain resilience.

Strategic Decision-Making

Data-driven insights from AI allow supply chain managers to make informed strategic decisions regarding inventory, sourcing, and logistics (Wamba et al., 2015). These insights support long-term organizational performance and competitiveness (Dubey et al., 2019).

Challenges and Considerations

Implementing AI in supply chains requires investment in technology, data infrastructure, and skilled personnel. Organizations must ensure data quality, address cybersecurity risks, and integrate AI solutions with existing systems (Kache & Seuring, 2017). Furthermore, integrating emerging technologies such as blockchain introduces additional complexity but offers opportunities for transparency and efficiency. Balancing AI automation with human oversight remains essential for ethical and flexible decision-making.

CONCLUSION

Artificial Intelligence plays a pivotal role in optimizing supply chain operations. By leveraging predictive analytics, machine learning, and automation, organizations can enhance efficiency, resilience, and strategic decision-making. While challenges such as data quality and integration exist, organizations that effectively implement AI solutions gain significant competitive advantage and operational excellence.

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