Review of supply chain innovation through artificial intelligence: Possible applications in Uzbekistan

S. Salikhov[1] [a]

[1]ITF Group LLC, MO, USA

Abstract: The presented article represents a systematic literature review of empirical studies on the adoption of AI for applications in the field of supply chain management. In the last decade, AI has advanced remarkably, bringing transformative changes to business operations and society. This review explores current technological approaches and their wide-ranging applications, offering valuable insights with potential to revolutionize supply chain processes in regions like Uzbekistan, where AI integration could drive significant economic growth and operational advancements. This study sets the stage for future academic research in Uzbekistan while also offering insights to help managers make better decisions about using AI in supply chain management.

Keywords: artificial intelligence, internet technologies, supply chain innovations, SCM, logistics, disruption management, intelligent solutions, logistics, transportation

1. Introduction

Since the 1950s, Artificial Intelligence has come a long way, experiencing both breakthroughs and quieter periods [1]. Over the past three years, especially with the rise of generative AI technologies in 2022, interest in AI has skyrocketed. AI has become an integral part of daily life, revolutionizing industries like supply chain management and demonstrating its potential to transform the world around us.

Countries around the world, including Uzbekistan, have begun actively implementing AI in their operations, demonstrating a growing commitment to leveraging this powerful technology. The Government of Uzbekistan has announced an AI development strategy with a view to a $1.5 billion market by 2030 [2]. This plan covers several key industries and initiatives, tying in elements of supply chain systems, like using AI to forecast crop yields.

However, bringing AI into everyday life is a very intricate challenge for its own nature. These difficulties become more clearly evident in SCM, as the interlinking of various operations and organizations makes implementation even harder. Besides, integration of AI across different levels in ever-evolving systems contributes to the complexity [3]

For instance, figure 1 presents the gap between high-performing and low-performing organizations in applying AI technologies to key supply chain processes like demand forecasting, supply planning, and logistics. High performers are better in adopting this innovation because of the use of the right resources and support. More often than not, high-quality data, advanced technology, and skilled teams provide a full implementation of such systems. Additionally, their organizations are more prepared and committed to integrating AI/ML into their processes, giving them a significant advantage over others. Therefore, it is critical to recognize challenges inherent in such implementations that could have the potential of altering successful delivery.
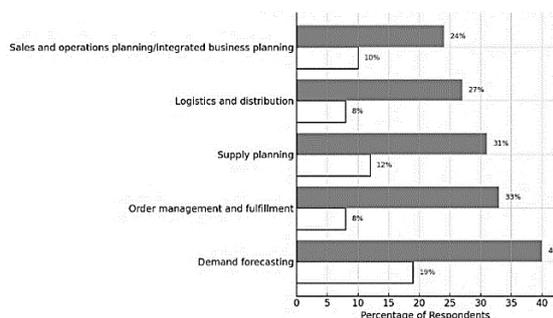

Figure 1. High vs. Low Performers in AI/ML Decision Optimization [4]

In this respect, several challenges are common for the wide application of these technologies. Lack of data, weak technical infrastructure, and unprepared organizational environments are some major hurdles to the effective adoption of these initiatives. Addressing such challenges require targeted efforts to unlock the full potential of AI/ML in optimizing supply chains.

Bridging these discussions will involve a systematic review of empirical studies published in peer-reviewed journals to provide evidence-based insights. Additionally, to offer a well-rounded perspective on the integration of AI into supply chain management, the definition of SCM adopted for this review should be comprehensive, covering internal processes within the firm as well as independent agents such as suppliers, buyers, and customers, to ensure a holistic overview of the field.

2. Methods and materials

The methodology for this review was designed based on keyword searches across Scopus, the Uzbek Database, and Web of Science, with a primary interest in research from the last 10 years to ensure topical relevance.
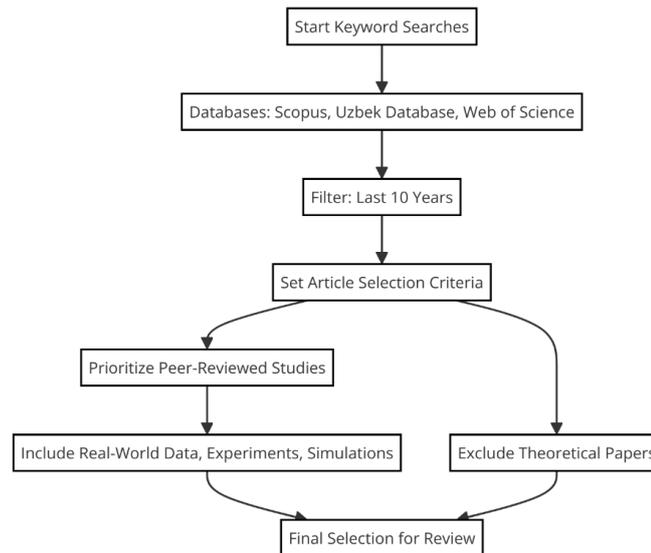
---

aa [ID] https://orcid.org/0009-0004-8478-1875

Fig. 2. Article Selection Process

Article selection was based on set criteria, prioritizing those with peer-reviewed studies related to the application of AI in SCM. Only papers that utilized real-world data, experiments, simulations, or studies within supply chain environments were included. The review deliberately excluded theoretical papers in order to focus on practical, empirical insights relevant to SCM applications.

3. Results

This study reviewed articles focusing on industries such as automotive, electronics, telecommunications, and food. Most of the articles came from core disciplinary areas like Operations and Supply Chain Management, Engineering and Technology, General Management, and Innovation, thus showing the wide scope and applicability of AI. The key finding of the study was that most of the research efforts were focused on implementation of AI in data management and the integration of complementary technologies, which highlighted the broad coverage of the subjects in the context of the study.

The reviewed articles highlight various applications of AI in SCM, including enhancing the efficiency and real-time capability of logistics management. For example, AI models analyze big datasets for more accurate travel time predictions. [5]

The finding has also shown that the companies using quality data management may have a competitive advantage in the market[6]. However, to feed the AI for data analysis, the quality of data is very crucial, and poorly collected data can make costly mistakes in buyer-supplier relationships[7]. Moreover, AI integration in the SCM framework would be helpful in reducing the dependency on different parties in the nodes for data as it can process publicly available information [8]. Importantly, AI can do data simulations virtually to understand the development alternative scenario, assisting the company with planning and forecasting. [9].

AI is crucial in managing *supply chain dynamism[a]*, enabling the firm to map out potential risks, vulnerabilities, and disruptions. This transformative capability of AI will dramatically change the risk management process by enabling machine learning-powered analytics to predict potential risks with accuracy in advance [10]. However, to effectively integrate AI and respond to emerging technological challenges, organizations should focus on competencies such as cybersecurity, user experience design, and hardware [11]

Another study showed how AI can improve cost management, enhance transparency, strengthen buyer-supplier collaboration, and increase efficiency and sustainability in SCM. This is achieved by the application of machine learning models that analyze data, predict costs, and identify critical cost drivers [12]. Another article presents AI integrated with Blockchain that offers more transparency and security in data sharing, showing how such a combination can reinforce risk management and contribute toward digital transformation in SCM [13].

Moreover, generative AI has been found to improve supply chain coordination by enabling real-time, smooth communication between companies and their supply chain partners, helping them work together more efficiently [14].

According to other study, AI can help the robots learn, adapt, and work effectively. Particularly, it helps them in object recognition, data analysis, and performance improvement over time. AI allows the robots to predict maintenance, identify quality issues, and collaborate safely with humans. That makes the robots flexible, capable, and effective in performing a variety of tasks in dynamic environments [15].

Moreover, the combination of AI, IoT, and blockchain offers so many advantages in supply chain management, especially transportation. IoT sensors monitor the real-time status of temperature and humidity, among other factors, while AI interprets this data to predict and prevent problems before they occur. Blockchain further enhances this with

[a]**Note**: *Supply chain dynamism* refers to the level of variability, unpredictability, and change in the conditions and factors affecting a supply chain.

security and transparency, making sure that the data cannot be altered with and is accessible only to the right people. Collectively, these technologies contribute to trust, efficiency, and making the logistics aspect of SCM notably smooth [16].

It is also necessary to discuss the broader implications of AI, blockchain, IoT combination on management practices and policymaking. For instance, AI-driven predictive models backed by blockchain and internet technologies significantly enhance the ability to forecast resource demands and optimize distribution strategies during emergencies. Such a blend of innovation ensures accurate and timely predictions that help organizations to respond to unfamiliar conditions swiftly, which is quite crucial in crises like natural disasters or pandemics [17].

Finally, AI can also help companies enhance the environmental performance of their supply chains by analyzing the data on resource usage, energy consumption, and waste generation across all operations. Most notably, it can identify inefficiencies and suggest areas for improvement, thus enabling companies to use resources more effectively, reduce waste, and minimize their overall impact on the environment [18].

4. Discussion

The findings of this study underpin the transformative potential of AI in supply chain management, especially in the evolving economic landscape of Uzbekistan. As Uzbekistan is on the path of continuous modernization of its industries and adopting digital transformation, AI presents huge opportunities to enhance efficiency, strengthen resilience, and promote sustainability across key areas of its supply chain operations.

High-quality, reliable data is a critical element in the application of AI in supply chain management for Uzbekistan. Currently, fragmented data systems and inconsistent data collection practices may reduce the effectiveness of AI-driven insights. Centralized and standardized data collection systems will help Uzbekistan create a platform for the successful integration of this technology. It is especially important that AI can work with openly available data and reduce reliance on third-party sources as the country's digital systems are still in development. Besides, virtual simulations powered by AI may help businesses in Uzbekistan to plan better by modeling various scenarios and improving their forecasting capabilities.

Uzbekistan faces very specific supply chain challenges, including fluctuating economic conditions, seasonal changes in demand, and evolving trade policies. AI can make all the difference by spotting risks, working out weak points, and managing disruptions in real time. For instance, AI-powered models may predict delays, optimize inventory, and deliver goods on schedule. This is very important, especially for such industries as agriculture and textiles, which heavily rely on smooth supply chain operations to ensure profitability and competitiveness in world markets. However, the Uzbek government and businesses have to pay attention to the creation of good technology infrastructure and training of the workforce to fully unleash the potential of AI.

AI can analyze big datasets, providing enormous benefits with regard to logistics and cost management in Uzbekistan. It can optimize routes of travel, accurately predict time for delivery, and reduce expenses on transportation by using both historical and real-time data. It is very important for the export-oriented industries of Uzbekistan, where efficient logistics means meeting international market demand. It also enhances transparency and strengthens relationships between buyers and suppliers by highlighting areas of cost drivers and providing valuable insights for actionable expense management.

AI can also contribute to Uzbekistan's commitment to sustainable development through enhanced environmental performance related to the local supply chain system. Analyzing data on energy consumption, resource utilization, and waste generation allows AI to help industries identify areas of inefficiency and target improvements. For example, in agriculture and manufacturing, AI can optimize resource allocation to minimize waste and reduce environmental impact, thus addressing Uzbekistan's national priorities for green economic growth. However, the adoption of AI in SCM requires a collaborative approach by policymakers and businesses in Uzbekistan. Policymakers have to create frameworks that promote innovation, data privacy, and mitigate the risks of AI deployment. On the organizational level, companies should upskill their workforce, cross-functional collaboration, and integrate AI into existing processes for seamless adoption [19].

5. Conclusion

This study has demonstrated that AI has the power to change supply chain management fundamentally, especially in the context of a developing economy like that of Uzbekistan. As this country embarks on comprehensive modernization and digital transformation processes, AI offers good opportunities for enhancing efficiency, resilience, and sustainability throughout the operations of supply chains. From logistics and cost optimization to managing supply chain dynamism and improving environmental performance, AI offers solutions for several persistent problems while introducing entirely new perspectives. Nevertheless, to realize the complete potential of AI in Uzbekistan, both the government officials and the enterprises need to put in their effort jointly. Addressing these challenges and aligning efforts across sectors would allow Uzbekistan to unlock the full potential of AI in supply chains for greater economic growth, competitiveness, and sustainability.

References

[1] Harvard University. (2017). The history of Artificial Intelligence. Retrieved from https://sitn.hms.harvard.edu/flash/2017/history-artificial-intelligence/

[2] Cabinet of Ministers of Uzbekistan. (2023). On measures to implement the state program for the development of artificial intelligence for 2023–2030. Retrieved from https://lex.uz/ru/pdfs/7158606

[3] Durach, C.F., Kembro, J., & Wieland, A. (2017). A new paradigm for systematic literature reviews in supply chain management. Journal of Supply Chain Management, 53(4), 67–85.

[4] Gartner. (2024, February 20). Gartner says top supply chain organizations are using AI to optimize processes at more than twice the rate of low-performing peers. Gartner Newsroom. Retrieved from https://www.gartner.com/en/newsroom/press-releases/2024-02-20-gartner-says-top-supply-chain-organizations-are-using-ai-to-optimize-processes-at-more-than-twice-the-rate-of-low-performing-peers

[5] Chen, Y. T., Sun, E. W., Chang, M. F., & Lin, Y. B. (2021). Pragmatic real-time logistics management with traffic IoT infrastructure: Big data predictive analytics of freight travel time for Logistics 4.0. International Journal of Production Economics, 238, 108157. https://doi.org/10.1016/j.ijpe.2021.108157

[6] Brock, J. K.-U., & von Wangenheim, F. (2019). Demystifying AI: What Digital Transformation Leaders Can Teach You about Realistic Artificial Intelligence. Business Horizons, 61(4). https://doi.org/10.1177/1536504219865226.

[7] Cannas, V. G., Ciano, M. P., Saltalamacchia, M., & Secchi, R. (2023). Artificial intelligence in supply chain and operations management: A multiple case study research. International Journal of Production Research, 61(14), 3333-3360. https://doi.org/10.1080/00207543.2023.2232050.

[8] Brintrup, A., Kosasih, E., Schaffer, P., Zheng, G., Demirel, G., & MacCarthy, B. L. (2023). Digital supply chain surveillance using artificial intelligence: Definitions, opportunities and risks. International Journal of Production Research, 61(20), 4674-4695. https://doi.org/10.1080/00207543.2023.2270719.

[9] Chuang, H. H., Chou, Y., & Oliva, R. (2021). Cross-item learning for volatile demand forecasting: An intervention with predictive analytics. Journal of Operations Management, 67(7), 828–852.

[10] Wang, G., Gunasekaran, A., Ngai, E. W., & Papadopoulos, T. (2016). Big data analytics in logistics and supply chain management: Certain investigations for research and applications. International Journal of Production Economics, 176, 98–110. https://doi.org/10.1016/j.ijpe.2016.03.014

[11] Kinkel, S., Capestro, M., Di Maria, E., & Bettiol, M. (2023). Artificial intelligence and relocation of production activities: An empirical cross-national study. International Journal of Production Economics, 261, 108890. https://doi.org/10.1016/j.ijpe.2023.108890

[12] Bodendorf, F., Dentler, S., & Franke, J. (2023). Digitally enabled supply chain integration through business and process analytics. Industrial Marketing Management, 114, 14–31.

[13] Rodríguez-Espíndola, O., Chowdhury, S., Dey, P. K., Albores, P., & Emrouznejad, A. (2022). Analysis of the adoption of emergent technologies for risk management in the era of digital manufacturing. Technological Forecasting and Social Change, 178, 121562.

[14] Kanitz, R., Gonzalez, K., Briker, R., & Straatmann, T. (2023). Augmenting organizational change and strategy activities: Leveraging generative artificial intelligence. Journal of Applied Behavioral Science, 59(3), 345–363.

[15] Pillai, R., Sivathanu, B., Mariani, M., Rana, N. P., Yang, B., & Dwivedi, Y. K. (2021). Adoption of AI-empowered industrial robots in auto component manufacturing companies. Production Planning & Control, 32(12), 1517–1533. https://doi.org/10.1080/09537287.2021.1882689

[16] S. Wong, J.K.-W. Yeung, Y.-Y. Lau, T. Kawasaki, A case study of how maersk adopts cloud-based blockchain integrated with machine learning for sustainable practices, Sustainability 15 (9) (2023) 7305.

[17] Huang, D., Wang, S., & Liu, Z. (2021). A systematic review of prediction methods for emergency management. International Journal of Disaster Risk Reduction, 62, 102412. https://doi.org/10.1016/j.ijdrr.2021.102412

[18] Abou-Foul, M., Ruiz-Alba, J. L., & López-Tenorio, P. J. (2023). The influence of artificial intelligence capabilities on servitization: Examining the moderating role of absorptive capacity from a dynamic capabilities perspective. Journal of Business Research, 157, 113609. https://doi.org/10.1016/j.jbusres.2022.113609

[19] Burger, M., Nitsche, A.-M., & Arlinghaus, J. (2023). Hybrid intelligence in procurement: Disillusionment with AI's superiority? Computers in Industry, 150, 103946.

Information about the authors

Sokhibkhon Salikhov — Supply Chain Management Expert | Manager, ITF Group LLC | MBA, University of Wisconsin-Madison
E-mail: sohibxondoc@gmail.com
Tel.:+99890 990 96 33
https://orcid.org/0009-0004-8478-1875