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Review Article

Artificial Intelligence-Driven Logistics and Supply Chain Management: Industry Applications and Future Perspectives

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Abstract: In recent years, the digital transformation of logistics and supply chain management has gained momentum, leading to substantial advancements through the integration of artificial intelligence (AI). AI, which offers a broad range of applications, is now integral to enhancing operational efficiency in logistics and supply chains. This paper explores the various applications of AI in these domains, supported by both real-world industry examples and academic literature. The research employs a combined methodology of systematic literature review (SLR) and field research to achieve its objectives. The study aims to identify where AI solutions are applied within logistics and supply chains and to correlate these applications with real-world examples. Findings indicate that AI usage in logistics is categorized within a theoretical framework encompassing 12 distinct domains. The paper details AI applications in prominent companies, including Walmart, Amazon, UPS, DHL, Ocado, Alibaba, Maersk, Siemens, FedEx, Kuehne + Nagel, and DB Schenker. Ultimately, this paper examines how AI has revolutionized logistics and supply chain management, illustrating the transformation through industry applications and academic literature. The results demonstrate a clear trend of AI becoming increasingly integrated into logistical processes, underscoring its growing impact day by day.

Keywords: Artificial intelligence, Smart Logistics, Smart Supply chain

Yapay Zekâ Tabanlı Lojistik ve Tedarik Zinciri Yönetimi: Sektörel Uygulamalar ve Gelecek Perspektifleri

Özet: Son yıllarda lojistik ve tedarik zinciri yönetiminin dijitalleşmesi hız kazanmış ve yapay zekâ (YZ) kullanımıyla önemli ilerlemeler kaydedilmiştir. Geniş bir uygulama yelpazesi sunan yapay zekâ, lojistik ve tedarik zincirlerinde operasyonel verimliliğin artırılmasında önemli bir unsur haline gelmiştir. Bu makale, bu alanlardaki yapay zekâ uygulamalarını, hem gerçek dünya endüstri örnekleri hem de akademik literatür ile destekleyerek incelemektedir. Araştırma, sistematik literatür taraması (SLR) ve saha araştırmasını birleştiren bir metodoloji kullanmaktadır. Çalışmanın amacı, lojistik ve tedarik zincirlerinde yapay zekâ çözümlerinin nerelerde uygulandığını belirlemek ve bu uygulamaları gerçek dünya örnekleri ile ilişkilendirmektir. Bulgular, lojistikte yapay zekâ kullanımının 12 farklı alanı kapsayan teorik bir çerçeve içerisinde sınıflandırıldığını göstermektedir. Makalede Walmart, Amazon, UPS, DHL, Ocado, Alibaba, Maersk, Siemens, FedEx, Kuehne + Nagel ve DB Schenker gibi önde gelen şirketlerdeki yapay zekâ uygulamaları ayrıntılı olarak ele alınmaktadır. Sonuç olarak, bu makale yapay zekânın lojistik ve tedarik zinciri yönetiminde nasıl bir devrim yarattığını incelemekte ve bu dönüşümü hem endüstri uygulamaları hem de akademik literatür aracılığıyla ortaya koymaktadır. Elde edilen sonuçlar, yapay zekânın lojistik süreçlere giderek daha fazla entegre olduğunu ve etkisinin gün geçtikçe arttığını göstermektedir.

Anahtar Kelimeler: Akıllı Lojistik, Akıllı Tedarik Zinciri, Yapay Zeka.

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1. Introduction

Artificial Intelligence (AI) has brought remarkable advancements to logistics and supply chain management (SCM), improving efficiency, precision, and adaptability in numerous operations. Key AI applications in SCM encompass areas like demand prediction, inventory control, logistics streamlining, and transportation, employing methods such as time-series analysis, clustering algorithms, neural networks, SARIMA, and LSTM models (Tanish, 2024). The synergy between artificial intelligence and Big Data Analytics (BDA) has significantly enhanced decision-making processes, minimized costs, and optimized resource utilization, contributing to increased operational efficiency and strategic innovation (Eyo-Udo, 2024).

The integration of AI-driven data analytics, machine learning, and autonomous decision-making functions with blockchain technology has streamlined logistics, forecasted trends, and automated processes. This combination has notably enhanced transaction speeds, data validation procedures, and the overall effectiveness of supply chains (Vinay et al, 2024). Additionally, AI has been instrumental in identifying inefficiencies within supply chains, allowing companies to take corrective actions to improve performance, such as analyzing data on inventory levels, order processing times, and transportation costs (Petriashvili et al, 2024).

The use of deep learning in SCM has also become prominent, enabling better demand responsiveness, shorter lead times, and lower costs by anticipating demand, optimizing logistics and transportation routes, and identifying supply chain bottlenecks (Pandey et al, 2024). Although significant progress has been made, issues like data privacy, ethical challenges, and the demand for skilled professionals continue to be vital barriers to the adoption of AI in supply chain management (Eyo-Udo, 2024). Future studies should focus on examining AI's long-term effects on supply chain sustainability, the ethical dimensions of autonomous technologies, and how AI integrates with other emerging innovations (Eyo-Udo, 2024). In summary, the integration of AI with advanced technologies such as blockchain and IoT holds great promise for creating more resilient, efficient, and transparent supply networks, driving further innovations in SCM (Tanish, 2024) (Vinay et al, 2024).

The number of studies and application areas is increasing daily and with artificial intelligence transforming local chains into global chains. This research will investigate how these developments are utilized in logistics and supply chains, supported by real-world industry examples and academic literature.

In this context, the aim of this study is to systematically identify and classify the areas in which artificial intelligence is applied within logistics and supply chain management, while also examining real-world company practices that reflect these applications. By combining a structured literature analysis with sectoral examples, the study not only highlights the breadth of AI adoption across different logistics functions but also provides an integrated perspective linking academic insights with industry practices. In doing so, the research contributes to the literature by bridging the gap between theoretical frameworks and practical implementations, thereby offering valuable insights for both scholars and practitioners. Unlike previous studies that have examined isolated functions, this study is the first to comprehensively map AI applications across all seven logistics activities, offering a holistic framework for understanding the transformative role of AI in logistics and supply chain management.

2. Literature Review

Artificial Intelligence has increasingly been recognized as a transformative force in logistics and supply chain management, particularly through its capacity to enhance efficiency, resilience, and data-driven decision-making. By integrating technologies such as machine learning and predictive analytics, organizations are now able to optimize operations, anticipate disruptions, and ultimately improve performance across complex supply networks. Recent studies underline that this transformation is not limited to a single domain but extends across several critical areas of logistics. In this regard, Richey Jr. et al. (2023) emphasize both the radical opportunities generative AI offers and the challenges it brings, providing a roadmap for advancing AI research in logistics and supply chain management.

One of the most prominent applications is predictive analytics, which allows real-time data processing to generate accurate demand forecasts and anticipate possible disruptions (Rane et al, 2024). Such capabilities directly contribute to route optimization, reducing delivery times and associated costs, and thus providing firms with both operational and financial advantages (Krisknakumari, 2024). Closely linked to these developments is the field of inventory management and automation, where AI supports automated replenishment systems and enables more precise monitoring of stock levels. This reduces the risks of overstocking and stockouts, while autonomous delivery systems further minimize human error and enhance overall efficiency (Rane et al, 2024; Krisknakumari, 2024). In particular, Malhotra and Kharub (2025) show how AI adoption in e-commerce logistics improves efficiency, with supply chain consistency and last-mile delivery acting as critical mediators.

Beyond efficiency, AI also contributes significantly to transparency and traceability in global supply chains. The integration of AI-enhanced blockchain technologies has made it possible to ensure ethical sourcing, reduce fraud, and strengthen monitoring of supplier performance (Rane et al, 2025). These capabilities not only improve transactional security but also foster the development of more resilient and reliable supplier networks. Despite these substantial benefits, the literature also highlights persistent challenges. Shatat (2025) identifies both the advantages and obstacles of adopting AI techniques in logistics, underlining the importance of addressing barriers to maximize effectiveness. Similarly, Ifty (2025) points out that while AI enhances cost-effectiveness through automation, predictive analytics, and real-time tracking, high implementation costs, cybersecurity risks, and workforce adaptability remain pressing concerns. Financial limitations, technological barriers, and the shortage of skilled professionals remain significant obstacles to the widespread adoption of AI-based solutions (Younesse et al, 2025). Addressing these issues is essential if firms are to fully leverage the transformative potential of AI in reshaping supply chain operations.

While these thematic perspectives highlight AI's key application areas, the broader academic literature also reveals how research in this field has evolved over time. Early contributions such as Brintrup (2020) focused on conceptual frameworks, classification systems, and capability blocks, providing the first attempts to systematize AI in supply chains. These works emphasized the potential of AI as a strategic resource for reconfiguring supply chain processes. At the same time, bibliometric overviews such as Boršoš and Koman (2025) have shown that research spans diverse themes, from digital transformation and sustainability to human–machine interaction, mapping the dynamic evolution of AI in logistics.

Subsequent studies, including Younis et al. (2021) and Riahi et al. (2021), shifted the focus toward performance optimization and competitive advantage. They demonstrated how AI and machine learning techniques could reduce inefficiencies such as the bullwhip effect, improve responsiveness, and strengthen supply chain agility. This stage of research marked an important transition from abstract models to tangible operational benefits.

As the field matured, scholars began to investigate diverse functional applications. Razzaq et al. (2022) and Călinescu (2022) highlighted how AI supports supplier management, logistics optimization, and blockchain integration, while Gong (2022) demonstrated how algorithms can improve warehousing efficiency and distribution path planning. These contributions broadened the understanding of AI from a supportive tool into an enabler of digital transformation across the entire supply chain.

Recent years have witnessed an even stronger emphasis on advanced techniques and multidimensional approaches. Kriouich et al. (2023) offered a systematic overview of AI methods ranging from deep learning to fuzzy logic and robotics while Hryhorak et al. (2023) examined how AI changes managerial roles by shifting from supportive decision-making to increasingly autonomous systems. Mohsen (2023) further explored AI's impact on supply chain performance, identifying its potential for enhancing forecasting accuracy, logistics planning, and cost efficiency.

The most recent literature shows a clear convergence between AI and broader sustainability and resilience agendas. Pandey et al. (2024) and Eyo-Udo (2024) stressed the dual role of AI in boosting efficiency while also enabling environmentally sustainable practices and innovation. Vinay et al. (2024) examined AI's integration with blockchain, underlining its potential to improve security, transaction accuracy, and traceability. Similarly, studies such as Sied (2024) and Mathur (2024)

focused on digital warehousing, predictive maintenance, and cost management, emphasizing the opportunities and risks associated with AI-driven systems.

In summary, the literature illustrates a clear trajectory: from conceptual explorations and optimization studies to diversified applications across logistics functions, and finally to integrated approaches linking AI with sustainability, blockchain, and IoT. While remarkable progress has been made, critical challenges remain particularly ethical issues, data privacy concerns, and the shortage of skilled professionals. These gaps point to the need for future research that not only advances technological innovation but also ensures that AI adoption generates long-term strategic and sustainable value in logistics and supply chain management.

3. Materials and Methods

In order to fulfill the objectives of the study, a structured approach was adopted for material collection, selection of analytical tools, and addressing the research questions. This involved conducting a systematic literature review (SLR) complemented by field research. This study aims to identify the areas where artificial intelligence solutions are utilized in logistics and supply chains and to match these with real-world applications by utilizing a qualitative research methodology.

In the material collection phase, publications from the last 10 years (2014-2024) were reviewed using the keywords "logistics"^"artificial intelligence," "supply chain," and "artificial intelligence" through the following databases: DergiPark Akademik (TUBİTAK), Ebsco, Elsevier eBooks, Emerald Insight (Journals), Google Scholar, IEEE Xplore Digital Library (Journals, proceedings, standards), PlumX Metrics, ProQuest Dissertations and Theses Global, ProQuest Ebook Central (formerly Ebrary Academic Complete), Scopus (Elsevier index/abstract database), Springer E-Books, Taylor & Francis Online and Web of Science. Additionally, a field study was conducted by examining the websites and working reports of various organizations.

4. Findings

When examining bibliometric analyses conducted in the literature, it has been observed that artificial intelligence is applied in various processes within the supply chain, including planning, sourcing, manufacturing, delivery, returns, and enabling (Riahi et al,2021).

Recent studies are examined in Table 1 and are listed according to their application areas.

Table 1. Application areas of academic studies in the literature

Study/Publication Type	Applications
Brintrup, 2020 (Book Chapter)	The paper discusses the applications of artificial intelligence in supply chains, focusing on conceptual frameworks, SC AI capability blocks, industrial use cases, and challenges in the field.
Younis et al., 2021 (Journal Article)	The paper explores the use of artificial intelligence (AI) and machine learning (ML) in supply chains, emphasizing their potential to optimize performance and provide firms with competitive advantages. Key applications include optimizing operations, reducing the bullwhip effect, enhancing efficiency, and improving responsiveness.
Riahi et al., 2021 (Journal Article)	This study explores the impact of AI on supply chain processes, emphasizing the transformative roles of machine learning, robotics and natural language processing. It outlines the advantages AI brings to supply chains while noting the scarcity of research in this domain and advocating for deeper investigation.
Razzaq et al.,2022 (Book Chapter)	The paper examines AI integration in supply chain management, focusing on supplier, manufacturing, and logistics management. It presents real-world examples of AI's role in automating and optimizing processes across the supply chain, highlighting the benefits and value of AI solutions for corporations.

Table 1. Continued.

Călinescu, 2022 (Journal Article)	The paper explores the applications of blockchain and AI in logistics, highlighting benefits like transparency, cybersecurity, authenticity verification, smart contracts, freight tracking, and traceability. It emphasizes how these technologies can improve logistics efficiency by accelerating operations and reducing task completion time. The study shows how blockchain ensures data integrity, while AI enhances freight monitoring, dock management, and counterfeit detection.
Gong, 2022 (Journal Article)	The paper explores AI applications in logistics, focusing on algorithms for optimizing distribution paths in warehousing. It highlights AI's role in accurately predicting inventory levels and optimizing inventory measures, and examines the use of an improved swarm intelligence algorithm for optimizing logistics warehousing and distribution paths.
Toe et al.,2023 (Book Chapter)	The paper covers AI applications in supply chain management, including demand forecasting, automating quality assurance, estimating delivery times, and optimizing deliveries. These applications aim to enhance efficiency and reduce costs.
Sied, 2024 (Journal Article)	The paper explores digital warehousing and Artificial intelligence implementations in supply chain operations, focusing on their impact on product pricing and warehouse maintenance costs. It highlights how accurate inventory estimates provide a competitive edge and how AI enhances operational efficiency and competitiveness.
Kriouich et al., 2023 (Conference Paper)	This study explores AI applications in supply chain management, incorporating various techniques such as deep learning, machine learning, expert systems, natural language processing, fuzzy logic, knowledge representation, neural networks, social intelligence, Gaussian models, support vector machines, robotics, computer vision, and ant colony optimization. These methods are emphasized as pivotal tools for improving and optimizing supply chain processes.
Karpova et al., 2023 (Book Chapter)	The paper explores how AI, IoT, robotics, and intelligent analytics are used in managing flow processes within supply chains to improve business efficiency. It emphasizes the role of intelligent analytics in organizing big data and highlights the use of Process Mining and Data Mining to identify and address bottlenecks, enhancing operational effectiveness.
Mohsen, 2023 (Journal Article)	The paper examines AI applications in supply chain management, focusing on data analysis, demand predictions, optimizing logistics and transportation routes, and identifying inefficiencies. AI can improve responsiveness, reduce lead times, and lower costs. The research addresses the gap in understanding AI's impact on supply chain performance and highlights techniques and subfields within SCM that can benefit from AI integration.
Pereira et al., 2023 (Book Chapter)	The paper explores AI implementation in the supply chain, focusing on AI-driven big data analytics (AI-BDAC). It highlights AI-BDAC's role in improving internal integration, organizational processes, and supply chain agility, ultimately enhancing performance. The study emphasizes that advanced technologies like big data and AI can help organizations in emerging economies achieve better integration and performance.
Gołąbek, 2023 (Book Chapter)	The paper explores AI applications in a distributed supply chain control model for real-time product personalization and identification. It focuses on using AI to automate processes, enhance product quality, improve human-machine synergy, and enable accurate personalization within Industry 5.0. The research emphasizes developing a platform for managing company processes and products with AI, highlighting data analysis, optimization, and real-time product identification and classification.

Table 1. Continued.

Mora Lozano et al., 2024 (Journal Article)	The paper analyzes key private and public supply chain security programs in the Caribbean and Latin America, focusing on visibility and uncertainty for logistics managers in selecting security programs. It compares four major programs and develops a general framework using qualitative and quantitative methods. The research offers insights into managing security risks and highlights the need for guidance for companies looking to enhance supply chain security.
Hryhorak et al., 2023 (Journal Article)	The paper examines AI applications in supply chain management, focusing on transforming key business processes. It highlights the development of complex autonomous decision-making systems, specialist-AI interaction, and the shift from supportive to autonomous AI roles. The study emphasizes effectively combining human roles with AI to optimize processes, manage accountability, control mechanisms, and address ethical implications.
Starkina et al., 2023 (Journal Article)	The paper explores logistics integration technologies in retail trade networks, focusing on the ECR concept and CPFR technology. It examines how these technologies are used to address key supply chain issues and achieve integration. The main applications include implementing ECR and CPFR to enhance retail supply chains and mitigate management risks.
Zeng et al., 2023 (Journal Article)	The paper explores the use of Incessant Data Processing (IDP) for managing harmonized data in supply chain management, aiming to reduce errors and predict demand fluctuations. It utilizes federated learning to analyze information across the supply chain for better predictions. The research also simulates the process using IoT data, improving prediction accuracy, reducing analysis time, decreasing errors, and increasing adaptability.
Xue, 2023 (Journal Article)	The paper explores AI applications in supply chain management, including data analysis, forecasting, planning, scheduling, automation, risk management, and anti-fraud measures. AI aids in route optimization by analyzing real-time data, weather, and road conditions to cut costs and enhance delivery efficiency. It also highlights real-time monitoring of goods, predictive analysis for transportation demand, and inventory management.
Sohrabi, 2023 (Book Chapter)	The paper explores AI applications in logistics, such as warehouse operations, remote production, and smart tire technology. It demonstrates how AI creates new opportunities for problem-solving and quality development in logistics. The paper highlights AI's capability to rapidly process and interpret extensive data sets. and improve processes through machine learning as a key advantage for logistics companies.
Shobhana, 2024 (Book Chapter)	The paper examines various AI technologies; big data, machine learning, cloud computing, blockchain, chatbots, and ChatGPT across different sectors, enhancing efficiency and customer satisfaction. It details their use in supply chains, highlighting both benefits and limitations.
Rodríguez et al., 2024 (Book Chapter)	The paper explores a simulation model applied to the rice logistics at Cienfuegos port, aiming to optimize resource use in various logistics processes. It helps predict necessary resources for stable port operations and showcases different application scenarios, highlighting resource needs across the logistics chain.
Aliyev et al., 2024 (Book Chapter)	The paper examines ChatGPT's use in e-commerce and logistics to enhance customer support, provide personalized recommendations, and aid in product search. It highlights AI's role in creating a seamless customer experience by analyzing market trends and using customer data for tailored recommendations, discounts, and content. Applications include data collection from various sources to improve the e-commerce ecosystem through physical and virtual sensors.

Table 1. Continued.

Radovanovic, 2024 (Journal Article)	The paper explores cloud-based communication technologies and services relevant to logistics and supply chains, focusing on process visualization, data utilization, and ICT. It highlights how these technologies enable remote, real-time monitoring of processes, vehicles, devices, and people, offering valuable insights for improving efficiency and performance in business and research.
Vanoy, 2023 (Journal Article)	The paper explores AI applications in international logistics, focusing on process automation and data-driven decision-making. It also highlights AI's role in enhancing educational quality, optimizing processes, and personalizing learning in logistics and international business education. The research underscores AI's importance for operational efficiency in logistics and for preparing students for the labor market.
Sarıoğlu, 2023 (Book Chapter)	The paper explores AI-based predictions in supply chain management, emphasizing route determination, demand management, and inventory management as key applications. These applications aim to boost logistics efficiency and manage the supply chain effectively, enhancing business competitiveness and resilience in a dynamic environment.
Dwivedi, 2023 (Book Chapter)	The paper explores the utilization of AI in supply chain operations and logistics, focusing on how AI aids informed decision-making, cost reduction, and customer satisfaction. It highlights AI tools like automation and IoT for enhancing operational efficiency and decision-making, including demand forecasting, inventory management, transportation mode and route optimization, and carrier selection.
Shah et al., 2024 (Book Chapter)	The paper explores AI applications in logistics and supply chain management, focusing on planning, route optimization, resource management, and delivery effectiveness. It highlights AI-powered autonomous delivery systems for faster, more reliable delivery. Additionally, AI analyzes data to provide insights into customer behavior and demand patterns, aiding in demand forecasting, inventory optimization, and overall supply chain efficiency.
Pandey et al., 2024 (Book Chapter)	The study explores AI applications in supply chain management (SCM), emphasizing methods that boost efficiency, areas with significant AI potential, and the effects of AI on SCM performance. It discusses how AI supports demand forecasting, logistics and route optimization, and bottleneck identification, leading to enhanced demand responsiveness, shorter lead times, and cost reductions.
Vinay et al., 2024 (Journal Article)	The paper explores AI applications in optimizing logistics, predicting trends, and automating tasks to enhance blockchain supply chains. It highlights the practical applications and challenges of integrating AI with blockchain, showing how AI improves efficiency and accuracy, transaction times, data verification, and overall supply chain performance.
Petriashvili et al., 2024 (Journal Article)	The paper explores AI's role in identifying hazardous products by analyzing identification information at customs checkpoints and delivery locations. It aims to detect harmful commodity groups and substances. The research also highlights using machine learning algorithms for data preprocessing and analysis to identify products with harmful concentrations during initial data collection.
Eyo-Udo, 2024 (Journal Article)	The paper explores AI applications within supply chain operations, encompassing demand prediction, inventory control, and logistics enhancement. It highlights the impact of machine learning, robotics and natural language processing, and on decision-making, cost reduction, and resource allocation. The study emphasizes how AI improves supply chain efficiency through operational processes and strategic innovation, contributing to sustainability in supply chain management.

Table 1. Continued.

Mathur, 2024 (Journal Article)	The study investigates AI applications in Supply Chain Management (SCM), with a focus on areas such as demand forecasting, inventory control, logistics, and transportation. It outlines AI methods like time-series analysis, clustering, neural networks, SARIMA, and LSTM models. Additionally, it explores the role of blockchain and the Internet of Things (IoT) in enhancing supply chain traceability and operational efficiency.
Madancian et al., 2024 (Book Chapter)	The study focuses on four major AI applications in supply chain management: autonomous systems, predictive analytics, sustainability initiatives, and collaborative networks. These applications aim to transform the industry by facilitating real-time decision-making, forecasting market trends, promoting sustainability, and improving transparency and stakeholder coordination.

The most frequently repeated terms (keywords), ranked by occurrence, include Artificial Intelligence (AI), Supply Chain, Logistics, Management, Optimization, Technology, Processes, Data, Efficiency, Integration, Forecasting, Model, Performance, Prediction, Research, Systems, Automation, Algorithms, Security, Demand, Challenges, Inventory, Transportation, Warehousing, Blockchain, Distribution, and Risk (Figure 1). These keywords reflect the primary themes and focus areas in AI-driven supply chain research, highlighting the intersection of digital transformation, operational efficiency, and risk mitigation in modern logistics.

The prominence of terms such as "Artificial Intelligence," "Optimization," and "Automation" suggests that AI is increasingly leveraged to enhance decision-making, streamline operations, and improve overall supply chain performance. The presence of "Forecasting," "Prediction," and "Model" indicates a strong emphasis on data-driven insights for demand planning and risk assessment, which are critical for maintaining supply chain resilience. Additionally, "Security," "Risk," and "Blockchain" point to the growing concerns around supply chain vulnerabilities and the need for advanced solutions to ensure transparency, traceability, and protection against disruptions.

Moreover, the inclusion of "Inventory," "Warehousing," "Transportation," and "Distribution" underscores the role of AI in optimizing key logistics functions, from stock management to last-mile delivery. The increasing significance of "Integration" and "Technology" highlights the necessity for seamless digital connectivity among various supply chain stakeholders, facilitating real-time data exchange and collaboration. As AI continues to evolve, research is expected to further explore these domains, addressing emerging challenges while unlocking new opportunities for efficiency, sustainability, and competitive advantage in supply chain management.

Figure 2 illustrates the percentage distribution of academic publications on artificial intelligence in logistics and supply chain management across four periods between 2005 and 2025. While only a marginal share of studies appeared between 2005 and 2014, a notable growth occurred after 2020, with the years 2023–2025 alone accounting for more than 60% of the total publications. These findings highlight the recent acceleration of research in this field and demonstrate the increasing scholarly attention directed toward AI-driven logistics in the past five years.

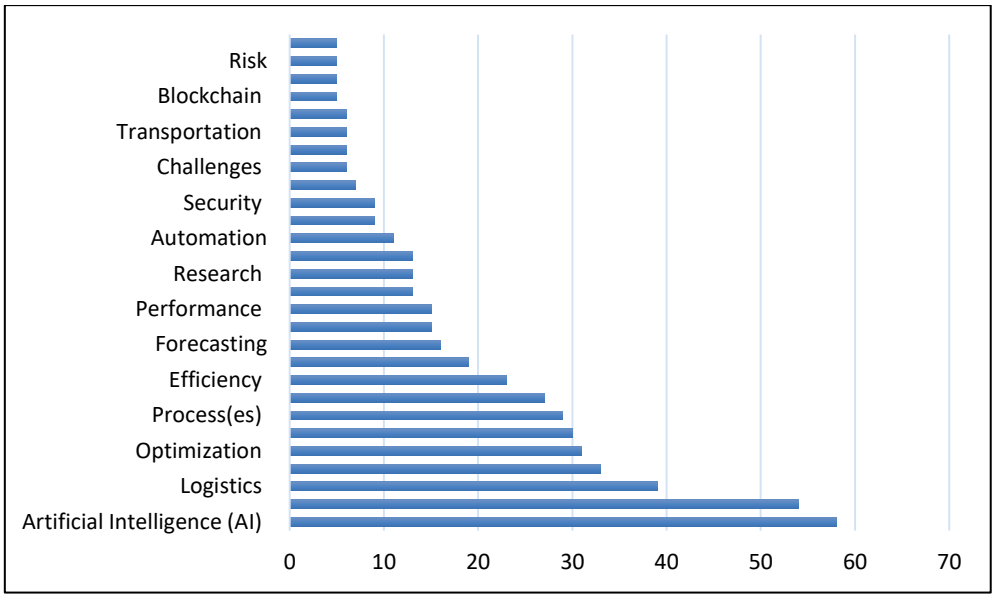

Figure 1. Frequency of keywords

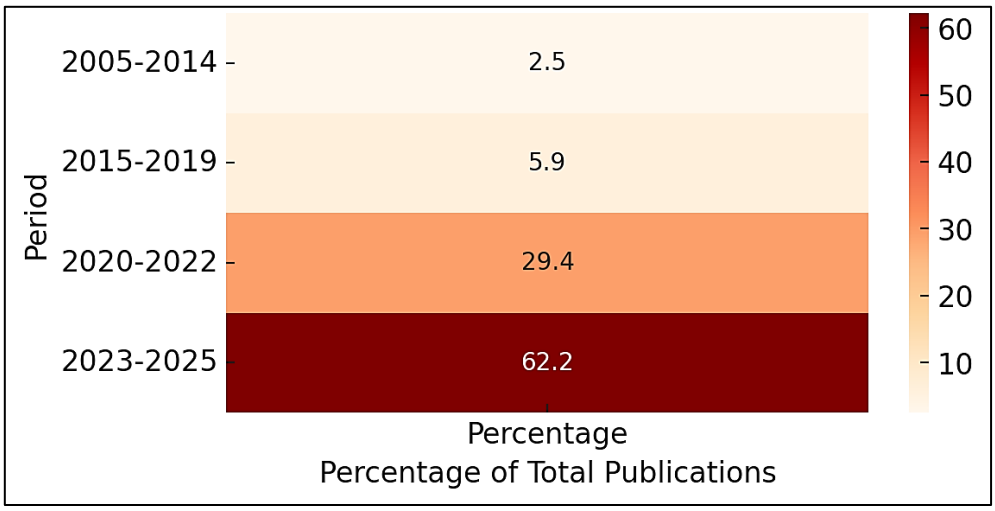

Figure 2. Percentage distribution of publications on artificial intelligence in logistics and supply chain management by period (2005–2025)

5. Results

The literature review reveals that artificial intelligence (AI) is applied across a wide range of areas within logistics and supply chain management. These areas are continually expanding with the addition of new subfields, leading to ongoing improvements in processes. Demand and Inventory Management, Warehousing, Value Added Services, Insurance, Transportation, Terminal Services and Customs are the basic logistics activities in supply chain management (Tanyas, 2008). Logistics activities are grouped under 7 headings with their sub-areas and artificial intelligence usage areas are determined by literature analysis (Table 2).

In total, 120 studies published between 2005 and 2025 were analyzed. The temporal distribution shows a sharp increase after 2018, with nearly half of the studies published in 2023–2024. Notably, the inclusion of recent 2025 contributions indicates that research on AI in logistics and supply chains continues to expand, with a growing focus on sustainability, resilience, and integration with emerging technologies.

Table 2. Use of artificial intelligence according to logistics activities

Logistics Activity	Logistics Activity Sub-fields	Artificial Intelligence Usage	Study
1. Demand and Inventory Management	• Demand Planning • Inventory Management • Order Management • Customer Services	• Demand Forecasting and Inventory Management	Praveen et al. (2019), Gayam et al. (2021), Mediavilla et al. (2022), Eldred et al. (2023), Amosu et al. (2024), Kumar et al. (2024).
2. Warehousing	• Free Warehouse • Bonded Warehouse • Temporary Storage Area	• Warehouse Automation and Robotics	Drissi et al. (2023), Khopade et al. (2023), Subramanian et al.(2023), Nishar (2024), Tsou (2024).
3. Value-Added Services	• Packaging • Labeling • Kit Preparation, etc.	• Predictive Maintenance • Personalized Customer Service • Automated Quality Control	Ying et al. (2005), Protic et al. (2020), Kmiecik (2023), Vandermerwe et al. (2023), Surabhi et al. (2024).
4. Insurance	• Risk Assessment • Appraisal • Insurance Services, etc.	• Fraud Detection and Security • Risk Assessment and Pricing • Customer Service and Chatbots • Customer Segmentation and Personalization • Forecasting and Analytics	Nuruzzaman et al. (2018) Schulte et al. (2019), Spindler et al. (2019) Dhieb et al. (2020), Gruzauskas et al. (2020) Lior (2021), Gupta et al. (2022), Jha et al. (2023).
5. Transportation	• Rail Transportation • Sea Transportation • Road Transportation • Air Transportation • Multimodal Transportation	• Route Optimization and Fleet Management • Maintenance Forecasting and Management • Energy and Fuel Management • Safety and Accident Prevention	Dekhtyaruk et al. (2021), Iyer (2021), Schoepflin et al. (2021), Parveen et al. (2022), Du et al. (2023), Bharadiya (2023) Kuo et al. (2024), Le et al. (2024), Ping et al. (2024).
6. Terminal Services	• Inspection and Supervision • Securing • Fumigation, etc.	• Sensor-Based Monitoring and Management • Smart Surveillance Systems • Automatic Image Analysis	De Langen et al. (2009), Protic et al. (2020), Halme et al. (2021), Sirotic et al. (2023).
7. Customs	• Import • Export • Transit, etc.	• Automatic Document Processing • Dynamic Tariffs and Tax Management • Violation Prediction	Kafando (2020), Boute et al. (2022), de Andrade (2023), Olomu (2023), Kyrychenko et al. (2023), Shubailat et al. (2024).

Figure 3. Application areas of artificial intelligence in logistics and supply chain (developed by the author)

Figure 3 highlights the applications of artificial intelligence (AI) in logistics and supply chain management. AI supports multiple domains, including predictive analytics, demand forecasting, route optimization, warehouse automation, inventory control, and risk management. These applications are further bolstered by processes such as customer behavior analysis, production planning, and dynamic routing.

The sector applications of artificial intelligence in the fields of logistics and supply chain have been identified through field research, with access obtained to the applications of 12 companies across 6 areas (Table 3). Table 3 presents the logistics and supply chain operations in which companies Walmart, Amazon, UPS, DHL, Ocado, Alibaba, Maersk, Siemens, FedEx, DHL, Kuehne + Nagel, and DB Schenker are utilizing artificial intelligence (AI). This comprehensive overview reveals the diverse ways AI is being adopted to enhance efficiency, reduce costs, and drive innovation. It underscores the growing importance of AI as a critical enabler for achieving competitive advantage in the logistics and supply chain sectors.

Table 3. Processes carried out with artificial intelligence support in logistics and supply chain

Processes	Company	Area of application	Study
Demand Forecasting and Inventory Management	**Walmart**	Walmart leverages AI to enhance inventory management by forecasting customer demand and aligning inventory levels to meet those needs. Their AI systems process extensive data from sources such as sales records, weather forecasts, and social media trends to ensure products are stocked appropriately and available when needed.	(Weber, and Schütte, 2019) (Hunt and O'Reilly, 2020) (Manocha and Harnal, 2022)
	Amazon	Amazon leverages machine learning algorithms for demand forecasting, which helps in reducing stockouts and overstock situations. The AI system forecasts future demand by analyzing historical sales data, seasonal patterns, and various relevant factors.	(Lari et al., 2022) (Liu, 2022) (Sierszen and Drabek 2024)
Route Optimization and Fleet Management	**UPS**	UPS's ORION (On-Road Integrated Optimization and Navigation) system uses AI to optimize delivery routes. By analyzing data such as traffic conditions, package delivery locations, and driver availability, ORION reduces fuel consumption, lowers operational costs, and improves delivery efficiency.	(Davenport, 2018) (Soumpenioti and Panagopoulos, 2023) (Olaoye and Henry, 2024)
	DHL	DHL employs AI-driven route optimization to enhance its delivery network. The company's AI system considers real-time traffic data, delivery time windows, and vehicle capacities to create the most efficient delivery routes.	(El Makhloufi, 2023) (Sohrabi, 2023) (Soumpenioti and Panagopoulos, 2023)
Warehouse Automation and Robotics	**Ocado**	The online grocery retailer Ocado uses AI-powered robots in its automated warehouses. These robots work collaboratively to pick and pack groceries, significantly reducing the time and labor required for order fulfillment.	(Cao, 2021) (Bogue, 2022) (Bogue, 2024)
	Alibaba	Alibaba's Cainiao Network employs AI and robotics in its smart warehouses to automate sorting and packing processes. The use of AI-driven robots has improved operational efficiency and reduced order processing times.	(Falcone et al., 2020) (Hu et al., 2022) (Tse and Pun, 2024)
Predictive Maintenance	**Maersk**	Maersk utilizes AI for predictive maintenance of its shipping fleet. The AI system analyzes sensor data from ships to anticipate potential equipment failures, enabling proactive maintenance and minimizing downtime.	(Durlik et al., 2024) (Kamau et al., 2024) (Sahoo, 2024)
	Siemens	Siemens integrates AI in its logistics operations to perform predictive maintenance on machinery and equipment in its manufacturing and distribution facilities. This approach minimizes unexpected breakdowns and enhances operational efficiency .	(Woschank et al., 2020) (Annanth et al., 2021) (Aljazzar, 2023)
Customer Service and Chatbots	**FedEx**	FedEx uses AI-powered chatbots to handle customer inquiries, track shipments, and provide real-time updates. The AI chatbots improve customer service efficiency by handling routine queries, freeing up human agents to manage more complex issues.	(Mukhtarov,2023) (Tung et al., 2024) (Aghazadeh and Khoshnevis, 2024)
	DHL	DHL's AI chatbot assists customers with shipment tracking and delivery updates. The chatbot leverages natural language processing (NLP) to understand and respond to customer queries effectively .	(Nguyen,2020) (Kern, 2021) (Lysenko et al., 2023)

Table 3. Continued

Fraud Detection and Security	**Kuehne + Nagel**	Kuehne + Nagel employs AI to detect fraudulent activities in its logistics operations. The AI system analyzes transaction data to identify unusual patterns and potential fraud, enhancing the security of the supply chain.	(Newman, 2018) (Chang et al., 2020) (Shahriar, 2023)
	DB Schenker	DB Schenker uses AI to enhance cybersecurity measures in its logistics network. The AI system monitors network traffic and identifies potential security threats, ensuring the protection of sensitive data .	(Negruţiu et al., 2020) (Skender, et al., 2022) (Wang and Wijesinghe, 2024)

6. Conclusion and Recommendations

This study has examined the transformative role of artificial intelligence (AI) in logistics and supply chain management (SCM) by synthesizing insights from both industry applications and academic research. The findings highlight that AI contributes significantly across multiple logistics domains, including demand forecasting, inventory management, transportation optimization, warehouse automation, predictive maintenance, customer service, and supply chain security. When integrated with big data analytics, AI enables organizations to improve decision-making, reduce costs, and allocate resources more effectively.

Industry cases such as Walmart, Amazon, and UPS illustrate the tangible benefits of AI adoption, ranging from enhanced demand planning and stock management to optimized routing and last-mile delivery. Similarly, firms like Ocado and Alibaba demonstrate the efficiency gains of automated warehousing, while Maersk and Siemens showcase predictive maintenance in reducing downtime. These examples confirm the practical value of AI in achieving operational excellence.

However, the literature analysis also indicates that research is unevenly distributed across logistics activities. While transportation and demand management are well-represented, areas such as customs, terminal services, and value-added logistics remain underexplored. This gap underscores the need for future research to investigate underrepresented domains, evaluate cost–benefit dimensions, and assess AI's role in advancing sustainability and resilience agendas. Moreover, ethical considerations, data privacy, and workforce adaptability should be incorporated into future analyses to ensure that AI adoption delivers long-term strategic and societal value.

A statistical overview of the reviewed studies further reinforces these conclusions. Out of the 120 publications examined, 51 studies (43%) could be directly classified into logistics activity domains, while the remaining 68 did not contain explicit activity-related keywords in their titles and were considered indirectly. Among the classified works, the largest share focused on transportation (24.3%) and insurance (21.6%), followed by demand and inventory management (16.2%) and customs (16.2%). In contrast, terminal services (10.8%) and value-added services (7%) emerged as the least researched areas. These figures demonstrate that although AI is widely applied across logistics, certain domains are still underrepresented, highlighting clear avenues for future academic inquiry.

In summary, AI offers logistics firms a substantial competitive advantage, but realizing its full potential requires overcoming barriers such as financial constraints, technological readiness, and skills shortages. Future studies should therefore expand the scope beyond efficiency and optimization to include sustainability, governance, and cross-sectoral comparisons, thereby providing a more comprehensive understanding of AI-driven transformation in logistics and supply chains.

Declaration of Contribution of Researchers

The authors' contribution rates to the study are equal.

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