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# Artificial Intelligence (AI) Adoption in Supply Chain Management Dynamics of Manufacturing Firms in Emerging Markets

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## Abstract

While big firms in developed countries have embraced Artificial Intelligence (AI) for Supply Chain Management (SCM), same cannot be said for firms in emerging markets, hence necessitating this study to examine AI adoption in plastic manufacturing firms in emerging markets, as a broad objective. The study relied on secondary qualitative data, from peer-reviewed journals published between 2020-2025. Data collection followed a structured literature review protocol, and findings were analyzed thematically. The thematic analysis for the first objective which sought to identify the types of AI applicable in SCM indicated a clear set of AI technologies applicable to SCM in plastic firms including machine leaning, robotics, computer vision and natural language processing. The result for objective two which sought to determine the prospects of adopting AI in SCM plastic manufacturing firms in emerging markets showed that plastic firms that adopt AI for their SCM stands to gain from more accurate forecasting, improved quality, lower costs, and stronger competitiveness. Findings for objective three which assessed challenges of AI adoption in SCM in plastic manufacturing firms in emerging markets revealed a set of interrelated barriers including economic (costs), infrastructural (power/connectivity), technical (data availability/quality), human (skills and resistance), and institutional (security/privacy and policy). The study concluded that indeed, there are several areas AI can be adopted in SCM in manufacturing firms in emerging markets, and that when deployed, they stand to gain massively, notwithstanding the challenges they could face while attempting to adopt it. The study, therefore, among others recommended that plastic manufacturing firms in emerging markets need to adopt practical AI tools for demand forecasting, warehouse automation, and quality control to improve efficiency, reduce waste, and enhance responsiveness.

**Keywords:** Artificial Intelligence (AI), Machine Learning, Technology, Supply Chain Management, Emerging Markets.

## Introduction

The world is increasingly tilting towards technology everywhere, and everything technology. A world where technology is gradually permeating practically all aspect of human and organizational lives. To this end, Nwabuike, Onodugo, Arachie and Nkwunonwo (2020) aver that with the advent of the Fourth Industrial Revolution, the globe is currently seeing rapid technological advancement. Similarly, Arachie, Nzewi, Emejulu &

Kekeocha (2020) posit that the world is becoming increasingly technologically driven, and taking centre stage in the whole technology savvy world is Artificial Intelligence (AI).
Artificial intelligence (AI) is a technology enabling computers and digital devices to learn, read, write, communicate, perceive, create, engage, analyze, provide recommendations, and perform many tasks often executed by people (Benbya, Davenport & Pachidi 2020). Therefore, AI acts like human, not just any human, but intelligent humans, as it relieves people of their duties; performing and automating mostly repetitive tasks in organizations. Duan, Edwards and Dwivedi (2019) see AI as the ability of machines to learn from experience and make decisions on series of performance as a human with intelligence.
The deployment of AI in various fields has witnessed astronomic increase lately. Arachie, Dibua and Idigo (2023) state that AI has become prominent in various domains, including medical, engineering, and finance. Supply Chain Management (SCM) as a field has also been receiving a lot of attention in terms of AI deployment, following isolated deployment in the past. The application of AI has primarily been documented in discrete instances or proofs of concept, with limited comprehension regarding its potential to facilitate capability enhancement at the supply chain level (Sharma et al. 2022a).
One of the most disruptive technologies for contemporary operations and supply chain management (OSCM) is AI (Fosso Wamba et al. 2021; Dubey et al. 2021; Grover, Kar & Dwivedi, 2022), The emergence of AI in SCM signifies a transitional period in which technology surpasses conventional limits, providing unparalleled prospects for optimization and efficiency. It signifies a substantial transition towards more agile, responsive, and intelligent supply chain systems (Nsisong, 2024). This is because AI has been observed to improve effectiveness and efficiency in the SCM processes. AI plays an essential role in improving processes and functions in the supply chain (Molopa, 2023). AI-powered SCM automates and optimizes supply chain processes by integrating multiple technologies such as predictive analytics, Machine Learning (ML) algorithms, natural language processing (NLP), and robotics (Goswami, Mondal, Sarkar, Gupta Sahoo & Halder, 2025).
Artificial intelligence (AI) technologies, including ML, NLP, and predictive analytics, offer unparalleled solutions for tackling intricate supply chain issues (Crawford et al., 2023). Utilizing extensive datasets, AI facilitates immediate insights and decision-making, enhancing operations and minimizing inefficiencies (Attah, Garba, Gil-Ozoudeh & Iwuanyanwu, 2024). AI-driven demand forecasting enables organizations to predict market trends with enhanced precision, hence reducing risks linked to overstocking or under-stocking (Umana et al., 2024).
Many big players in the technology field have put the effort in applying AI in SCM, such as Amazon, Walmart, Philips, eBay (Dwivedi et al. 2019; Mahroof 2019). However, the level of adoption in emerging markets remain largely underexplored with respect to AI deployment in the supply chain practices, specifically in plastic manufacturing firms. It is against this backdrop that this study was necessitated to evaluate AI usage SCM within the plastic manufacturing industry in emerging markets. Specifically, this study seeks to:

i. Identify the types of AI that could be used in SCM in plastic manufacturing firms in emerging markets.
ii. Determine the prospect of adopting AI in SCM in plastic manufacturing firms in emerging markets.
iii. Assess challenges of AI adoption in SCM in plastic manufacturing firms in emerging markets.

## Review of Related Literature

**Artificial Intelligence (AI)**

Artificial Intelligence is perceived differently by different people. While most persons see it as machines or applications performing the duties of intelligence individuals, others see it as a science or field**.** Scientifically, Russell and Norvig (2016); Soleimani (2018) define AI as the study and design of a branch of intelligent agents being developed to understand the environment rationally and take actions intelligently. A popular textbook by Russell and Norvig (2016) defines AI as the intelligence exhibited by machines and software, constituting a domain of computer science aimed at developing this intelligence. The objective of AI is to comprehend intelligent beings (Soleimani 2018). That is, making machines to act like humans who are assumed to be intelligent. For the action of a machine or application to be captioned as that of AI, it has to be smart and intelligent. That is why Arachie, Nwosu, Ugwuanyi and Muhammed (2025) aver that AI operates when machines, programs, and software are configured to emulate human reasoning, enabling them to make intelligent decisions and alleviate human duties. Similarly, Arachie Dibua and Idigo (2023) point out that AI is the ability of machines to do what intelligent humans do.

Also concentrating on the intelligent nature of machines when AI is being discussed or deployed is Toorajipour, Sohrabpour and Fisch (2021) who describe AI as a huge topic of computer learning that concentrates on producing intelligent machinery that can execute assignments that would otherwise involve people's intelligence. By mimicking human intellect and learning, AI technologies let systems examine enormous data sets, produce insights, and make judgments with extraordinary speed and accuracy (Shankar, 2018; Libai et al., 2020; Li & Xu, 2022). In this, the accuracy and speed of execution takes centre stage. If the speed with which tasks are executed and the accuracy of the tasks being executed are in question, then it is not AI that is being deployed.

An argument put out by Arakpogun, Elsahn, Olan, and Elsahn (2021) is that AI is a collection of information and communication technologies that mimic human intelligence. According to Rai, Constantinides, and Sarker (2019), it gives machines the ability to demonstrate cognitive capabilities that were previously only linked with human minds. It is regarded to be a machine model technology that has the ability to effortlessly improve the capacities of human intelligence (Dellermann, et al., 2021). This is accomplished by executing technological activities ranging from simple to sophisticated and advanced (Dellermann, et al., 2021; Chamorro-Premuzic, Polli, & Dattner, 2019).

Different industries have seen the rise in AI deployment, that it is now regarded as being ubiquitous. Cao et al. (2021) state that the recent emergence of sophisticated algorithms, along with extensive datasets and enhanced computer power, has augmented the popularity and pervasiveness of AI across several industry sectors. This pervasiveness has led to a number of AI applications, such as recommendation systems, human-speech interacting devices, advanced web search engines, self-driving cars, and generative and creative tools (Modgil, Gupta, Stekelorum & Laguir, 2021; Pournader et al. 2021).

**Supply Chain Management (SCM)**

While organizations that are into production of goods hold the number of products produced to high esteem, the processes leading to such production is also as important. Hence, the concept of supply chain management (SCM), which does not only entail the processes of procuring raw materials or input to final production, but the management of both raw materials, machines and people that are intricately interwoven. Stefanovic and Stefanovic (2009) posit that from the business entity perspective, supply chain represents not only the products but also the entire system of organisations, people, resources, and even services. From the business process perspective, a supply chain often spans the entire globe and involves production, trade, and logistics organisation around the world (Zijm & Klumpp 2016). However, the end product is always the central point of all SCM, which is the products that are finally produced. To this end, Misra (2018) avers that SCM is the practice of integrating a company's and its suppliers' business processes so that information, goods, and services are made available to customers at an added value. The process entails synchronising policymaking and activities so that the correct number of products are delivered to the correct location and customer at the correct time, while minimising costs and satisfying service requirements (Misra, 2018).

Lately, just like it is in most industries and practices, SC has witnessed the influx of technology into its core operations. Supply chain and logistics are slowly becoming intricate and supply chain managers are more into technological modernisations to make informed decision (Molopa, 2023). Hence, operations and supply chain managers in the recent era need to understand better how technologies such as AI can be applied to solve SCM problems. In the light of this development, top consulting firms like McKinsey, Deloitte, Ernst & Young, among others, have highlighted the potential of AI applications to create business value and enable competitive advantage (Mackinsey & Company 2020; Deloitte, 2020; Ernst & Young, 2020). AI-powered SCM is a rapidly emerging field that uses the most recent developments in AI and machine learning (ML) to improve and simplify supply chain processes (Goswami, Mondal, Sarkar, Gupta, Sahoo & Halder, 2025).

**Application of Artificial Intelligence (AI) into Supply Chain Management (SCM)**

Artificial Intelligence (AI) has been consistently embraced by a range of industries, e-commerce and manufacturing, among others for supply chain purposes (Usmani, Sharma, Bung, kumar, Ahmad & Gupta, 2023). The historical development of AI in SCM is characterized by significant milestones that demonstrate the increasing complexity and integration of AI technology. The evolution of AI in SCM, from rudimentary algorithms for inventory control to the implementation of ML models for dynamic pricing and demand forecasting, demonstrates a shift towards increasingly autonomous and intelligent systems (Nsisong, 2024).

The utilization of AI in SCM is multifaceted, encompassing numerous domains of the supply chain, including forecasting, planning, execution, and monitoring (Nsisong, 2024). Iwuanyanw et al. (2024) assert that various AI technologies are employed in logistics to tackle the intricate issues encountered by contemporary supply chains. ML, predictive analytics, and robotics are particularly noteworthy among these. Kaplan and Haenlein (2019) assert that research efforts concentrate on many aspects, including natural language recognition and processing, image recognition, and object manipulation. Moreover, AI technologies can be categorized into many sorts, such as analytical, human-inspired, and humanized. Usmani, et. at. (2023) asserts that AI is predominantly perceived as robotics; yet, it encompasses a broader technological spectrum, including ML, NLP, learning systems, gaming systems, and object identification (Arachie, Dibua & Idigo, 2023).

Weber, Beutter, Weking, Böhm and Krcmar (2022) assert that ML and deep learning (DL) are two significant methodologies in the domains of SCM and AI implementation. ML employs algorithms, including supervised, unsupervised, and semi-supervised techniques, to train software agents. Nonetheless, DL depends on artificial neural networks to execute complex learning tasks (Elavarasan & Pugazhendhi, 2020). Learning algorithms, including artificial neural networks, Bayesian networks, genetic algorithms, and support vector machines, utilize advanced processing capabilities to execute tasks such as association, classification, clustering, and regression. AI has demonstrated efficacy in numerous domains, including robotics, ML, data intelligence, electronic gaming, semantic modeling, and the modeling of human performance (data, networks) (Elavarasan & Pugazhendhi, 2020).

Summarily, AI might be adopted in the following areas:

a) Learning systems that can adapt behaviours based on real-time data (Sharma et al. 2022b).
b) Situation-aware systems that are able to identify the existing conditions, and adapt behaviours accordingly (D'Aniello et al. 2022).
c) Autonomous decision-making systems that can make decisions differently from traditional decision support systems (Sharma et al. 2022b).
d) Processing of streaming images, video, audio and non-structured text type of data (D'Aniello et al. 2022).

**Table 1: Some Examples of Industry Experiences of AI in SCM**

| Company | Type of AI | Example of Application | Example of Main Benefits |
|---|---|---|---|
| **Amazon** | Robots | Warehouse operations | Productivity improvement and errors minimisation |
| **DHL** | IDEA algorithm | Routes optimisation and staff allocation | Order-picking processes improvement, cost minimisation, and e-fulfilment optimisation |
| **General Motors** | Computer vision | Monitoring failing robotics in assembly operations | Predictive maintenance and downtime minimisation |
| **Goodyear** | AI sensors with IoT | Smart tyre | Monitoring and control of the tyre changes and self-repair in case of damage |
| **Nestlé** | Augmented reality (AR) | Remote production and assistance, connecting suppliers, people and factories | Operations efficiency increase, quick response, $CO_2$ minimisation |
| **Netflix** | Machine learning | Movies and content production | Resources and production process optimisation, and customer product prediction |
| **Atomwise** | Deep convolutional neural network | Drug discovery | Drug discovery process optimisation |

Source: Wamba, Queiroz, Guthrie & Braganza (2021). *Industry experiences of artificial intelligence (AI): Benefits and challenges in operations and supply chain management. Production Planning & Control.* https://doi.org/10.1080/09537287.2021.1882695

**Prospect of Adopting Artificial Intelligence (AI) in Supply Chain Management (SCM)**

The potential of AI in SCM deployment is quite enormous as captured in extant literature. Kumari et al. (2022) highlight the transformative potential of AI in SCM, emphasizing its capacity to bridge the gap between large corporations and small to medium-sized enterprises (SMEs) through innovative and cost-effective solutions. Helo and Hao (2021) point out the role of AI in optimizing routing and scheduling, taking into account factors such as traffic conditions, vehicle capacity, and delivery windows. This optimization they say can lead to reduced transportation costs, lower carbon emissions, and improved delivery times. Furthermore, AI-powered autonomous vehicles and drones are beginning to play a role in last-mile delivery, promising to revolutionize the logistics sector (Nsisong, 2024).

The human resources of an organization also benefit from the implementation of AI in SCM. Chaudhari (2022) emphasizes the importance of AI in amplifying the strategic and creative capabilities of human resources, therefore, boosting human intelligence rather than supplanting it. Through the analysis of diverse data sources, AI can detect potential hazards and vulnerabilities in the supply chain, encompassing geopolitical threats and possible supply interruptions. This enables organizations to build contingency plans and strategies to proactively manage these risks (Nsisong, 2024). Kumari et al. (2022) affirm the optimization potential of AI, emphasizing its role in demand forecasting, inventory management, and logistics efficiency. Nsisong (2024) asserts that AI-powered chatbots and virtual assistants can furnish customers with real-time tracking information, address inquiries, and manage returns and swaps.

Chaudhari (2022) discusses the application of AI techniques in demand forecasting, supply forecasting, and pricing planning, among others. By leveraging AI, companies can improve their processes, reduce costs and risks, and increase revenue. The ability to accurately predict demand and optimize inventory levels based on real-time data analytics is a key advantage of AI in SCM, leading to more efficient and cost-effective operations (Nsisong, 2024). AI-powered SCM solutions may assist firms in better forecasting inventory demands, reducing waste, accelerating delivery times, and increasing overall efficiency (Goswami, et al., 2025). AI infusion in SCM also improves the efficiency in tracing products when need be. Goswami, et al., (2025) state that AI-powered SCM also has the potential to increase supply chain transparency and traceability.

The green practices of corporations can also be improved to assist firms in achieving environmental sustainability. The incorporation of AI into SCM promotes the implementation of environmentally sustainable practices, in accordance with the increasing focus on sustainability and ecological accountability (Nsisong, 2024). The amalgamation of AI with SCM enhances operational efficiency and directs supply chains towards a more sustainable future (Nsisong, 2024). Gupta, Kumar, and Khurana (2023) examine the capacity of AI to harmonize supply chain operations with environmental considerations and sustainability requirements. The uncertainty inherent in supply chains can be mitigated through the implementation of AI throughout all SCM operations. Atwani, Hlyal, and ElAlami (2022) assert that AI's capabilities can mitigate difficulties including demand uncertainty, stochasticity, and the bullwhip effect.

The most outstanding potential of AI infusion into SCM is its ability to improve efficiency, reduce cost and make for data backed decision making. This was captured by almost all the scholars that have written about the improvements that comes about as a result of AI deployment in SCM. Rahim, Rahman, Ahmi and Waheed (2024) aver that technologies such as ML, deep learning, predictive analytics, and automation can provide better insights, improve operations, enhance efficiency and productivity, improve customer satisfaction, and streamline the decision-making process. AI according to Akerele et al., (2024) markedly improves operational efficiency through the automation of diverse jobs and the optimization of processes throughout the supply chain. AI employs ML algorithms to analyze supply chain data, identifying inefficiencies such as bottlenecks, redundant processes, and delays, while proposing methods to optimize operations. AI-driven anomaly detection technologies can identify possible disturbances early and facilitating proactive actions (Iwuanyanwu et al., 2024). Moreover, AI applications in robotics and automation optimize warehouse operations, enhancing productivity and diminishing dependence on manual labour (Attah et al., 2024).

**Challenges of Artificial Intelligence (AI) adoption for Supply Chain Management (SCM)**

Just like it is in most innovations and discoveries, at the early stages, there are always stumbling blocks against early adopters. AI is no difference, as there are bottlenecks that fight against its deployment by both small firms and firms in developing or emerging economies of the world, this is despite its enormous potentials when, and if eventually adopted. While AI offers significant potential for enhancing business processes, improving decision-making, and driving innovation, its integration into organizations comes with several challenges and limitations (Gil-Ozoudeh et al., 2023; Akinsulire et al., 2024). The most common challenges that have been identified in extant literature and industry experts include finance, resistance, and poor enabling infrastructures and laws. There are also issues of competencies and security concerns. Wamba et al. (2021) identify challenges to AI incorporation in SCM to encompass data privacy concerns, the need for skilled personnel, and the integration of AI technologies with existing systems. Mikalef et al. (2021) point to the fact that existing issues still preventing firms from deploying AI in their SCM processes include lack of transparency, concerns about data privacy and security, disbelief in human-machine relations, and biases when devising or training algorithms (Levy 2018; Leyer & Schneider, 2021). Similarly, Adewusi et al. (2024) state that challenges bedevilling companies from adopting AI in SCM include data privacy concerns, cybersecurity, and the ethical considerations.

The hurdles to AI adoption in SCM span ethical considerations, data privacy, transparency, and visibility (Dwivedi, et al., 2023), copyright issues, the lack of regulatory templates, and workforce adaptability (Budhwar et al., 2023; Dwivedi, al., 2023). On their part, Adobor, Awudu and Norbis (2023) examined the organizational and managerial obstacles that hinder the smooth incorporation of AI into SCM and discovered that although, AI has the ability to transform supply chain operations, the absence of economic justification, strategic planning, and essential competences impedes its implementation. According to Attah, et al., (2024), these challenges may include financial constraints and technical barriers to ethical considerations and organizational resistance. Beyond financial costs, the technical expertise required to successfully implement AI is another barrier to adoption. AI technologies rely on sophisticated algorithms, machine learning models, and data science methodologies, which demand a high level of expertise (Barrie et al., 2024).

Artificial Intelligence systems depend on extensive data to produce insights and inform judgments, rendering ethical issues with data utilization and privacy substantial obstacles to their implementation (Bassey et al., 2024). AI models necessitate access to sensitive personal data, like customer information, purchase histories, and behavioral patterns, to provide tailored experiences or enhance corporate operations (Attah, et al., 2024) A notable obstacle to AI integration is organizational resistance to change (Attah, et al., 2024). Employees and management may exhibit skepticism about AI adoption due to apprehensions around job displacement, the possible disruption of established workflows, or fear of uncertainty (Agupugo et al., 2022). A multitude of employees believe that AI may supplant their positions, resulting in job displacement or alterations in job duties. This apprehension can generate opposition to AI adoption and impede the seamless integration of emerging technology. Furthermore, entrenched organizational cultures may impede AI integration (Attah, et al., 2024).

## Methodology

This study adopts a descriptive research design. The descriptive design is appropriate because the research seeks to evaluate the impact of Artificial Intelligence (AI) on supply chain management (SCM) within plastic manufacturing firm. By employing this design, the study will systematically describe and document the types of AI applicable to SCM, the challenges of AI adoption, and the prospects of integrating AI into the sector. The sources of data for this study is majorly secondary. These sources included peer-reviewed journals and articles accessible through well-established academic databases such as Web of Science, Scopus, Goggle Scholar, ResearchGate, Academia and Semantic Scholar. The data collection instrument for this study is a systematic literature review (SLR) protocol, which provide a structured framework for gathering relevant secondary data. The inclusion criteria included only peer-reviewed journals and articles published between 2020 and 2025, in order to ensure that data reflected current trends and developments. Non-scholarly materials, outdated sources, and studies unrelated to AI in supply chain management were excluded. This instrument ensured that the literature collected was relevant, credible, and aligned with the research objectives. Validity and reliability were ensured by using only peer-reviewed and credible academic sources. The restriction to studies published between 2020 and 2025 enhanced the relevance of findings by focusing on recent developments in AI and SCM. Findings from one study were crossed-checked against others to ensure consistency. This triangulation of sources enhanced the reliability of the study. The process of data collection began with the identification of keywords, followed by the screening of abstracts and full texts to determine relevance. The selection of studies was guided by the inclusion and exclusion criteria. A total of 30 peer-reviewed journal articles were initially downloaded, after initial screening to ensure they follow the inclusion and exclusion criteria, only 16 articles were then utilized for the analysis. Data were analyzed using thematic analysis. Thematic analysis was suitable because it allowed the researchers to identify recurring ideas and patterns within the literature. The process began with a thorough reading of the selected articles to gain familiarity with their content. Important points were then coded and grouped into themes. These themes were aligned with the research objectives. By synthesizing findings under these thematic categories, the analysis provided a structured and meaningful interpretation of the data.

## Data Presentation, Analysis and Discussion

### Findings and Thematic Analysis

This section presents the thematic analysis conducted using Braun and Clarke's (2006) six-step approach. The analysis drew on secondary qualitative data derived from the reviewed literature, allowing for the identification of recurring patterns, meanings, and relationships across scholarly discussions on AI adoption in SCM within plastic manufacturing firms in emerging markets. The six steps are familiarization, coding, theme generation, theme review, theme definition, and reporting. These steps guided the analytical process. The analysis yielded three overarching themes aligned with the study's objectives which are to identify the types of AI applicable in SCM, assess challenges of AI adoption, and determine prospects of adopting AI in SCM plastic manufacturing firms in emerging markets.

**Table 2: Types of AI applicable in SCM in manufacturing firms**

| Codes | Theme | Description | References |
|---|---|---|---|
| Demand forecasting, predictive analytics, supervised learning, ML models | Machine learning & predictive analytics | ML algorithms and predictive analytics support demand forecasting, inventory optimisation, supplier coordination and predictive maintenance—helping reduce uncertainty and align production with market demand. | Zouari et al. 2021; Zhao et al. 2022; Choi 2021 |
| Warehouse robots, automated sorters, Robotic Process Automation (RPA) for administrative tasks | Robotics & RPA | Physical robots improve warehousing/handling while RPA automates repetitive administrative workflows (invoicing, order processing), lowering errors and cycle times. | Ivanov & Dolgui 2021; Kamble et al. 2021; Gao et al. 2020 |
| Image inspection, visual defect detection, camera sensors | Computer vision for quality control | Computer vision systems inspect moulded parts (surface defects, bubbles, dimensional issues) in real time, increasing quality assurance and reducing waste. | Zhao et al. 2022; Wang et al. 2020 |
| Chatbots, automated order-tracking, extraction from unstructured text | Natural language processing (NLP) & conversational AI | NLP enables automated supplier/customer interactions, extracts useful signals from unstructured communications and supports order management. | Chopra & Meindl 2022; Liu et al. 2020 |
| Integrated analytics platforms, digital twins | AI-driven decision-support systems & digital twins | Hybrid platforms (data + AI) and digital twins enable scenario testing, end-to-end visibility, and faster decisions across procurement, production and logistics. | Ivanov & Dolgui 2020; Wamba et al. 2021 |

Source: Literature Review in the Study, 2025

Table 1 gives the thematic analysis of the first objective which seeks to identify the types of AI applicable in SCM. The analysis indicates a clear set of AI technologies applicable to SCM in plastic firms: ML (for forecasting and maintenance), robotics/RPA (for physical and back-office automation), computer vision (for quality control), NLP (for communications and unstructured data), and integrated AI platforms/digital twins (for decision support and simulation). These tools map directly to the operational needs of plastic manufacturing (forecasting, quality, warehousing, supplier interaction) identified across the review.

**Table 3: Prospects of AI adoption in SCM**

| Codes | Theme | Description | References |
|---|---|---|---|
| Improved forecasts, reduced stockouts, buffer optimisation | Enhanced forecasting & inventory optimisation | AI-driven forecasting reduces stock mismatches, lowers holding costs and aligns production to demand variability. | Zouari et al. 2021; Zhao et al. 2022; Umana et al. 2024 (as cited) |
| Automated inspection, fewer defects, predictive maintenance | Superior quality control & predictive maintenance | Computer vision and predictive analytics detect defects early and schedule maintenance to reduce downtime and scrap. | Zhao et al. 2022; Ivanov & Dolgui 2021; Wang et al. 2020 |
| Faster throughput, lower cycle times, process automation | Operational efficiency & cost reduction | Robotics, RPA and process automation accelerate workflows, reduce errors and compress lead times, improving unit economics. | Kamble et al. 2021; Ivanov & Dolgui 2021 |
| Data-driven strategy, market responsiveness | Competitive advantage & strategic agility | AI enables firms to respond faster to market shifts, customise offerings and compete beyond local markets. | Wamba et al. 2021; Garcia-Murillo & Annabi 2020 (as cited) |
| Traceability, compliance, sustainability gains | Transparency, compliance & sustainability prospects | AI combined with digital records improves traceability, supports compliance and enables resource-efficient (greener) operations. | Goswami et al. 2025 (as cited); Jabbour et al. 2020 |

Source: Literature Review in the Study, 2025

Table 2 presents the result for objective two which seeks to determine the prospects of adopting AI in SCM plastic manufacturing firms in emerging markets**.** The result shows that despite the constraints, the literature highlights compelling operational and strategic benefits: more accurate forecasting, improved quality, lower costs, and stronger competitiveness. These prospects position AI not only as an efficiency tool but also as an enabler of traceability and sustainability, important for export readiness and regulatory compliance.

**Table 4: Challenges of AI adoption in SCM**

| Codes | Theme | Description | References |
|---|---|---|---|
| Capital Expenditure (CAPEX), Operating Expenditure (OPEX), software/hardware costs | High implementation & maintenance costs | Capital expenditure for hardware, software licensing and ongoing maintenance limits uptake—especially for SMEs in the plastic sector. | Kamble et al. 2021; Zouari et al. 2021; Choudhury et al. 2022 |
| Unreliable power, poor internet, weak ICT infrastructure | Infrastructural deficiencies | Unstable electricity and limited broadband hinder real-time AI applications and cloud/edge deployments in many emerging-market settings. | Ivanov & Dolgui 2021; Zhao et al. 2022; Eze et al. 2023 (as cited) |
| Lack of data, poor data quality, fragmented records | Data availability & data quality issues | AI models require historical, structured data; many firms lack such datasets or have fragmented records, limiting model performance. | Wamba et al. 2020; Zhao et al. 2022 |
| Shortage of skilled personnel, workforce resistance | Skills shortage & organizational resistance | Limited local AI/data expertise and fear of job displacement create human-capital and cultural barriers to smooth adoption. | Nnaji & Ugwoke 2022; Ivanov & Dolgui 2021; Attah et al. 2024 (as cited) |
| Privacy, security, algorithmic bias, lack of policy | Data governance, security & policy gaps | Concerns about data privacy, cybersecurity risks, ethical use and absence of clear regulatory frameworks reduce organizational willingness to deploy AI. | Wamba et al. 2021; Chopra & Meindl 2022; Zouari et al. 2021 |

Source: Literature Review in the Study, 2025

Table 3 indicates the findings for objective three which seeks to assess challenges of AI adoption in SCM in plastic firms in emerging markets. The analysis converges on a set of interrelated barriers: economic (costs), infrastructural (power/connectivity), technical (data availability/quality), human (skills and resistance), and institutional (security/privacy and policy).

## Conclusions

This study examined the adoption of Artificial Intelligence in supply chain management within plastic manufacturing firms in emerging markets, drawing insights from recent peer-reviewed literature. The findings demonstrate that AI technologies such as machine learning, robotics, computer vision, and natural language processing hold significant potential to improve forecasting accuracy, operational efficiency, quality control, and overall competitiveness. However, the study also recognizes its limitation in relying exclusively on secondary data, which restricts the ability to capture firm-specific realities, contextual variations, and real-time implementation challenges faced by manufacturers in emerging economies. Despite this constraint, the systematic synthesis of existing studies provides a coherent understanding of current adoption patterns, prospects, and barriers, including high costs, infrastructural deficiencies, skill gaps, and policy concerns. The study therefore concludes that while AI adoption in supply chain management remains constrained in emerging markets, its transformative potential is undeniable. With deliberate investments in infrastructure, skills, and supportive institutional frameworks, plastic manufacturing firms can leverage AI to achieve sustainable efficiency, resilience, and long-term competitive advantage.

### Recommendation

Based on the findings, the following recommendations are made:

1. Integrate Relevant AI Technologies into Core SCM Operations: Plastic manufacturing firms should adopt practical AI tools such as machine learning for demand forecasting, robotics for warehouse automation, and computer vision for quality control to improve efficiency, reduce waste, and enhance responsiveness across their supply chains.
2. Leverage AI for Long-Term Competitiveness and Sustainability: Firms should develop strategic roadmaps that use AI-driven analytics to support decision-making, predictive maintenance, and sustainable resource use, enabling the plastic sector to achieve higher productivity, market agility, and integration into global value chains.
3. Address Structural and Organizational Barriers to Adoption: Government and industry stakeholders should invest in reliable power, digital infrastructure, and workforce training to build AI readiness, while firms should embed change-management strategies to overcome employee resistance and strengthen data management capacity.

### Limitations of the Study

This study relied solely on secondary data from peer-reviewed literature, which limits the inclusion of firm-specific and real-time experiences of plastic manufacturing firms in emerging markets. The absence of primary empirical data may restrict the depth of contextual insights and generalizability of the findings. Additionally, the limited number of studies focusing specifically on AI adoption in plastic manufacturing supply chains constrained the scope of evidence available for analysis.

### Recommendations for Further Studies

For more empirical rigour, future studies should adopt primary empirical approaches such as surveys, interviews, or case studies to capture firm-level experiences of AI adoption in supply chain management. Similarly, comparative studies across different manufacturing subsectors or countries in emerging markets are also recommended to identify contextual differences and best practices. Additionally, longitudinal research could examine the long-term performance, sustainability, and workforce implications of AI adoption in supply chains.

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