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A Survey of Enterprise Supply Chain Management with Digital Transformation Artificial Intelligence Technologies Applications

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***Abstract*—Enterprise supply chain management (ESCM) is undergoing a sea change due to technological advancements such as digital twins, cloud computing, big data analytics, blockchain, and the IoT. Businesses may see improvements in their supply chains' transparency, efficiency, cooperation, agility, and resilience after implementing these technologies. This review delves into the history and evolution of corporate supply networks, as well as the digital and intelligent supply chain architecture. As a result of digital transformation, organizations are able to automate processes, make data-driven decisions, monitor in real-time, and anticipate risks. Stakeholders in the supply chain can utilize digital twin technology to enhance real-time system presentation, scenario simulation, resource optimization, and collaborative decision-making. In addition, tasks like transportation, distribution, inventory management, forecasting, and manufacturing are all improved by AI technologies including deep learning, machine learning, large language models, natural language processing, and generative AI. AI and IoT can be combined to allow data to flow continuously and be intelligently processed, further enhancing operational responsiveness and predictive capabilities. Finally, AI-powered digital transformation is a complete answer for companies that want to improve supply chain resilience, cut costs, and streamline their supply chain processes. However, standardization of data, interoperability between systems, the scalability of technology, and appropriate utilization of technology are important future research and implementation issues.**

Keywords—Artificial Intelligence, Internet of Things, Digital Twin, Machine Learning, Enterprise Supply Chain Management, Digital Transformation, Big Data Analytics, Supply Chain Resilience.

I. Introduction

Supply chain academia and practice are presently undergoing an exciting time. New technological developments and the hope of an economic revolution have opened the door to a far wider variety of alternatives. Analytics, Big Data, the IoT, and other related technologies have enabled the collection, storage, and processing of data sets on a scale never before seen [1][2]. As data volume grows, there are more advantages that supply chain researchers and practitioners are touting, especially if overall firm performance is enhanced. Planning and executing the supply chain, which includes inventory replenishment, demand-supply coordination, and more accurate supply and demand planning, are hot topics in today's global economic arena, where firms are competitively engaged [3]. One of the most pressing issues today, SCM involves the coordination of the flow of materials, services, and data from their originators to their final consumers. This process may be extremely profitable or disastrous for a company. A key component of modern company strategy, SCM has seen its definition and use broadened in tandem with the proliferation of digital technologies such as blockchain and the IoT [4].

In today's world of business, speed, accuracy, and flexibility are essential for staying competitive. Traditional supply chains are often unable to meet evolving customer demands and sudden changes in the market. If companies fail to make improvements in their systems, they can experience delays, cost increases and lost opportunities. That is why SCM is undergoing transformation thanks to AI [5]. AI can help businesses predict customer requirements, manage inventory, and deliver products more effectively[6]. Imagine a system that discovers the fastest and least expensive route to delivering products to market where they are needed. Imagine a facility where clever robots enable employees to rapidly and precisely pack and sort products. These AI-powered tools are not just about optimizing processes; they are also transforming how businesses can compete [7].

Digital transformation in SCM also improves supply chain robustness, which is an additional perk [8]. Resilience is defined as the capacity of a supply chain to detect, anticipate, respond to, and recover from interruptions. Studies show that companies that adopt a digital transformation approach are more likely to identify and assess supply chain risks [9] and can adapt their network mapping to ensure the supply/demand balance in the event of a disruption. Also, supply chain managers may benefit from AI-driven solutions by analyzing data in real-time to make better decisions, which in turn improves agility and responsiveness [10]. The capacity to react quickly with information can significantly impact the

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supply chain's performance in this age of unpredictable interruptions.

A. Structure of the paper

The following is the paper's outline: Enterprise Supply Chain Management (ESCM) is introduced in Section II, along with its architecture and fundamentals. Digital transformation and conventional supply chains are discussed in Section III. Section IV delves into the explanation of AI applications and how it integrates with the Internet of Things (IoT). Finally, Section V presents the main results and makes recommendations for further study.

II. Fundamentals of Enterprise Supply Chain Management

ESCM is a process that coordinates the supply, manufacture, distribution, logistics and customers in order to ensure materials, information and money move efficiently through the organization. It connects the activities of procurement, production, inventory, warehousing, transportation and distribution. These days, big data analytics, blockchain, artificial intelligence, the Internet of Things, cloud computing, and other forms of digital technology are integrated into the majority of corporate supply chain management software[11]. These technologies work together to enhance the supply chain's transparency, efficiency, agility, operational efficiency, and resilience [12][13]. Enterprise Supply Chain Architecture is the holistic structure of an enterprise's supply chain, which is the arrangement of business functions, processes, stakeholders and operational activities. It establishes a systematic framework for coordinating procurement, production, inventory, logistics, distribution, and customer-related activities. A well-designed architecture supports process standardization, resource coordination, information sharing, and effective management across the entire enterprise supply chain[14].

A. Supply-Chain Resilience (SCR)

Resilience in the supply chain is defined as the capacity to react to and recover from disturbances. That is why stressed the need for transparency, adaptability, and speed as cornerstones of resilient supply chains [15]. They stress the significance of consideration of resilience throughout supply chain design to guarantee prompt response to interruptions. Discussed the factors that influence SCR, organized by three main resilience phases: preparedness, resistance, and rebound.

B. Real-Time Monitoring

The utilization of digital twins of physical systems or objects allows for precise, real-time monitoring of such operations using DTT. Using sensors and Internet of Things devices, information about the physical system's state, operation, and circumstances may be immediately acquired. This is useful to detect any potential issues at an early stage, so that appropriate action can be taken or decisions made before the issue arises [16]. Rapid response to changing circumstances, better maintenance processes and increased operational effectiveness are all positive outcomes. As a conclusion, many of the other advantages listed below can be triggered by real-time monitoring's greater system visibility.

C. Decision-Making Improvement

Superior decision-making, risk management, and predictive analytics are all possible because of DTT's increased system visibility. Using real-time data alongside analysis of historical data, decision-makers can simulate conditions to help them allocate resources more effectively, anticipate potential problems, and make predictions about the future. Cost, efficiency, and resilience may all be optimized by proactive decision-making [17]. Further, DT can improve resource management and monitoring, stakeholder engagement, and the ability to make adaptive decisions in the face of change. The core concept of digital twins is that they provide decision-makers with a wealth of tools for making smart, efficient and future-proof decisions.

D. Supply-Chain Collaboration

Distributed ledger technology (DTT) improves supply-chain cooperation by giving all participants in the chain access to complete supply chain visibility in real-time. Digital twins make it easy for all parties involved to share and access data by simulating physical assets and processes in a digital format. This transparency enables joint decision-making with well-informed and timely facts. Incorporating predictive analytics into digital twins allows for the provision of early warning indicators of potential issues, promoting proactive problem-solving. The supply chain may be made more resilient if all parties involved work collaboratively to assess and lessen potential hazards. Moreover, central platforms ensure effective communication, minimizing the risk of misunderstandings and delays. Members of the team work together to optimize the process by adjusting production, inventory, and distribution based on real demand [18].

III. Traditional vs Digital Supply Chains

The traditional SC model entails the transformation of raw resources into completed items and the timely delivery of those commodities to consumers. The flow of products and services from manufacturers to end users involves several critical business operations. Common SC steps comprise [19]:

- **Collection of raw materials:** Gathering the raw materials is the first step in making anything. Raw materials can be anything from a single ingredient to a combination of elements.
- **Obtaining raw materials from suppliers:** Gathering raw materials from vendors is an essential part of this process.
- **Production:** Once the raw ingredients have been gathered and procured from vendors, the manufacture of the goods may begin.
- **Distribution:** Distribution to merchants or consumers occurs at this stage.
- **Consumption:** The last step is for finished goods to be purchased and eaten by consumers or merchants.

A. Digital supply chains

A digital SC is an intelligent, value-driven network that uses state-of-the-art technology and analytical tools to provide monetary gains for the company. Digital SCs optimize performance, make smart judgments, and quickly adjust to changing conditions by using data analysis and digital technology [20]. Using this framework, businesses may improve their decision-making in relation to inventory needs, product demand, and the relationships between these variables by implementing a number of procedures that leverage cutting-edge digital technology. Digital SCs are more network-like in operation. Digital SC differs from conventional linear SC in that it is network-based. The benefits of digital SCs, as stated, are:

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- **Improved visibility into SC performance -** Using real-time supplier performance monitoring, businesses may head off any disruptions by fixing issues before they even arise.
- **Process automation -** A digital SC promotes efficiency, productivity, and profitability by streamlining company operations and making them more efficient. It gets rid of the tedious tasks of entering data by hand and calling in for status updates. Modern technology, such sensors, enables the SC to track inventories in real-time.
- **Lower costs and faster innovation -** The real-time data provided by a digital SC makes it simpler to optimize and manage operations such as raw material flows, resource planning, and forecasting. As a result, expenses go down. Improving communication and teamwork helps find inefficiencies in the process, which shortens the time it takes to develop and launch a new product [21].
- **Advanced Analytics:** The digital SC offers customers access to advanced analytics tools that may help them learn more, make better decisions, and enhance their forecasting abilities.
- **Enhanced planning:** Sharing and utilizing current data on control and quality allows organizations in a digital SC to avert problems from escalating. The goal of digital SC management is to streamline all SC-related processes in terms of planning and administration.
- **Reduced delivery times:** Digital SCs greatly reduce wait times, allowing for more efficient and faster delivery.
- **Improved financial management -** Shorter lead times and less capital locked up in overstocked warehouses are two ways digital SCs may greatly reduce financial demands and boost cash flow.
- **Forward-looking Approach:** Digital SCs allow businesses to look ahead of events and make proactive decisions about SC management, as they can gather, analyze and share vast amounts of data.

Fig. 1. Digital SC structure

B. *Digital Transformation in Enterprise Supply Chains*

Enterprise supply chains undergo digital transformation when innovative digital technologies are used to update and improve operational efficiency by replacing antiquated supply chain procedures with more contemporary ones. It can facilitate the sharing of information in real-time, improve supply chain visibility, make informed decisions based on data, automate processes, and strengthen the collaboration between partners. They enable businesses to boost efficiency and productivity, lower expenses, enhance agility, bolster resilience, and adapt to market shifts. The phenomenon of digital transformation of organizations is attracting an increasing number of academics from business schools across the world as the information age and digital technologies continue to advance at a rapid pace.

- **Technical Perspective:** Digital transformation of organizations research has historically centered on the centrality of IT to company processes [22]. The term "digital transformation" describes the process by which conventional businesses increasingly use commercially available IT and ICT.
- **Value Perspective:** Academic focus on digital transformation has moved from an operational level to a value-level understanding as the field has grown in scope and complexity. Companies undergo digital transformation when they use digital technology to reimagine their operational model and alter their consumer value offer, according to certain academics like Berman [23].
- **Strategic Transformation Process Perspective:** The academic community's perspective of corporate digital transformation has typically comprised three stages: technology application, value generation, and cross-system change. The average score for Chinese firms in the 2020 China Enterprise Digital Transformation Index was a dismal 45 out of 100, putting the percentage at 9% [24].

IV. INTEGRATION OF AI AND IOT IN SUPPLY CHAINS

The rapid integration of AI and the Internet of Things into modern supply chains is enhancing collaboration, data exchange, and decision-making. IoT devices gather data in real-time from a variety of sources, including sensors, RFID tags, GPS, and other smart devices, and then send that data to AI systems for processing [25]. The integration enables businesses to gain visibility into inventory, shipment tracking, and even future demand, providing deeper insights into operations. Artificial intelligence models analyze this data to foretell patterns in the supply chain, optimize processes, and automate decisions. Organizations are now able to make proactive decisions based on actionable information thanks to predictive analytics, ML, and optimization algorithms. Effective integration can involve complex IoT sensors, cloud-based platforms and AI-driven tools that provide ongoing data and insights [26]. However, the problem of data standardization and system interoperability is still a big hurdle..

A. *AI Applications in Enterprise Supply Chain Management*

ESCM with AI improves transportation and distribution, manufacturing and inventory management, demand planning and forecasting, and purchasing and procurement. By supporting these key supply chain functions, AI helps organizations improve operational efficiency, optimize resources, reduce costs, enhance decision-making, and achieve better overall supply chain performance.

1) Forecasting & demand planning

The organization's top priorities are production, procurement, inventory management, marketing campaigns, demand planning, new product innovation, and demand forecasting. Most of the time, managers care about whether or not they are right. Some popular approaches for demand forecasting include time series, exponential smoothing, moving average, and Box-Jenkins. These methods all assume that demand follows a trend similar to historical trends [27]. It is difficult to forecast future demand for new products or services without a historical context, as these methods depend on accurate consumption statistics.

2) Procurement & Purchasing

"Procurement" is shorthand for the process of collecting energy, semi-finished items, supplies, accessories, raw materials, and more for the many departments' production and sale needs. Decisions about production capacity, main activity, and personnel knowledge impact the acquisition or making process. The company needs to have a long-term view when defining things like budgets, supply plans, supplier demand levels, etc. It gets increasingly difficult to make a choice with all these restrictions [28]. As a result, while thinking about ways to use AI technology, researchers discussed procurement and buy management and found that the connections with suppliers and the upstream supply chain were quite important. In order to fix the main problems with the CBR approach of supplier selection, the authors used ANNs. Because of their incredible capacity for self-adaptation, ANNs enhance the precision of supplier selection procedures all the way through the update and decision-making phases.

3) Production & Inventory management

Management of production encompasses the entire process, from developing a strategy to delivering the final product, including all phases in between. An integral aspect of production management, scheduling aims to get the most out of people, machines, inventories, and physical mobility in all aspects of operations while keeping costs down and meeting service objectives. The outcome is that AI is widely used to optimize production management on many levels [29]. Hierarchical SC planning makes excellent use of ANN by determining the optimal lot sizes for each SC process, the setup time, and the inventory needed for the demand and production plan. Implementing rough set theory in inventory management has two outcomes: improving service rates and delivering optimal inventory management by lowering bullwhip impacts. The resulting model codifies best practices and provides clarity to data that was previously ambiguous due to ABC analysis.

4) Transportation & Distribution

Three activities have a significant impact on transportation and distribution. Packed, loaded, and unloaded vehicles; rounds; collective transport supervision; vehicle and empty package returns; and many more responsibilities fall under the umbrella of transportation flow management. Distribution network management involves route scheduling, transportation infrastructure choices[30], transshipment and storage infrastructure selection, and stock control throughout the distribution network, both internally and externally [31]. Managing the flow of commodities is the main focus of transportation and distribution, which aims to meet customer demands as efficiently and economically as possible. Distribution and transportation experts need to be nimble enough to keep up with the rapid-fire technical developments that alter industry standards and boost efficiency, all while meeting the ever-increasing standards for precision and thoroughness imposed by modern life.

5) Resilience and Risk Management

AI can strengthen supply networks. A company's success, supply chain resilience, and artificial intelligence all go hand in hand. For instance, AI mitigates the impact of worldwide pandemics like COVID-19, manages last-mile deliveries and personalized requests, and uses constant monitoring to increase transparency [32]. A qualitative as well as a quantitative assessment of resilience is critical.

Supply chain operations rely on ANNs for risk management detection and mitigation. Cases of supply interruption, demand fluctuations, and changes in market circumstances constitute these risks. Risk management policies may be developed by the examination of past data, trends, and patterns; these rules can help mitigate the impact of disruptions and increase resilience.

V. Literature Review

The most recent successes in digitalizing business supply chains using AI technology are detailed in this section. The writers pay special attention to the intelligent technology components, operational advantages, and contemporary research obstacles. Table I summarizes recent studies, highlighting research focus, adopted technologies, key findings, and research gaps, providing a comprehensive overview of AI-driven ESCM developments.

R. Bala, et al. (2026) compare and contrast the traditional and modern SCM systems and look into the efficiency of operations observed, integration of information, responsiveness, and cost optimization in both systems. Conventional SCM strategies are usually based on disjointed data systems, inefficient coordination, and a level of less real-time visibility, which tend to lead to delays, inaccurate forecasts, and high operational expenses. Modern SCM systems, on the contrary, take advantage of digital-based technologies, including ERP, IoT, cloud computing, blockchain, and enhanced analytics to enhance transparency, coordination, and accuracy of decision-making [33].

C. P. Gupta (2026) highlighted serious issues with data, such as cybersecurity, inadequate cross-system collaboration, prohibitive implementation costs, and ethical considerations around the skills gap in today's workforce. There are two main contributions made by the model. The article starts by explaining the basics of how the IoT and AI collaborate to strengthen resilience through proactive routing, predictive analytics, and sustainability. Secondly, it highlights the sociopolitical concerns and technological limits that hinder the proper implementation of the paradigm [34].

B. Wissal and E. Z. Rachid (2025) explore the ways in which SCM control procedures and technologies are being transformed by the use of AI. This study extracts and analyzes three crucial features of the shift that took place between 2018 and 2025 from 48 peer-reviewed articles collected in Scopus, WOS, and ScienceDirect. It begins by looking at how AI-driven technologies like blockchain, digital twins, and predictive analytics have changed the way control tools for logistics management have developed [35].

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P. Bajaj, et al. (2025) investigates AI based solutions that improve operational procedures, stock optimization, and demand forecasting accuracy in increasingly complicated commercial settings. This study of 47 businesses from various sectors found that AI significantly improved their performance. They reduced operating expenses by 23%, had a 42% improvement in forecast accuracy, reduced stockouts by 37%, and surplus inventory by 29% [36].

Y. Li, C.et al. (2024) make available the development of a web-based supply chain financing platform. After establishing credibility and exchanging relevant data, the oil and gas industry stands to gain substantially from the digital supply chain financial services platform. Some of these goals include fostering high-quality development, enhancing supply chain value and competitiveness, expanding finance capacity, decreasing risks and costs, and increasing industrial efficiency [37].

B. Cai, et al. (2024) The purpose of this design and development project is to create a business centralized purchasing supply chain platform that uses artificial intelligence to streamline internal procurement operations, give reliable evaluations of procurement procedures, and encourage collaboration among key supply chain participants. Now say that the idea was successful and feasible because the Beitou centralized purchasing supply chain platform is operational [38].

J. Hu (2023) analyzes the present status of the digital applications used by China's SCM system. Changes in the demand for workers, notable outcomes from digital applications, continuous scaling up, improved enterprise production efficiency, and a variety of digital technologies with clearly differentiated degrees of application are all notable features of China's SCM system. After that, the paper delves into the specifics of the problems with China's SCM system, covering topics such product design, strategic sourcing, manufacturing, warehousing, shipping, billing, and customer support. In order to fix these problems, it suggests optimization strategies that use big data analytic tools [39].

Research gap: Despite significant advances in digital supply chain transformation, existing studies mainly focus on individual technologies or specific supply chain functions. There is limited research that covers an integrated enterprise-level framework incorporating AI, IoT, cloud computing, blockchain, ERP and advanced analytics. In addition, issues of cybersecurity, data interoperability, implementation costs, labor skills, ethical issues and sustainability are still not well-addressed. Further, there is no comparative empirical research assessing the long-term effectiveness, scalability, and practical implementation of enterprise-wide digital transformation in various sectors and complex enterprise supply chains using integrated AI technologies.

Table I ENTERPRISE SUPPLY CHAIN MANAGEMENT WITH DIGITAL TRANSFORMATION USING AI

Author & Year	Study Focus	Technologies / Approach	Key Findings	Research Gap / Limitation
R. Bala et al. (2026)	Comparison of traditional and modern SCM systems	ERP, IoT, Cloud Computing, Blockchain, Advanced Analytics	Modern SCM improves transparency, coordination, information integration, responsiveness, decision-making, and cost optimization.	Lack of comprehensive integration of emerging technologies into a unified enterprise SCM framework.
C. P. Gupta (2026)	AI-IoT integration for resilient and sustainable SCM	AI, IoT, Predictive Analytics, Proactive Routing	AI-IoT integration enhances resilience, predictive decision-making, proactive routing, and sustainability.	Cybersecurity, interoperability, high implementation costs, workforce skills, and ethical issues remain unresolved.
B. Wissal & E. Z. Rachid (2025)	AI-driven transformation of supply chain management control	AI, Predictive Analytics, Digital Twins, Blockchain	AI reshapes logistics management control practices and improves data-driven supply chain operations.	Limited research on comprehensive enterprise-wide integration and practical implementation of multiple AI technologies.
P. Bajaj et al. (2025)	AI-based demand forecasting and inventory optimization	AI, Demand Forecasting, Stock Optimization	AI reduced stockouts by 37%, excess inventory by 29%, improved forecast accuracy by 42%, and reduced operational expenses by 23%.	Further validation is required across different industries, supply chain structures, and long-term operational conditions.
Y. Li et al. (2024)	Digital supply chain finance platform	Digital Platform, Data Sharing, Supply Chain Finance	Improved financing efficiency, reduced costs and risks, expanded financing capacity, and enhanced supply chain competitiveness.	Limited focus on integration with AI-driven analytics and broader enterprise supply chain management functions.
B. Cai et al. (2024)	AI-based centralized purchasing supply chain platform	AI, Centralized Procurement, Digital Platform	Enabled precise procurement evaluation, process supervision, and interconnected collaboration across supply chain activities.	Limited consideration of broader supply chain functions, scalability, interoperability, and advanced AI integration.

VI. CONCLUSION AND FUTURE WORK

AI and the digital revolution are about to make ESCM indispensable. Digital twins, cloud computing, AI, the IoT, big data analytics, blockchain, and cloud computing might all work together to help organizations get more insight, automate more processes, communicate better, and make data-based decisions. Important tasks in the supply chain, including demand forecasting, manufacturing, inventory management, transportation, distribution, and risk management, can be aided by generative AI, large language models, machine learning, deep learning, and natural language processing, among many other technologies. By facilitating decision-making, scenario modeling, real-time system monitoring, and predictive analysis, digital twins also boost supply chain performance. In addition, the synergy between AI and IoT enhances operational intelligence by continuously gathering and analyzing real-time data, assisting organizations in better identifying risks and reacting to disruptions. Overall, intelligent digital supply chains provide greater agility, efficiency, resilience, and responsiveness to changing market conditions. But it is not enough to overcome challenges with regard to data quality, interoperability, standardization, scalability, cybersecurity, privacy, and the interpretability of AI. Thus, organizations need to use integrated and strategically aligned digital technologies for sustainable and resilient supply chain operations.

Future AI studies should focus on exploring how the IoT, digital twins, cloud computing, big data analytics, and scalable supply chain frameworks may be built. Further studies should focus on explainable AI, cybersecurity, data privacy, ethical decision-making, interoperability, and real-world validation across diverse industries.

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