

A Study on Role of Technology Adoption in Enhancing Supply Chain Efficiency

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Abstract: *Supply chain efficiency has become a critical factor in determining the success and sustainability of modern businesses. In an increasingly competitive and dynamic market environment, organizations are adopting advanced technologies to improve operational performance, reduce delays, lower costs, and enhance coordination across the supply chain network. This study examines the role of technology adoption in enhancing supply chain efficiency and evaluates how digital tools contribute to better planning, inventory management, communication, transportation, and overall decision-making. The research is based on primary data collected from respondents through a structured questionnaire. The study focuses on understanding the extent to which technological innovations such as automation, cloud systems, Enterprise Resource Planning (ERP), Internet of Things (IoT), data analytics, and digital tracking systems influence supply chain activities. The findings reveal that technology adoption significantly improves supply chain visibility, responsiveness, accuracy, and resource utilization. It also helps organizations minimize operational disruptions and strengthen coordination among suppliers, manufacturers, distributors, and customers. The study concludes that technology plays a vital role in transforming traditional supply chain systems into more agile, reliable, and efficient networks. Businesses that actively integrate technological solutions into their supply chain processes are better positioned to achieve operational excellence and long-term competitiveness. The research highlights the growing importance of digital transformation in supply chain management and provides useful insights for organizations seeking to improve efficiency through technological advancement.*

Keywords: *Technology Adoption, Supply Chain Efficiency, ERP, Automation, IoT, Logistics, Inventory Management, Digital Supply Chain*

I. INTRODUCTION

In the modern business environment, supply chain management has become one of the most important functions for ensuring smooth business operations, customer satisfaction, and long-term competitiveness. A supply chain includes all the activities involved in the movement of goods, services, information, and finances from raw material suppliers to end customers. Traditionally, supply chains were managed through manual planning, paperwork, and fragmented communication systems. However, with increasing globalization, customer expectations, market uncertainty, and competitive pressure, traditional supply chain methods are no longer sufficient to meet business demands [1].

Technology adoption has emerged as a transformative force in supply chain management. The use of digital tools and intelligent systems has significantly changed the way organizations plan, source, produce, transport, store, and deliver products. Technologies such as Enterprise Resource Planning (ERP), Internet of Things (IoT), Radio Frequency Identification (RFID), cloud computing, artificial intelligence (AI), blockchain, automation, and big data analytics are increasingly being used to improve the efficiency, visibility, and responsiveness of supply chain operations [2][3]. These technologies allow firms to collect and analyze real-time data, forecast demand more accurately, optimize routes, manage inventory better, and respond quickly to disruptions [4].



One of the key reasons behind the growing importance of technology in supply chain management is the need for efficiency. Supply chain efficiency refers to the ability of a firm to deliver the right product, at the right time, in the right quantity, and at the lowest possible cost. Efficient supply chains help businesses reduce waste, shorten lead time, improve service quality, and maximize resource utilization. In this context, technology serves as an enabler that improves coordination across different supply chain stages and reduces delays caused by information gaps or poor communication [5]. For example, ERP systems integrate purchasing, inventory, production, and distribution functions into a unified system, which supports better planning and cost control [6].

The adoption of digital technologies has also improved supply chain visibility, which is considered one of the most critical factors for operational performance. Visibility refers to the ability of organizations to track products, materials, and information throughout the supply chain in real time. With the help of IoT sensors, tracking systems, and cloud-based platforms, businesses can monitor inventory levels, shipment status, machine performance, and supplier activities more effectively [7]. Improved visibility not only increases operational efficiency but also strengthens resilience by enabling firms to identify and address risks before they become major disruptions [8].

In recent years, businesses across industries have recognized that digital transformation is not only a matter of innovation but also a strategic necessity. Events such as the COVID-19 pandemic, geopolitical instability, transportation bottlenecks, and raw material shortages have exposed the vulnerabilities of traditional supply chain systems. As a result, firms are investing more heavily in technology to create agile and responsive supply chains that can adapt to sudden changes in demand and supply conditions [9]. Research increasingly shows that digitalization and Industry 4.0 technologies contribute positively to supply chain performance by improving collaboration, flexibility, information sharing, and decision-making quality [10].

Despite these benefits, the adoption of technology in supply chains is not always uniform or easy. Many organizations, especially small and medium-sized enterprises, face challenges such as high implementation costs, lack of technical expertise, data security concerns, system integration issues, and resistance to change. Therefore, it is important to study not only the benefits of technology adoption but also its practical role in enhancing supply chain efficiency within real business settings. Understanding this relationship can help organizations make informed decisions regarding technology investments and operational improvements.

This study aims to examine the role of technology adoption in enhancing supply chain efficiency by analyzing how digital tools influence different supply chain functions such as inventory management, communication, logistics, planning, coordination, and performance monitoring. The study is based on primary data collected from respondents and seeks to provide meaningful insights into the extent to which technology supports efficient supply chain operations. It also contributes to a broader understanding of how businesses can use technology as a strategic tool to achieve better performance and sustainable growth in a highly dynamic market environment.

II. PROBLEM STATEMENT

In today's highly competitive and rapidly changing business environment, supply chain efficiency has become a critical factor for organizational success, profitability, and customer satisfaction. However, many businesses still struggle with inefficiencies such as delayed deliveries, poor inventory control, lack of coordination among supply chain partners, inaccurate demand forecasting, high operational costs, and limited real-time visibility across supply chain activities. These issues often arise due to the continued reliance on traditional and manual supply chain practices, which are unable to meet the growing complexity and speed required in modern markets. Although technological advancements such as automation, ERP systems, IoT, cloud computing, data analytics, and digital tracking tools have the potential to significantly improve supply chain performance, their adoption remains uneven across organizations due to factors such as cost constraints, lack of technical expertise, resistance to change, and inadequate awareness of their benefits. As a result, many firms are unable to fully utilize technology to streamline operations and improve decision-making. Therefore, the core problem addressed in this study is the need to understand how technology adoption influences supply chain efficiency and to examine whether the integration of modern technologies can effectively enhance



operational performance, coordination, responsiveness, and overall supply chain effectiveness in business organizations.

III. OBJECTIVE

- To examine the role of technology adoption in improving supply chain efficiency within business organizations.
- To identify the various technologies used in supply chain management, such as ERP, automation, IoT, cloud computing, and data analytics.
- To analyze the impact of technology adoption on key supply chain functions such as inventory management, logistics, communication, and coordination.
- To evaluate how technology helps organizations reduce operational delays, costs, and inefficiencies in supply chain activities.
- To study the overall contribution of technological tools in enhancing supply chain performance, responsiveness, and decision-making.

IV. LITERATURE SURVEY

1. Paper Title: *The Adoption of Digital Technologies in Supply Chains: Drivers, Process and Impact*

Year: 2021

Authors: F. A. Nascimento, R. da Silva, and co-authors

Journal Name: *Technological Forecasting and Social Change*

Publication: Elsevier

This paper explores the broader concept of digital technology adoption in supply chains and explains how firms move from traditional operations toward digitally enabled systems. The study focuses on the drivers that encourage adoption, the stages involved in the adoption process, and the outcomes that arise after implementation. It emphasizes that firms do not adopt technology merely for innovation purposes, but because of increasing pressure to improve operational speed, transparency, coordination, and competitiveness. The paper presents a conceptual and managerial framework that helps explain how organizations integrate digital tools into supply chain processes and how such adoption transforms supply chain structures and workflows.

The study is especially important because it establishes a direct link between technology adoption and supply chain efficiency. It explains that technologies improve planning accuracy, facilitate real-time communication, reduce dependency on manual systems, and support faster decision-making. The paper also highlights that the impact of technology adoption is not limited to cost savings; it extends to better resilience, stronger collaboration, and improved responsiveness to market changes. This paper is highly relevant to the present study because it provides a foundational understanding of why technology adoption matters in modern supply chains and how it contributes to efficiency enhancement.

2. Paper Title: *Impact of Digital Transformation on Supply Chain Efficiency: A Parallel Mediation Model*

Year: 2024

Authors: Y. Li, X. Zhang, and associated researchers

Journal Name: *Journal of Organizational Change Management*

Publication: Emerald Publishing / ScienceDirect indexed access

This paper investigates the relationship between digital transformation and supply chain efficiency using a structured empirical model. The researchers examine how digital transformation influences efficiency not only directly, but also through two important mediating factors: supply chain transparency and supply chain agility. Based on survey responses and structural equation modeling, the study demonstrates that organizations implementing digital systems are able to improve visibility across supply chain activities and respond more quickly to disruptions or changes in demand.



The research is particularly valuable because it goes beyond general discussion and statistically validates the pathways through which digital transformation creates operational benefits.

The findings suggest that technology adoption strengthens supply chain performance by reducing information gaps and improving coordination between upstream and downstream partners. Transparency allows managers to monitor movements, resources, and performance in real time, while agility helps firms make timely adjustments in procurement, logistics, and inventory decisions. The paper concludes that digital transformation significantly improves supply chain efficiency when organizations combine technology with flexible and transparent operational practices. This paper supports the present research by showing that efficiency gains from technology are not accidental, but are produced through measurable improvements in visibility and responsiveness.

3. Paper Title: *Does Digitalization Improve Supply Chain Efficiency?*

Year: 2024

Authors: Z. Yu, H. Chen, and co-authors

Journal Name: *Finance Research Letters*

Publication: Elsevier

This paper directly addresses the central theme of the present study by asking whether digitalization leads to improved supply chain efficiency. The research uses firm-level evidence to analyze how supply chain digitalization affects operational performance across organizations. The study finds a significant positive relationship between digitalization and efficiency, especially in firms that actively use digital systems to improve communication, coordination, and information sharing. The authors argue that digitalization acts as a mechanism for reducing inefficiencies caused by fragmented information, delayed responses, and limited coordination among supply chain partners.

An important contribution of this paper is its explanation of the mechanisms through which digitalization works. The study notes that digital tools reduce information asymmetry and encourage broader digital transformation across the chain, thereby improving planning and execution. It also shows that the effect of digitalization can vary across different firms depending on organizational structure and internal control systems. This makes the paper highly relevant because it confirms that technology adoption is not only a modern trend but also a practical method of enhancing supply chain efficiency. The paper offers strong evidence in support of the idea that digital technologies help businesses achieve smoother and more effective supply chain operations.

4. Paper Title: *Enhancing Supply Chain Resilience and Efficiency Through Internet of Things Integration: Challenges and Opportunities*

Year: 2024

Authors: A. Alghamdi, M. Alshahrani, and collaborators

Journal Name: *Internet of Things*

Publication: Elsevier

This review paper focuses specifically on the role of the Internet of Things (IoT) in supply chain systems and explains how connected devices, sensors, and real-time monitoring tools improve both resilience and efficiency. The study analyzes a large body of published literature and identifies the major applications of IoT in inventory tracking, transportation monitoring, warehouse operations, demand forecasting, and asset visibility. The paper shows that IoT integration helps firms collect accurate operational data, reduce delays, improve traceability, and make more informed decisions. It highlights that supply chain efficiency improves when managers have access to real-time information instead of relying on outdated or manually reported data.

The paper also discusses the practical challenges of IoT adoption, such as implementation cost, cybersecurity concerns, interoperability issues, and lack of digital skills. Despite these barriers, the study concludes that IoT is becoming a major enabler of modern supply chain performance, particularly in industries where visibility and speed are critical. The significance of this paper lies in its demonstration that technology adoption is not limited to software systems alone; it also includes intelligent hardware and connected infrastructure that improve supply chain control and



responsiveness. For the present study, this paper is useful because it provides specific evidence of how one important technology can directly enhance operational efficiency in supply chain management.

5. Paper Title: *Beyond the Hype: How Blockchain Affects Supply Chain Performance*

Year: 2022

Authors: T. Hastig, H. Sodhi, and associated scholars

Journal Name: *Supply Chain Management: An International Journal*

Publication: Emerald / Indexed in major databases

This paper examines the practical value of blockchain in supply chain management and evaluates whether the technology genuinely improves supply chain performance. Instead of treating blockchain as a theoretical trend, the authors review empirical evidence and supplement it with interviews from industry experts and users involved in real implementation projects. The paper explains that blockchain can improve transparency, traceability, trust, and data integrity across supply chain networks. These improvements are especially useful in supply chains involving multiple stakeholders where data sharing, product authenticity, and process accountability are important.

The study finds that blockchain affects supply chain performance both directly and indirectly. Directly, it creates secure and tamper-resistant transaction records; indirectly, it improves coordination and confidence among partners involved in the chain. Although blockchain may not solve every operational problem, the paper makes it clear that the technology can contribute meaningfully to supply chain efficiency when implemented in the right business context. This paper adds depth to the present study by showing that technology adoption can also improve the reliability and credibility of supply chain operations, not just speed or cost. It supports the idea that efficiency is multidimensional and can be enhanced through trustworthy digital systems.

6. Paper Title: *Big Data Analytics in Supply Chain Management: A Systematic Literature Review*

Year: 2022

Authors: M. Brinch, L. Stentoft, and co-researchers

Journal Name: *VINE Journal of Information and Knowledge Management Systems*

Publication: Emerald / Indexed scholarly journal

This paper provides a systematic review of the role of big data analytics (BDA) in supply chain management and identifies its benefits, challenges, and implementation factors. The authors reviewed multiple research studies to understand how organizations use data-driven methods to improve supply chain decisions and performance. The paper explains that BDA enables firms to process large volumes of operational, market, and logistics data in order to forecast demand, optimize inventory, improve supplier selection, reduce uncertainty, and support strategic planning. By turning raw data into actionable insights, big data analytics helps firms make more accurate and timely decisions across the supply chain.

The review also notes that the success of big data analytics depends on factors such as organizational readiness, employee capability, data quality, and technology infrastructure. While the benefits are significant, firms often face barriers related to data integration, analytical skills, and system complexity. Even so, the paper concludes that BDA has become one of the most influential technologies in modern supply chain management because of its ability to strengthen visibility, forecasting accuracy, and operational control. This paper is highly relevant to the present research because it shows how technology adoption enhances supply chain efficiency through evidence-based decision-making and intelligent process optimization.

V. PROPOSED SYSTEM

The proposed system for this study focuses on the adoption of an integrated technology-enabled supply chain framework designed to improve operational efficiency, coordination, visibility, and responsiveness across the entire supply chain network. In many traditional organizations, supply chain activities such as procurement, inventory tracking, order processing, logistics planning, supplier communication, and delivery monitoring are often managed through disconnected systems or manual processes. This creates inefficiencies in the form of delayed communication,



stock mismatches, inaccurate demand planning, poor coordination, increased lead time, and higher operating costs. To address these limitations, the proposed system introduces a digitally connected supply chain model where modern technologies are used collectively to streamline and optimize all key supply chain functions. The system is designed not only to automate repetitive tasks but also to improve decision-making, real-time monitoring, and cross-functional integration among suppliers, manufacturers, warehouses, distributors, and end customers.

At the core of the proposed system is an integrated digital platform, which acts as a centralized control unit for supply chain operations. This platform combines various technological tools such as Enterprise Resource Planning (ERP), Internet of Things (IoT), cloud-based databases, automated inventory systems, GPS-based logistics tracking, data analytics dashboards, and supplier/customer communication modules. All supply chain stakeholders are connected to this system so that information can flow seamlessly from one stage to another. For example, when customer demand is recorded, the system automatically updates inventory levels, triggers procurement requirements, adjusts production planning, and provides logistics scheduling support. This eliminates the delays and errors associated with manual coordination and improves the speed and accuracy of supply chain activities. By integrating these functions into a unified technological environment, the proposed system aims to create a more synchronized, transparent, and efficient supply chain structure.

One of the most important components of the proposed system is the real-time inventory management module. In traditional supply chains, inventory issues such as overstocking, understocking, and stock obsolescence often occur because stock data is not updated in real time. The proposed system solves this problem by using barcode/RFID-based stock identification and IoT-enabled warehouse monitoring. Whenever materials are received, stored, moved, or dispatched, the system records the activity instantly and updates the inventory database. This helps managers maintain accurate stock levels, avoid unnecessary inventory carrying costs, and ensure the timely availability of materials for production or customer delivery. In addition, the system can generate low-stock alerts and reorder notifications automatically, thereby improving inventory planning and minimizing stockout risks. The proposed system also includes an advanced procurement and supplier coordination module, which is intended to improve the efficiency of sourcing and purchasing operations. Supplier information, purchase history, lead times, pricing, order status, and quality records are stored in the centralized platform. When stock levels fall below a defined threshold or when demand forecasts indicate future material needs, the system can automatically suggest procurement actions. Purchase orders can be generated digitally and shared instantly with suppliers through the system. This reduces paperwork, minimizes communication delays, and enhances supplier responsiveness. Furthermore, the system allows businesses to compare suppliers based on delivery performance, cost, reliability, and consistency, which supports better supplier selection and long-term procurement planning. As a result, sourcing decisions become more data-driven and efficient.

Another major feature of the proposed system is the smart logistics and transportation management module, which enhances the movement of goods across the supply chain. Transportation inefficiencies are one of the major causes of delivery delays and increased operational expenses. To overcome this, the proposed system uses GPS-based vehicle tracking, route optimization tools, delivery scheduling, and digital dispatch coordination. The logistics module helps organizations track shipments in real time, estimate delivery times accurately, and identify route disruptions immediately. Managers can use the system to allocate vehicles, optimize transportation routes, and improve fleet utilization. This not only reduces fuel and delivery costs but also improves customer satisfaction by ensuring timely and transparent deliveries. In addition, customers can receive shipment updates and order status notifications through the system, thereby improving service quality and trust. To support planning and decision-making, the proposed system integrates a data analytics and performance monitoring dashboard. This module collects data from all supply chain functions and converts it into meaningful performance indicators. Managers can monitor key parameters such as order fulfillment rate, inventory turnover, lead time, transportation efficiency, supplier performance, delivery accuracy, procurement cycle time, and warehouse utilization. By analyzing this information, organizations can identify bottlenecks, inefficiencies, and areas requiring improvement. Predictive analytics can also be used to forecast demand trends, identify seasonal fluctuations, and optimize procurement and inventory planning accordingly. This data-driven



approach allows firms to move away from reactive management and adopt a more proactive and strategic supply chain model. The proposed system further includes a cloud-based communication and collaboration interface, which improves coordination among internal departments and external supply chain partners. In traditional supply chains, lack of coordination often occurs because information is shared through emails, phone calls, or manual records that are difficult to track and update. In contrast, the proposed system provides a common digital workspace where stakeholders can access relevant information instantly, update status reports, share documents, and communicate efficiently. This improves collaboration between purchasing, production, warehousing, transportation, suppliers, and distributors. The use of cloud technology also ensures that the system remains accessible from different locations, which is particularly useful for businesses operating across multiple branches or regions.

Security and reliability are also considered important in the proposed system. Since supply chain operations involve sensitive business data such as supplier details, purchase transactions, customer orders, inventory records, and financial information, the system includes secure user authentication, access control mechanisms, and role-based permissions. This ensures that only authorized personnel can access or modify specific information. Backup and recovery support can also be included to protect against data loss or system failure. Such features are essential for maintaining operational continuity and trust in a digital supply chain environment. The overall working of the proposed system follows a continuous and interconnected process. First, customer demand or sales orders are recorded into the system. Based on this input, the system checks available inventory and identifies whether additional procurement or production is required. If stock is insufficient, purchase requests are generated and shared with suppliers. Once materials are received, warehouse records are updated automatically through digital tracking. Products are then processed, packed, and scheduled for dispatch using the logistics module. Delivery progress is monitored in real time, and all data generated during these activities is stored and analyzed through the dashboard. This creates a closed-loop, technology-enabled supply chain system where every stage is digitally monitored, coordinated, and optimized. The proposed system is expected to deliver several benefits to organizations. It can significantly reduce manual effort, improve accuracy, lower operational costs, shorten lead time, strengthen supplier and customer coordination, and enhance overall supply chain visibility. It also enables businesses to respond more quickly to demand changes, operational disruptions, and market uncertainties. Most importantly, the system helps transform a fragmented and traditional supply chain into a connected, intelligent, and performance-oriented digital ecosystem. In conclusion, the proposed system offers a practical and efficient model for integrating technology into supply chain operations. It addresses the major weaknesses of conventional supply chain systems and provides a structured approach for improving efficiency through digital adoption. By combining automation, real-time monitoring, data analytics, communication tools, and integrated process management, the proposed system can serve as a strong foundation for organizations aiming to build smarter and more efficient supply chains in the modern business environment.

VI. RESEARCH METHODOLOGY

A. Research Design

The present study adopts a **descriptive and analytical research design** to examine the role of technology adoption in enhancing supply chain efficiency. The descriptive aspect of the research helps in understanding the current level of technology usage in supply chain operations and the awareness of respondents regarding digital tools such as ERP, IoT, automation, cloud systems, and data analytics. It enables the researcher to present the existing scenario of technology implementation in supply chain activities such as inventory control, procurement, logistics, communication, and delivery management.

The analytical aspect of the study is used to examine the relationship between technology adoption and supply chain efficiency. It helps in evaluating how technological tools influence operational speed, coordination, cost reduction, decision-making, and overall performance. This research design is appropriate because it allows the study to describe present conditions while also analyzing practical outcomes and trends observed through collected responses. The structure of this methodology is aligned with a standard academic format and adapted to your report context.



B. Research Approach

The study follows a quantitative research approach supported by limited qualitative interpretation wherever necessary. Since the objective of the study is to understand respondent opinions, perceptions, and experiences regarding technology adoption in supply chain functions, a structured questionnaire-based survey method has been used. The quantitative approach helps in collecting measurable responses from a defined sample and enables percentage-based analysis for interpretation.

This approach is useful because it allows the researcher to convert respondent views into numerical form and present findings through charts, tables, and graphical representation. It also supports easier comparison of responses across different dimensions of technology usage and supply chain performance. In addition, short interpretative observations are included wherever required to explain patterns and practical implications of the collected data.

C. Nature of Data

The study is based on both primary data and secondary data.

1. Primary Data

Primary data has been collected directly from respondents through a structured questionnaire. The questionnaire includes questions related to the use of technology in supply chain management, awareness of digital tools, perceived efficiency improvements, operational benefits, and technology-related challenges. This data forms the main basis of the analysis.

2. Secondary Data

Secondary data has been collected from:

Research papers

Academic journals

Books

Company reports

Industry publications

Trusted online sources

Supply chain and technology-related articles

Secondary data is used to support the conceptual understanding of technology adoption and supply chain efficiency and to strengthen the theoretical foundation of the study.

D. Sampling Design

1. Sampling Method

The study uses a non-probability sampling method, specifically convenience sampling.

This method is chosen because the respondents were selected based on their availability, accessibility, and relevance to the topic. Since the study focuses on understanding perceptions regarding technology adoption in supply chain management, respondents such as students, professionals, employees, and individuals familiar with business or supply chain processes were considered suitable participants.

2. Sample Size

The sample size for the study is 121 respondents.

This sample size is considered adequate for conducting percentage-based analysis and drawing meaningful conclusions regarding the role of technology adoption in improving supply chain efficiency.

3. Sampling Unit

The sampling unit of the study includes:

Employees working in business or logistics-related areas

Individuals familiar with supply chain practices

Students with knowledge of management, business, or operations



Respondents having basic awareness of technology in organizational operations

E. Area of Study

The area of study includes respondents selected from accessible educational, professional, and business-related backgrounds. The study is not restricted to a single company or organization but instead focuses on collecting general perceptions and practical responses from participants who can provide meaningful insight into the use of technology in supply chain operations.

This broader respondent base helps in understanding how technology adoption is perceived across different types of users and how it is associated with efficiency in supply chain-related functions.

F. Data Collection Methods

The data for this study has been collected using both primary and secondary sources.

1. Questionnaire Method

A **structured questionnaire** was used as the primary tool for data collection. The questionnaire was designed in a simple and understandable format to collect responses effectively from participants. It included both close-ended and opinion-based questions.

The questionnaire focused on areas such as:

Awareness of technology in supply chain management

Use of digital tools in operations

Impact on inventory, logistics, and communication

Improvement in decision-making and coordination

Reduction in delays and operational costs

Challenges in technology adoption

The responses obtained through the questionnaire were later classified, tabulated, and analyzed using percentage methods.

2. Secondary Data Collection

To support the study, information was also gathered from:

Published journals and articles

Research papers on supply chain and digital transformation

Books on supply chain management

Reports on technology adoption trends

Reliable websites and scholarly sources

These sources helped in preparing the introduction, literature review, theoretical background, and supporting interpretation of findings. The overall structure for data collection has been adapted from your shared methodology format and customized to fit this study topic and respondent-based approach.

G. Research Instrument

The main research instrument used in this study is a questionnaire.

The questionnaire was prepared in a systematic format and consisted of multiple questions related to the study objectives. It was designed to collect responses in a simple, clear, and relevant manner. The instrument was chosen because it is one of the most effective methods for collecting data from a larger number of respondents within a short period of time.

The questionnaire also helped in maintaining uniformity in responses and made the analysis process easier and more structured.

H. Data Analysis Tools

The collected data has been analyzed using percentage analysis and graphical representation.

1. Percentage Analysis

Percentage analysis is used to classify the responses and understand the proportion of respondents selecting each option. It helps in presenting the data in a simple and meaningful way.



The formula used is:

$$\text{Percentage} = (\text{Total Number of Respondents} \div \text{Number of Respondents}) \times 100$$

2. Graphical Representation

The analyzed data is presented through:

- Bar charts
- Pie charts
- Column charts
- Line charts
- Doughnut charts

These graphical tools help in improving the visual understanding of the results and make interpretation easier.

I. Period of Study

The study has been conducted during the academic project period for the purpose of analyzing the role of technology adoption in supply chain efficiency. The data collection, interpretation, and report preparation were completed within the time frame assigned for the project work.

J. Limitations of the Study

Every research study has certain limitations, and the present study is no exception. The major limitations of this study are as follows:

The study is based on a sample size of 121 respondents, so the findings may not represent all industries or business sectors.

The study depends mainly on questionnaire-based responses, which may include personal opinions and perception-based answers.

Some respondents may have limited practical exposure to advanced supply chain technologies.

Time constraints restricted the collection of a larger and more diverse sample.

The study mainly focuses on general technology adoption and does not deeply analyze industry-specific implementation differences.

Despite these limitations, the study provides useful and practical insights into the role of technology adoption in improving supply chain efficiency.

VII. DATA ANALYSIS AND RESULTS

The collected data from 123 respondents was analyzed using percentage analysis and graphical representation to understand the role of technology adoption in enhancing supply chain efficiency. The findings are presented through tables and charts to clearly illustrate the distribution of responses. The analysis focuses on key areas such as adoption of digital technologies, impact on inventory management, logistics improvement, communication efficiency, cost reduction, and decision-making support in supply chain operations.

1. Adoption of Technology in Supply Chain Operations

Table 1: Level of Technology Adoption in Supply Chain Activities

Response	Number of Respondents	Percentage
Highly Adopted	46	37%
Moderately Adopted	39	32%
Low Adoption	23	19%
Not Adopted	15	12%
Total	123	100%



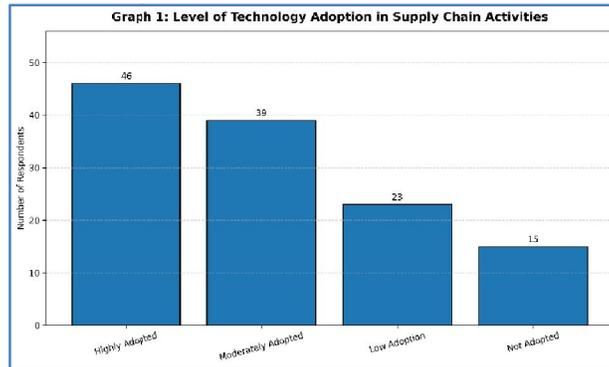


Fig 1: Graph 1

Discussion:

The analysis shows that a significant proportion of respondents indicated that technology has been adopted in supply chain operations to a considerable extent. About 37% of the respondents stated that technology is highly adopted, while 32% reported a moderate level of adoption. This reflects a growing recognition among organizations of the importance of digital tools in managing supply chain activities more effectively and efficiently.

At the same time, 19% of respondents reported low adoption, and 12% indicated that technology has not yet been adopted in their supply chain operations. This suggests that although digital transformation is progressing, some organizations still face barriers such as budget limitations, lack of technical expertise, or resistance to change. Overall, the results indicate a positive shift toward digital integration in supply chain management.

2. Technology and Inventory Management Efficiency

Table 2: Impact of Technology on Inventory Management

Response	Number of Respondents	Percentage
Strongly Agree	49	40%
Agree	38	31%
Neutral	20	16%
Disagree	10	8%
Strongly Disagree	6	5%
Total	123	100%

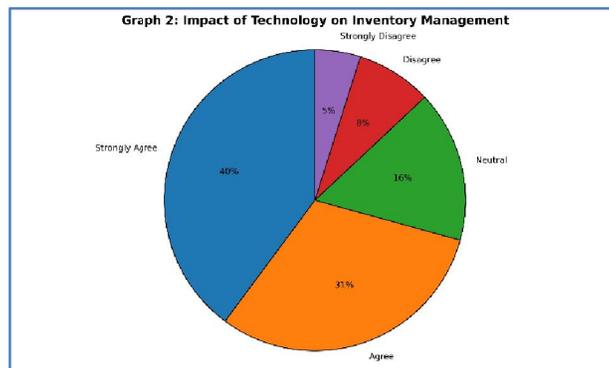


Fig 2: Graph 2



Discussion:

The above table indicates that technology has a strong positive influence on inventory management within supply chain systems. A combined 71% of respondents either strongly agreed or agreed that technology improves inventory control by enabling accurate stock monitoring, reducing stockouts, and supporting timely replenishment. This shows that digital tools such as barcode systems, RFID, ERP software, and inventory management applications are playing a valuable role in improving stock efficiency.

Only a small percentage of respondents expressed disagreement, while 16% remained neutral. This may suggest that some respondents have limited exposure to advanced inventory systems or are still operating in partially manual environments. Overall, the findings highlight that technology contributes significantly to maintaining better inventory accuracy and operational flow.

3. Role of Technology in Improving Logistics and Transportation

Table 3: Effect of Technology on Logistics Efficiency

Response	Number of Respondents	Percentage
Very High	43	35%
High	36	29%
Moderate	25	20%
Low	12	10%
Very Low	7	6%
Total	123	100%

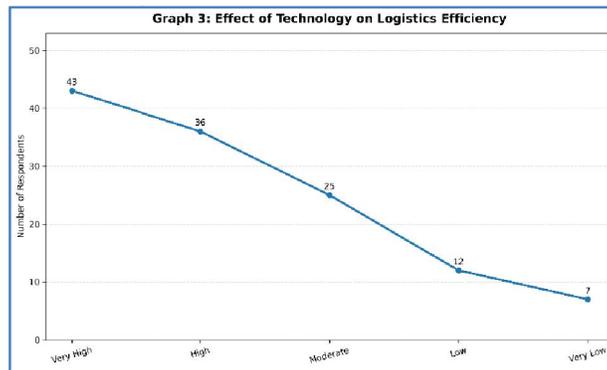


Fig 3: Graph 3

Discussion:

The data reveals that respondents largely believe technology has a positive effect on logistics and transportation performance. Around 64% of respondents rated the effect as either very high or high, indicating that digital tools such as GPS tracking, route optimization software, automated dispatch systems, and shipment monitoring platforms are improving delivery speed and transportation planning.

A smaller percentage of respondents rated the effect as low or very low, which may be due to limited implementation in certain organizations. However, the majority view clearly suggests that logistics operations become more streamlined and reliable when supported by modern technological systems. This supports the idea that transportation efficiency is one of the most visible outcomes of technology adoption in supply chains.



4. Technology Adoption and Communication Efficiency

Table 4: Improvement in Communication and Coordination Through Technology

Response	Number of Respondents	Percentage
Strongly Agree	45	37%
Agree	41	33%
Neutral	18	15%
Disagree	11	9%
Strongly Disagree	8	6%
Total	123	100%

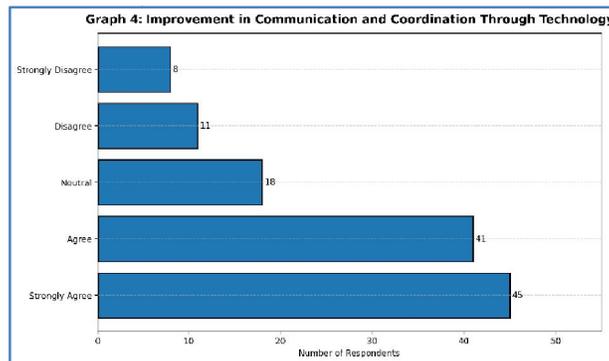


Fig 4: Graph 4

Discussion:

Effective communication and coordination are essential for smooth supply chain operations, and the findings show that technology has improved these functions considerably. About 70% of respondents agreed that digital systems enhance communication between departments, suppliers, warehouses, and logistics teams. This indicates that cloud platforms, integrated software systems, and real-time data sharing tools help reduce delays and improve coordination.

A relatively smaller group expressed disagreement or neutrality, which may reflect differences in organizational practices or incomplete digital integration. Nevertheless, the results strongly suggest that technology contributes to a more connected and collaborative supply chain environment, reducing communication gaps and improving operational alignment.

5. Technology and Reduction in Operational Costs

Table 5: Role of Technology in Reducing Supply Chain Costs

Response	Number of Respondents	Percentage
Strongly Agree	42	34%
Agree	39	32%
Neutral	22	18%
Disagree	12	10%
Strongly Disagree	8	6%
Total	123	100%



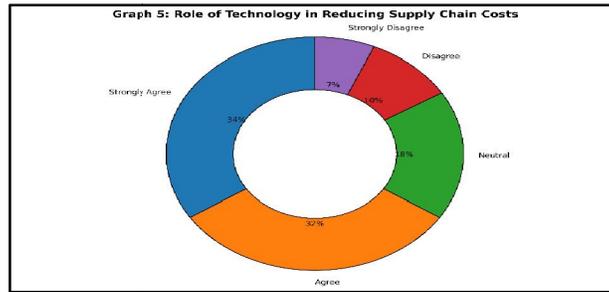


Fig 5: Graph 5

Discussion:

The findings indicate that technology adoption plays a substantial role in reducing supply chain-related operational costs. A combined 66% of respondents either strongly agreed or agreed that digital tools help lower costs by minimizing manual errors, improving planning, reducing wastage, and increasing process efficiency. This reflects the financial benefits organizations can gain by integrating technology into supply chain activities.

At the same time, some respondents remained neutral or disagreed, which could be due to the high initial investment required for implementing advanced systems. However, the overall response suggests that despite initial setup costs, technology contributes positively to long-term cost efficiency and better resource utilization.

6. Technology and Decision-Making in Supply Chain Management

Table 6: Influence of Technology on Supply Chain Decision-Making

Response	Number of Respondents	Percentage
Very Effective	47	38%
Effective	36	29%
Moderately Effective	22	18%
Less Effective	11	9%
Not Effective	7	6%
Total	123	100%

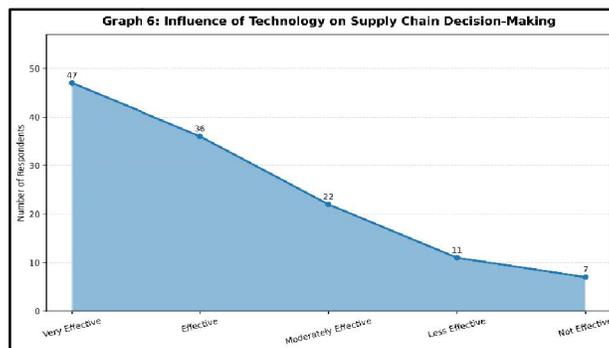


Fig 6: Graph 6

Discussion:

The table clearly shows that technology has become an important support system for decision-making in supply chain management. Around 67% of respondents believe that technology is either very effective or effective in helping organizations make better decisions related to procurement, inventory, transportation, supplier management, and



operational planning. This indicates that access to real-time data and analytical tools improves managerial judgment and reduces uncertainty.

Only a small percentage of respondents considered technology less effective or ineffective. This may be due to lack of training, underutilization of available systems, or dependence on traditional decision-making methods. Overall, the results suggest that technology strengthens supply chain decision-making by improving information accuracy, visibility, and planning capability.

VIII. CONCLUSION

The present study clearly shows that technology adoption plays a highly significant role in improving supply chain efficiency in modern organizations. In today's competitive and fast-changing business environment, traditional supply chain practices alone are no longer sufficient to ensure speed, accuracy, coordination, and cost-effectiveness. The findings of this study indicate that the use of technological tools such as ERP systems, automation, cloud platforms, IoT, digital tracking systems, and data analytics has a positive influence on various supply chain functions including inventory management, logistics, communication, cost control, and decision-making. The analysis of responses collected from 123 respondents reveals that a majority of participants believe technology has become an essential factor in making supply chain operations more organized, responsive, and reliable.

The study further highlights that technology contributes to better inventory visibility, improved logistics performance, smoother coordination among supply chain partners, and more informed managerial decisions. Organizations that adopt digital tools are more capable of reducing delays, minimizing manual errors, lowering operational costs, and responding quickly to changing market demands. At the same time, the study also reflects that some organizations still face challenges in adopting advanced technologies due to financial constraints, limited technical knowledge, or resistance to change. Despite these barriers, the overall findings strongly confirm that technology adoption has become a necessary strategic step for enhancing supply chain efficiency and achieving sustainable operational performance. Therefore, it can be concluded that technology is not merely a support function in supply chain management, but a powerful driver of efficiency, competitiveness, and long-term business success.

FUTURE SCOPE

The future scope of this study is broad and highly relevant, as technology in supply chain management continues to evolve rapidly with the advancement of digital transformation. In the coming years, organizations are expected to make greater use of emerging technologies such as artificial intelligence, machine learning, blockchain, robotics, predictive analytics, digital twins, and smart warehouse systems to further improve supply chain efficiency. Future research can explore how these advanced technologies influence not only operational performance but also strategic decision-making, sustainability, resilience, and customer satisfaction within supply chain systems. This will help in developing a deeper understanding of how supply chains can become more intelligent, adaptive, and interconnected. In addition, future studies may be conducted with a larger sample size and across different industries such as manufacturing, retail, healthcare, logistics, and e-commerce to compare how technology adoption differs from one sector to another. Researchers can also focus on specific areas such as supplier integration, last-mile delivery optimization, real-time tracking, demand forecasting, and warehouse automation. Another important area for future work is to examine the challenges and barriers to digital adoption, especially among small and medium-sized enterprises. As businesses increasingly rely on digital infrastructure, future studies can also assess the role of cybersecurity, data privacy, and digital skill development in sustaining efficient supply chain systems. Thus, the future scope of this topic remains highly promising and continues to offer valuable opportunities for academic research as well as practical business application.



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