

A Study on the Impact of Technology Revolution in Supply Chain Management.

Author Name¹: **Syed Younus,**

MBA Student, Vidya Vikas Institute of Engineering and Technology, Mysuru

Email id: sksyed2003@gmail.com

Second Author Name²: **Assistant Professor Madhunayaka,**

Vidya Vikas Institute of Engineering and Technology, Mysuru.

Abstract

Technological developments in digital technologies have greatly impacted supply chain management through increased efficiency, transparency, and better decision-making processes. This research will be conducted to explore the effects of the technological revolution in terms of supply chain management. Technologies such as artificial intelligence (AI), internet of things (IoT), big data analytics, blockchain, cloud computing, and automation will be discussed. The purpose of this research is to find out how these technologies affect supply chain management, inventory management, logistics, and communication.

Topic: A Study on the Impact of Technology Revolution in Supply Chain Management.

Introduction

In the modern business environment, technology has become one of the most important drivers of organizational growth and competitiveness. The rapid advancement of digital technologies has transformed the way businesses operate, communicate, and deliver value to customers. One of the key areas that has experienced significant transformation is Supply Chain Management (SCM). Supply chain management refers to the planning, coordination, and control of activities involved in sourcing, procurement, production, inventory management, transportation, and distribution of goods and services. The primary objective of supply chain management is to ensure that products and services reach customers efficiently, cost-effectively, and on time. The technology revolution has introduced innovative tools and systems that have significantly improved supply chain operations. Technologies such as Artificial Intelligence (AI), Internet of Things (IoT), Big Data Analytics, Cloud Computing, Blockchain Technology, Robotics, and Automation have changed traditional supply chain practices into highly integrated and intelligent systems. These technologies enable organizations to collect, process, and analyze large volumes of data in real time, helping managers make informed decisions and respond quickly to market changes. Traditionally, supply chains were managed through manual processes and paper-based documentation, which often resulted in delays, errors, lack of transparency, and increased operational costs. Communication between suppliers, manufacturers, distributors, and customers was slow and inefficient. Inventory management was challenging, and businesses frequently faced issues such as stock shortages, excess inventory, and inaccurate demand forecasting. However, with the emergence of digital technologies, organizations can now monitor and manage their supply chain activities more effectively. The Internet of Things (IoT) has revolutionized supply chain visibility by enabling real-time tracking of goods, vehicles, and inventory through connected sensors and devices. Businesses can monitor the movement and condition of products throughout the supply chain, reducing losses and improving operational efficiency. Similarly, Artificial Intelligence and Machine Learning technologies help organizations predict customer demand, optimize inventory levels, and identify potential risks before they occur. These technologies support better planning and decision-making, leading to improved productivity and customer satisfaction. Big Data Analytical plays a crucial role in modern supply chain management by analyzing large amounts of structure and unstructured data generated from various sources. Organizations use data analytics to understand customer behavior,

forecast market trends, improve supplier performance, and optimize logistics operations. The insights gained from data analysis help businesses reduce costs, improve service quality, and achieve a competitive advantage in the market. Cloud Computing has further enhanced supply chain integration by providing a centralized platform for storing and sharing information among supply chain partners. Cloud-based systems facilitate collaboration between suppliers, manufacturers, distributors, and retailers regardless of their geographical locations. Real-time information sharing improves coordination, reduces communication gaps, and increases operational efficiency across the entire supply chain network.

REVIEW OF LITERATURE

Chistopher (2016): He as highlighted that technological advancements such as automation and digital communication have significantly improved supply chain efficiency by reducing operational costs and increasing responsiveness to customer demands. **Ivanov and Dolgui (2020):** he examined the role of industry 4.0 technologies in supply chains and found that digital transformation enhances supply chain resilience, flexibility, and real-time decision-making capabilities. **Kamble, Gunasekaran, and Sharma (2018):** He studied the adoption of artificial intelligence (AI) and internet of things in supply chain and concluded that these technologies improve inventory management, forecasting accuracy, and operational performance. **Halfomann and Rusch (2017):** He found that big data analytics enables organizations to process large volumes of information, leading to better demand forecasting and improved strategic planning. **Queiroz and Wamba (2019):** He explored blockchain technology in supply chain management and reported that blockchain increases transparency, traceability, and trust among supply chain partners. **Sander, Semejin, and Mahr (2018):** He investigated the impact of digitalization on logistics operations and observed improvements in delivery speed, customer satisfaction, and overall supply chain visibility. **Wamba et al. (2020):** He has analyzed the effect of predictive analytics in supply chains and concluded that data driven decision making significantly enhances supply chain performance and risk management. **Buyukozkan and Gocer (2018):** Emphasized that digital supply chain technologies improve collaboration among suppliers, manufactures, and customers resulting in better coordination and reduced lead times. **Saberi et al. (2019):** Discussed the integration of blockchain and IoT in supply chains and found that these technologies help reduce fraud, improve product tracking, and strengthen supply chain security. **Dolgui and Ivanov (2022):** He highlights that emerging technologies such as artificial intelligence, Machine learning, and robotics are transforming supply chain operations by increasing automation, efficiency, and adoptability in dynamic market environments.

STATEMENT OF THE PROBLEM:

The quick evolution in terms of technologies including artificial intelligence, internet of things, big data analysis, blockchain, cloud computing, and automation have changed the way supply chain is managed in organizations. The use of technology has enhanced the efficiency of operations, inventory control, and real-time decision making. Yet, many companies still have problems when it comes to implementing new technologies due to the high cost of implementation, technical difficulties, and reluctance to change.

Although technological advances have become increasingly important for supply chain management, it is imperative to assess the real effects of the technology revolution on the performance, efficiency, responsiveness, and customer satisfaction of the supply chain. Thus, the main purpose of this research is to evaluate the effect of technological innovations on supply chain management and to determine the advantages and disadvantages of implementing them.

NEED FOR THE STUDY:

The rise of technologies in the digital world has greatly changed the way of doing supply chain management in various organizations, and some of the advanced technologies include artificial intelligence (AI), internet of things (IoT), big data analytics, blockchain, cloud computing, and automation which have helped organizations in increasing efficiency and reducing cost. In today's competitive and global world, it has become very necessary for companies to adopt such technologies in order to perform well in their supply chain functions.

This research is important in understanding how technological advancement impacts on the performance of supply chains and organizational success. This research provides an idea about the advantages, opportunities and challenges related to the use of advanced technologies in supply chain management processes. This research is important in

providing insights on how technologies can help in improving coordination, inventory management, logistics and other aspects of operational efficiency.

OBJECTIVES OF THE STUDY:

- To examine the extent of technology adoption in supply chain management.
- To analyze the impact of technological advancements on supply chain efficiency and performance.
- To evaluate the role of technology in improving inventory management, logistics, and communication.

HYPOTHESIS

H0 (Null Hypothesis): The integration of IoT devices has no significant impact on real-time asset tracking or inventory variance.

H1 (Alternative Hypothesis): The integration of Internet of Things (IoT) devices significantly improves real-time asset tracking and reduces inventory variance in global supply chains.

RESEARCH METHODOLOGY

RESEARCH DESIGN

Research methodology is the overall process that involves collecting, analyzing, and interpreting the data in order to meet the objectives of the research. In this case, the use of primary and secondary data has been employed for the purpose of assessing the effects of technology revolution in supply chain management. Primary data was collected using the questionnaire survey method while the non-probability snowball sampling technique was employed to select the respondents.

A convergent parallel mixed methods approach will be used for this research. Convergent parallel means that data will be gathered through both quantitative and qualitative techniques at the same time, analyzed separately and then synthesized.

SAMPLING METHOD

For this research I have chosen non-probability sampling method in that specifically snowball method to conduct this research.

Research Approach: Convergent Parallel Mixed Methods Approach (combining quantitative questionnaire data and qualitative secondary data collected simultaneously).

SOURCE OF DATA

- **Primary Data:** Primary data was acquired directly from the respondents through the means of a survey questionnaire. Information gained from the respondents gave direct insight into the effect of technological innovations on supply chain management.
- **Secondary Data:** - were collected from books, journals, research articles, websites, and published reports related to supply chain management and technological innovations such as AI, Big Data Analytics, Blockchain, and cloud computing. These sources helped in understanding the theoretical background and supporting the study findings.
- **Sampling Technique:** Non-Probability Snowball Sampling, where existing respondents referred additional participants with relevant knowledge of technology and supply chain management.

LIMITATIONS OF THE STUDY:

- The study is based on a limited sample size, which may not represent the entire population.
- The research relies mainly on respondents' opinions, which may be subject to personal bias.
- Time constraints limited the scope and depth of the study.

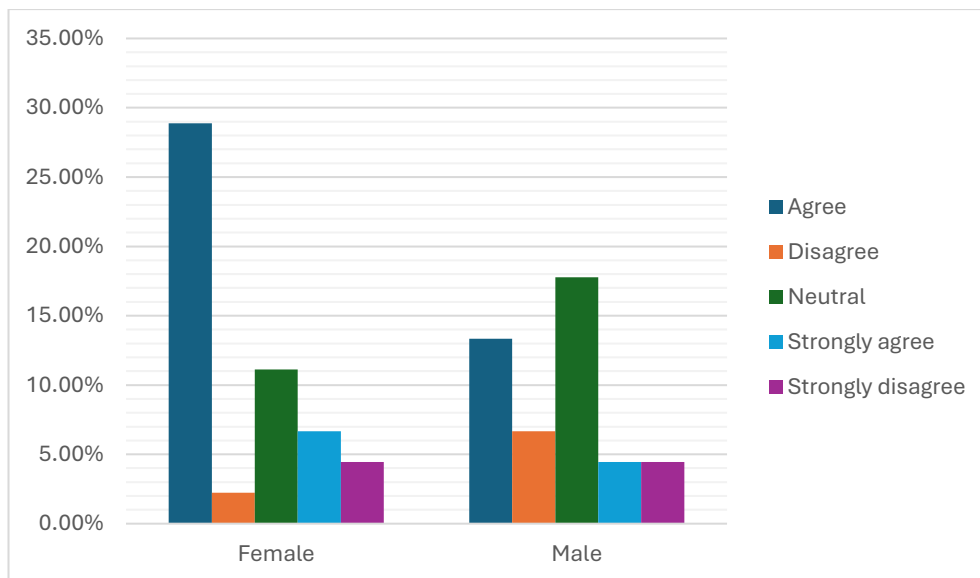
- The study focuses only on selected technological innovations such as Artificial Intelligence (AI), Internet of Things (IoT), Big Data Analytics, Blockchain, Cloud Computing, and Automation. Other emerging technologies were not considered.
- The findings are based on responses from a limited geographical area and may not reflect the practices of organizations in different regions or countries.

2. Age and Gender Distribution of Respondents

Count of 2.AGE	Column Labels				
Row Labels	18 to 24	25 to 34	35 to 44	45 to 60	Grand Total
Female	44.44%	6.67%	2.22%	0.00%	53.33%
Male	35.56%	4.44%	4.44%	2.22%	46.67%
Grand Total	80.00%	11.11%	6.67%	2.22%	100.00%

Analysis

The table shows that 80% of respondents belong to the 18-24 years age group, followed by 11.11% in the 25-34 years category. Females constitute 53.33% of the respondents, while males account for 46.67%.



Interpretation

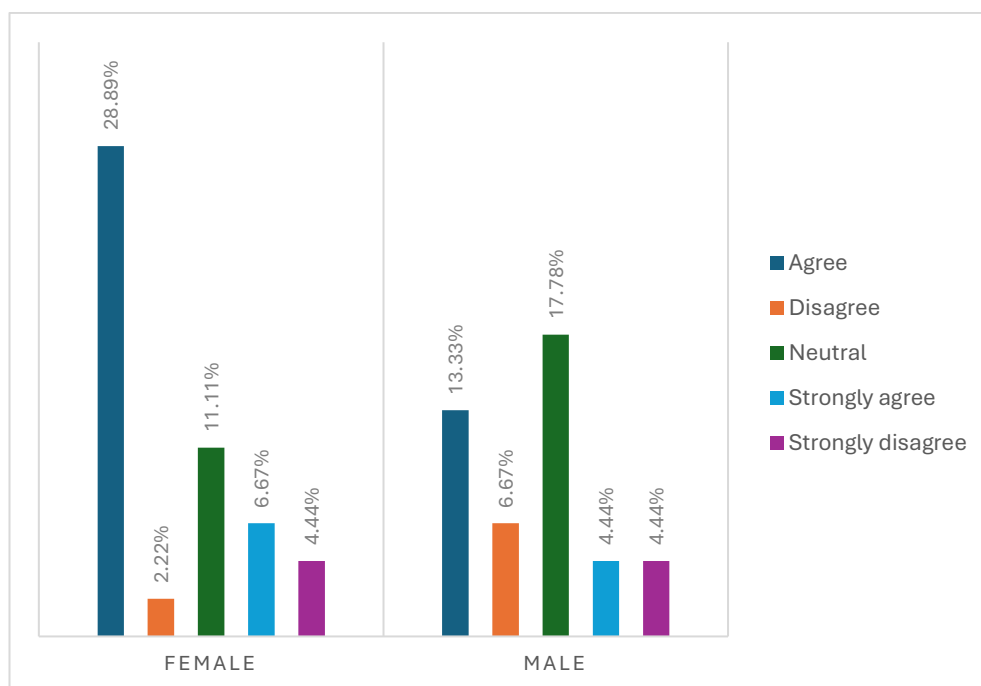
Most respondents are young individuals aged 18-24 years, indicating that the study mainly represents the views of younger participants. Female respondents slightly outnumber male respondents, providing a balanced gender distribution for the study.

8. Technology Improves Supply Chain Efficiency

Count of GENDER	1. Column Labels						
Row Labels	Agree	Disagree	Neutral	Strongly agree	Strongly disagree	(blank)	Grand Total
Female	26.67%	6.67%	13.33%	2.22%	2.22%	2.22%	53.33%
Male	15.56%	11.11%	13.33%	6.67%	0.00%	0.00%	46.67%
Grand Total	42.22%	17.78%	26.67%	8.89%	2.22%	2.22%	100.00%

Analysis

Among the respondents, 42.22% agreed that technologies advancement improve supply chain efficiency, while 26.67% remained neutral. Only 17.785 disagreed, and 8.895 strongly agreed.



Interpretation

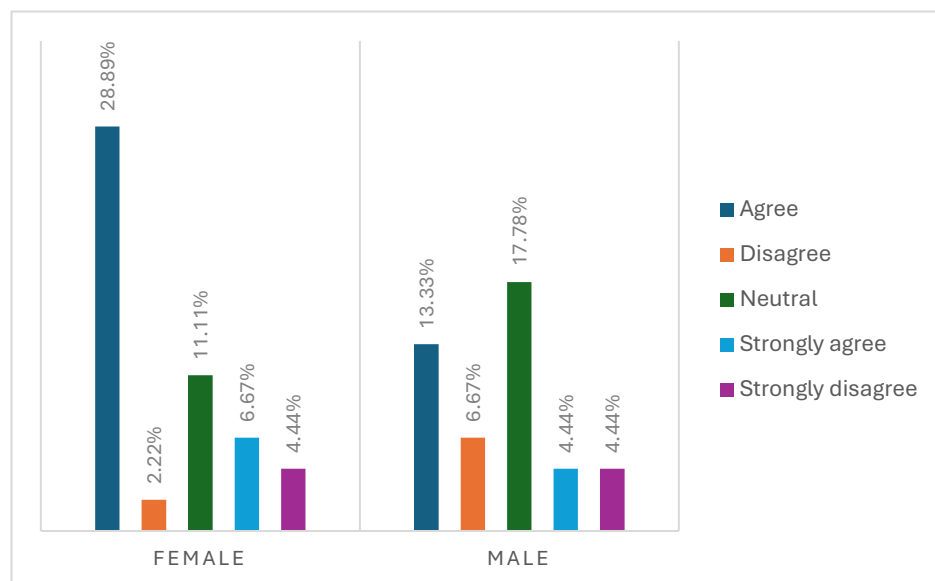
The findings reveal that respondents believe technology plays an important role in improving inventory management and communication processes within supply chains.

6. Technology Enhances Inventory Management and Communication

Count of 1. GENDER	Column Labels					
Row Labels	Agree	Disagree	Neutral	Strongly Agree	Strongly Disagree	Grand Total
Female	20.00%	2.22%	15.56%	8.89%	6.67%	53.33%
Male	22.22%	4.44%	6.67%	6.67%	6.67%	46.67%
Grand Total	42.22%	6.67%	22.22%	15.56%	13.33%	100.00%

Analysis

The table indicates that 42.22% of respondents agreed, 15.565 strongly agreed, and 22.225 remained neutral. Only 20% expressed disagreement or strong disagreement.



Interpretation

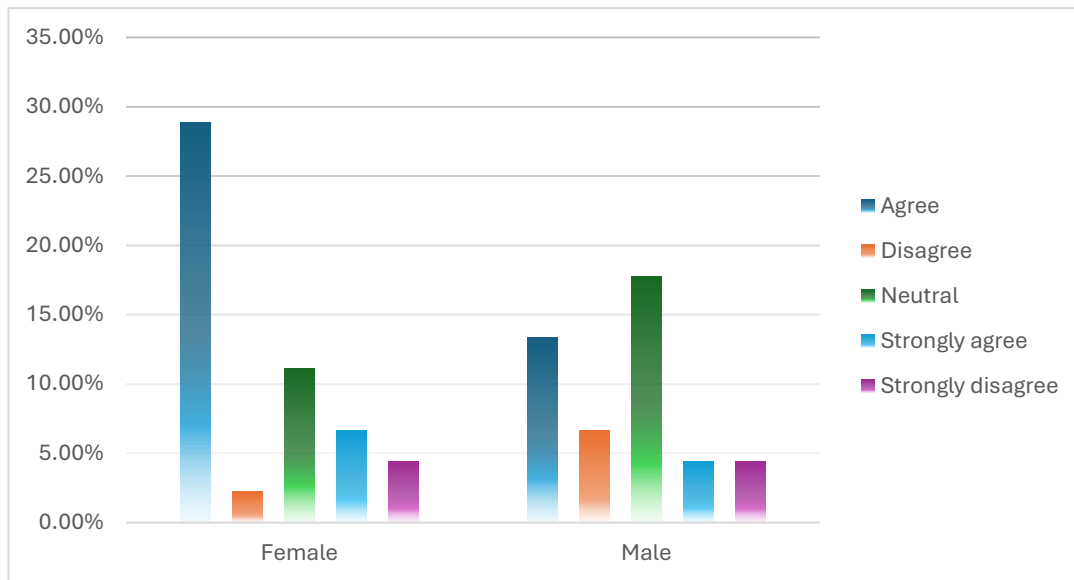
Most respondents hold a positive view on the contribution of technology towards increased efficiency in the supply chain. This shows that innovations in technology are usually viewed positively in improving performance.

11. Technology Improves Logistics and Delivery Performance

Count of 1.	Column Labels					
GENDER						
Row Labels	Agree	Disagree	Neutral	Strongly agree	Strongly disagree	Grand Total
Female	33.33%	6.67%	6.67%	4.44%	2.22%	53.33%
Male	20.00%	6.67%	6.67%	4.44%	8.89%	46.67%
Grand Total	53.33%	13.33%	13.33%	8.89%	11.11%	100.00%

Analysis

Most respondents (53.33%) agreed that technology positively affects logistics and delivery performance. About 13.33% remained neutral, while 24.44% expressed disagreement or strong disagreement.



Interpretation

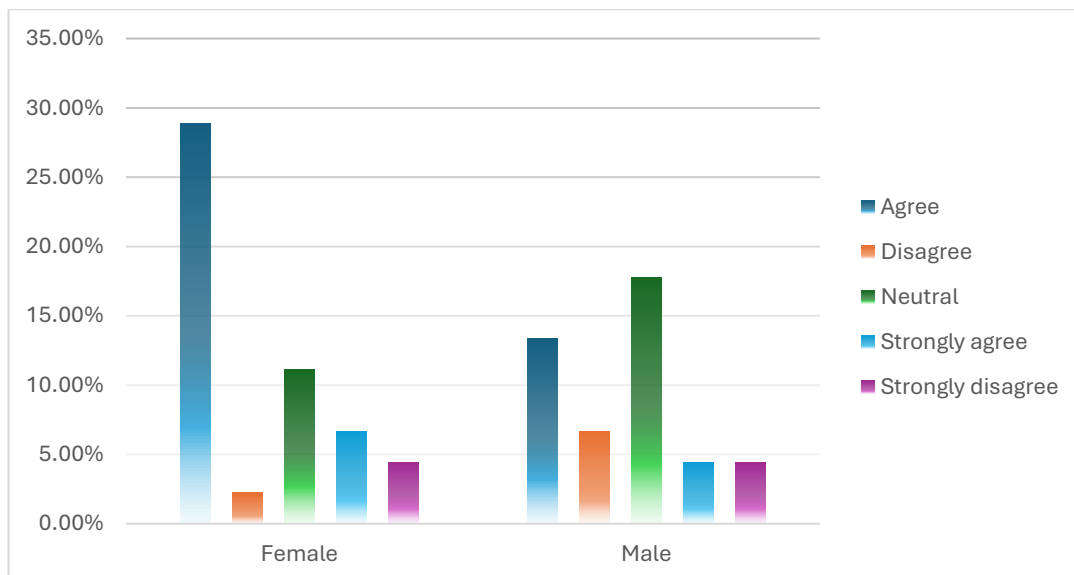
The results suggest that technological advancements contribute significantly to better logistics operations and timely delivery, thereby improving overall supply chain performance.

13. Overall Impact of Technology Revolution on Supply Chain Management

Count of 1.GENDER	Column Labels					
Row Labels	Agree	Disagree	Neutral	Strongly agree	Strongly disagree	Grand Total
Female	28.89%	2.22%	11.11%	6.67%	4.44%	53.33%
Male	13.33%	6.67%	17.78%	4.44%	4.44%	46.67%
Grand Total	42.22%	8.89%	28.89%	11.11%	8.89%	100.00%

Analysis

As can be seen from the table below, 42.22% agreed, and 11.115 strongly agreed that technological innovations have had a positive impact on supply chain management. On the other hand, 28.89% were neutral, whereas 17.78%



Interpretation

Many people understand that there is a positive effect of the technology revolution on supply chain management. This means that digital technologies like AI, Big Data, and automation help in making supply chains more efficient, transparent, and better for decision making.

SPSS TEST:

5. What is the primary industry sector of your organization? * 8. We utilize advanced Big Data analytics tools to drive our demand forecasting and inventory planning. Crosstabulation

Count

		8. We utilize advanced Big Data analytics tools to drive our demand forecasting and inventory planning.		
		1	2	3
5. What is the primary industry sector of your organization?	Logistics / Third-Party Transportation (3PL)	0	1	0
	Manufacturing / Production	0	1	3
	Other	1	5	5
	Retail / E-commerce	0	1	4
Total		1	8	12

5. What is the primary industry sector of your organization? * 8. We utilize advanced Big Data analytics tools to drive our demand forecasting and inventory planning. Crosstabulation

Count

		8. We utilize advanced Big Data analytics tools to drive our demand forecasting and inventory planning.		
		4	5	
5. What is the primary industry sector of your organization?	Logistics / Third-Party Transportation (3PL)	0	1	2
	Manufacturing / Production	4	0	8
	Other	12	3	26
	Retail / E-commerce	3	0	8
Total		19	4	44

Chi-Square Tests

	Value	df	Asymptotic Significance (2- sided)
Pearson Chi-Square	11.460 ^a	12	.490
Likelihood Ratio	12.167	12	.432
N of Valid Cases	44		

a. 18 cells (90.0%) have expected count less than 5. The minimum expected count is .05.

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
9. Our logistics network relies heavily on digital tracking systems to monitor goods in real-time.	45	1	5	3.38	1.211
10. Employees receive sufficient, continuous training to master new digital supply chain tools	45	1	5	3.49	1.160
11. The operational speed of our order processing and fulfillment has significantly increased	45	1	5	3.36	1.171
14. Information sharing and collaboration with external vendors/suppliers have improved remarkably.	45	1	5	3.33	1.000
Valid N (listwise)	45				

Hypothesis Test Summary

	Null Hypothesis	Test	Sig.	Decision
1	The categories of 7. Cloud-based platforms are deeply integrated into our supply chain system to share data instantly. occur with equal probabilities.	One-Sample Chi-Square Test	.004	Reject the null hypothesis.
2	The categories of 15. Overall operational costs associated with logistics and inventory holding have noticeably decreased. occur with equal probabilities.	One-Sample Chi-Square Test	.006	Reject the null hypothesis.
3	The categories of 9. Our logistics network relies heavily on digital tracking systems to monitor goods in real-time. occur with equal probabilities.	One-Sample Chi-Square Test	.011	Reject the null hypothesis.
4	The categories of 8. We utilize advanced Big Data analytics tools to drive our demand forecasting and inventory planning. occur with equal probabilities.	One-Sample Chi-Square Test	.000	Reject the null hypothesis.

Asymptotic significances are displayed. The significance level is .05.

Findings: -

- Technology has made the supply chain more efficient as a whole.
- Automation has minimized manual labor and operational costs.
- Real-time monitoring has increased visibility throughout the entire supply chain process.
- Artificial intelligence (AI) has made demand forecasting and inventory management better.
- Blockchain technology has increased transparency and product traceability.

Conclusion: -

The efficiency of the whole supply chain has been improved through technology.

Automation has reduced human labor and costs.

Real-time monitoring has ensured better visibility in the whole supply chain process.

Artificial intelligence has improved demand forecasting and inventory management.

Blockchain technology has enhanced transparency and traceability of products.

Suggestion: -

- Businesses need to incorporate advanced digital technology solutions like Artificial Intelligence (AI), Internet of Things (IoT), Big Data Analytics, Blockchain, and Cloud Computing to enhance the efficiency and competitiveness of the supply chain operations.
- Business organizations need to offer regular training and development opportunities to the employees to enable them to use the digital technology solutions in supply chain management.
- There is a need for increased security measures against cyber-attacks and data breaches by the businesses in order to ensure protection of the supply chain data.
- There is a need for SMEs to use digital technologies slowly according to their capability of implementation.
- Businesses need to collaborate and share information with the suppliers, distributors, and consumers through digital integration.

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