International Scientific Journal of Engineering aand Management (ISJEM) ISSN: 2583-6129
Volume: 05 Issue: 04 | April – 2026 DOI:10.55041/ISJEM06943
An International Scholarly || Multidisciplinary || Open Access || Indexing in all major Database & Metadata

A Study on Digital Transformation in Logistics and Supply Chain

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ABSTRACT

Digital transformation has become a critical factor in improving efficiency, transparency, and competitiveness in logistics and supply chain management. This study examines the impact of digital technologies such as Artificial Intelligence (AI), Internet of Things (IoT), cloud computing, and big data analytics on supply chain performance. The research is based on primary data collected from 278 respondents using a structured questionnaire. Statistical tools including percentage analysis, correlation, and regression analysis were applied. The findings indicate that digital transformation significantly improves operational efficiency, customer satisfaction, and productivity. However, challenges such as uneven adoption, lack of skilled workforce, and resistance to change continue to hinder full implementation. The study concludes that organizations must adopt integrated digital strategies and invest in workforce development to achieve sustainable growth.

KEYWORDS

Digital Transformation, Logistics, Supply Chain, Artificial Intelligence, IoT, Operational Efficiency, Data Analytics

INTRODUCTION

Digital transformation refers to the integration of digital technologies into all areas of business operations, fundamentally changing how organizations operate and deliver value to customers. In the logistics and supply chain sector, digital transformation has become essential due to increasing competition, globalization, and rising customer expectations.

Traditional supply chains relied heavily on manual processes, limited communication, and delayed decision-making. However, with the emergence of advanced technologies such as Artificial Intelligence, Internet of Things, cloud computing, robotics, and big data analytics, supply chains have evolved into more intelligent and automated systems.

The rapid growth of e-commerce has further accelerated digital transformation. Customers expect faster deliveries, real-time tracking, and seamless service experiences. To meet these demands, organizations are adopting digital solutions such as automated warehouses, route optimization systems, and predictive analytics.

The COVID-19 pandemic also highlighted the importance of digital transformation. Organizations with digital capabilities were able to respond quickly to disruptions, while traditional systems struggled to adapt. This has made digital transformation a strategic necessity rather than an optional improvement. In addition, globalization and complex supply networks have increased the need for real-time data sharing and coordination among stakeholders. Digital platforms enable better collaboration between suppliers, manufacturers, distributors, and customers, resulting in improved efficiency and reduced uncertainties.

THEORETICAL FRAMEWORK

The study is grounded in the **Diffusion of Innovation Theory** and the **Technology Acceptance Model (TAM)**, which emphasize that adoption depends on perceived usefulness and ease of use.

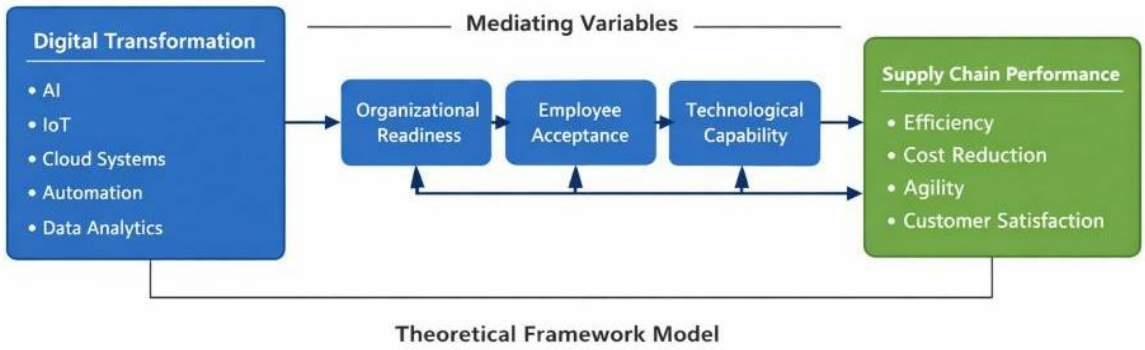

Figure 1 Theoretical Framework Model

Figure 1, illustrates how digital transformation (AI, IoT, Cloud) is mediated by organizational readiness and employee acceptance to impact overall supply chain performance.

REVIEW OF LITERATURE

The literature on digital transformation in logistics and supply chain management highlights the growing importance of technology in improving operational performance.

Ivanov (2020) emphasized the role of digital technologies in enhancing supply chain resilience during disruptions. Dubey et al. (2020) found that big data analytics improves forecasting accuracy and decision-making capabilities. Bag et al. (2021) identified artificial intelligence as a key tool for improving logistics efficiency through automation and optimization.

Studies also show that IoT enables real-time tracking of goods, improving visibility and transparency across supply chains. Cloud computing allows seamless data sharing and collaboration among stakeholders. Blockchain technology enhances security and traceability in supply chain transactions.

Recent research highlights the importance of integrating multiple technologies rather than relying on a single tool. Organizations that adopt a holistic digital transformation approach experience better performance outcomes compared to those implementing isolated solutions.

Despite these advancements, challenges such as high implementation costs, lack of skilled workforce, and resistance to change remain significant barriers. This study aims to address these issues by providing a comprehensive analysis of digital transformation and its impact on supply chain performance.

3. RESEARCH METHODOLOGY

3.1 Research Design

The present study adopts a descriptive research design to systematically examine the relationship between digital transformation and supply chain performance. A descriptive design is appropriate because it allows the researcher to describe characteristics of the population and analyse patterns based on collected data. It helps in identifying trends, behaviours, and relationships between variables without manipulating the study environment. This design ensures that the research findings are realistic and applicable to real-world logistics scenarios.

3.2 Research Approach

A quantitative research approach is employed in this study to ensure objective measurement and statistical validation of results. The quantitative method enables the researcher to collect numerical data and apply statistical tools such as correlation and regression analysis. This approach enhances the reliability and accuracy of the findings and allows generalization of results across similar populations. It also supports hypothesis testing and provides measurable insights into the impact of digital transformation.

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3.3 Data Collection

The study is based on both primary and secondary data sources. Primary data was collected through a structured questionnaire designed to capture responses related to digital adoption, operational efficiency, and supply chain performance. The questionnaire consisted of multiple-choice and Likert-scale questions to ensure clarity and consistency.

Secondary data was gathered from academic journals, books, research articles, and online databases. These sources provided theoretical support and helped in framing the research problem. Data collection was conducted within a limited time frame, ensuring timely completion of the study.

3.4 Sample Size

The study considers a sample size of 278 respondents, which is adequate for statistical analysis and ensures representativeness of the population. The respondents were selected from logistics and supply chain sectors, including students, professionals, and employees with knowledge of digital technologies. A larger sample size increases the reliability of the study and reduces sampling error.

3.5 Sampling Method

Simple random sampling technique was used in this study to ensure unbiased selection of respondents. In this method, every individual in the population has an equal chance of being selected. This approach minimizes bias and improves the validity of the research findings. It also ensures that the sample accurately represents the target population.

3.6 Tools Used

- Percentage Analysis
- Mean and Standard Deviation
- Correlation Analysis
- Regression Analysis

3.7 Limitations of the Study

- Limited sample size restricted to specific respondents
- Time constraints during data collection
- Possibility of respondent bias
- Rapid changes in technology may affect long-term relevance

4. RESULTS AND DISCUSSION

4.1 Demographic Analysis

The majority of respondents belong to the age group below 25 years, indicating strong participation from young professionals. Most respondents are postgraduates, suggesting a highly educated sample capable of understanding digital technologies

Category	Classification	Frequency	Percentage
Gender	Male	117	42%
	Female	107	38%
	Other	54	19%
Age	Below 25	150	53.96%
	26 – 35	6	2.16%
	36 – 45	31	11.15%
	46 – 55	27	9.71%

	Above 55	64	23.02%
Education	Undergraduate	42	15.11%
	Postgraduate	147	52.88%

Table 4.1 Demographic Summary

4.2 Digital Adoption

The study reveals that 83.81% of respondents use digital technologies in their operations. However, adoption levels vary significantly, with some organizations still at a low level of digital maturity.

Particulars	Frequency	Percentage
Yes	233	83.81
No	45	16.19

Table 4.2 Adoption of Digital Technologies

4.3 Operational Efficiency

A significant portion of respondents agree that digital transformation improves operational efficiency by reducing time, cost, and errors. However, some respondents disagree, indicating that benefits are not uniformly experienced.

Particulars	Frequency	Percentage
Strongly Disagree	68	24.46 %
Disagree	62	22.3 %
Neutral	0	0 %
Agree	59	21.%22
Strongly Agree	89	32.01%

Table 4.3 Digital Transformation and Efficiency

4.4 Tracking Systems

Tracking systems show mixed responses, with some respondents expressing dissatisfaction. This indicates the need for improvement in real-time monitoring technologies.

4.5 Correlation Analysis

Strong positive relationships were observed:

Variables Compared	Value	Significance
Forecasting & Customer Satisfaction	0.919	$p < 0.01$
Productivity and Supply Chain Performance	0.905	$p < 0.01$
Training and Management Support	0.900	$p < 0.01$

Table 2 Correlation Analysis between Key Variables

Interpretation: The exceptionally strong correlation ($r=0.919$) indicates that accurate, data-driven forecasting is the single most significant driver of customer satisfaction in modern logistics.

4.6 Regression Analysis

Regression analysis was conducted to examine the impact of independent variables on supply chain performance

Matric	Value
R	0.701
R^2	0.492
Adjusted R^2	0.486

Table 4.6 (a) Regression Analysis

- The model explains 49.2% of the variation in supply chain performance

Variable	Beta	Significance
Management Support	- 0.442	0.000
Digital Adoption	- 0.471	0.000
Supply Chain Performance	- 0.954	0.000

Table 4.6 (b) Regression Coefficient

The results indicate that supply chain performance has a strong positive influence, while management support and digital adoption show varying effects.

4.7 Discussion

The findings suggest that digital transformation enhances supply chain performance, but challenges such as lack of training and uneven adoption limit its effectiveness. Organizations must focus on both technological and human factors.

Additionally, companies that invest in employee training and digital infrastructure tend to achieve better outcomes compared to those that do not prioritize these aspects. This highlights the importance of strategic planning and continuous improvement.

5. FINDINGS

- High adoption of digital technologies among organizations
- Significant improvement in efficiency and productivity
- Strong relationship between forecasting and customer satisfaction
- Need for better tracking systems

- Importance of management support and training
- Digital maturity varies across organizations

6. SUGGESTIONS

- Promote uniform digital adoption across all departments
- Conduct regular training programs for employees
- Strengthen leadership support for digital initiatives
- Invest in advanced tracking technologies
- Encourage data-driven decision-making
- Develop long-term digital transformation strategies

7. FUTURE SCOPE

Future research can focus on emerging technologies such as blockchain, advanced AI, and automation. Studies can also explore different industries and geographic regions to gain broader insights. Comparative studies between developed and developing economies can provide deeper understanding of digital transformation challenges.

8. CONCLUSION

Digital transformation plays a vital role in improving logistics and supply chain performance by enhancing efficiency, transparency, and customer satisfaction. Technologies such as Artificial Intelligence, Internet of Things, cloud computing, and data analytics enable real-time data sharing, automation, and predictive decision-making. The findings of this study clearly indicate that organizations adopting digital technologies experience significant improvements in operational efficiency and overall performance. However, digital transformation is not limited to technology alone; it also depends on organizational readiness, employee skills, and effective management support.

The study further highlights that uneven levels of digital adoption exist across organizations. While some companies have achieved advanced digital maturity, others remain in the early stages of transformation. This gap affects overall industry performance and competitiveness. Additionally, the importance of data-driven decision-making has been emphasized, as digital tools allow organizations to analyze large datasets, predict trends, and respond effectively to market uncertainties. Companies that invest in employee training and digital infrastructure are more likely to achieve successful transformation outcomes.

Despite its advantages, digital transformation faces challenges such as high implementation costs, resistance to change, and lack of skilled workforce. To overcome these barriers, organizations must focus on continuous learning, innovation, and strategic planning. In conclusion, digital transformation is no longer optional but a necessity for modern logistics and supply chain operations. Organizations that effectively implement digital strategies will gain a competitive advantage, achieve sustainable growth, and enhance their ability to adapt to dynamic business environments.

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