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Project Dissertation Report

On

IMPACT OF DIGITALIZATION ON THE SUPPLY CHAIN PERFORMANCE IN INDIAN CENTRIC

Submitted By

Ritik Singh

2K23/DMBA/99

Under the guidance of

Dr. Mohd Shuaib

Assistant Professor, DTU

DELHI SCHOOL OF MANAGEMENT

Delhi Technological University

Bawana Road Delhi 110042

CERTIFICATE

This is to certify that **Ritik Singh**, roll no. **2K23/DMBA/99** has submitted the Major Research Project report titled **"Impact of digitalization on the supply chain performance in Indian centric"** in partial fulfilment of the requirements for the award of the degree of Master of Business Administration (MBA) from Delhi School of Management, Delhi Technological University, New Delhi during the academic year 2023-2024.

Dr. Mohd Shuaib
Assistant Professor
DSM,DTU

Dr. Saurabh Agrawal
Head of the Department
DSM, DTU

DECLARATION

I, **Ritik Singh**, at this moment, declare that the Major Research Project Report entitled **"Impact of digitalization on the supply chain performance in Indian centric"** submitted to Delhi Technological University is a record of my original work done under the guidance of **Dr. Mohd Shuaib, Delhi School of Management, Delhi Technological University**. This project report is submitted in partial fulfilment of the requirements for the award of the degree of MBA in Marketing and Supply Chain and Operations.

I also declare that this project report has not been submitted to any other university or institute for the award of any degree or diploma.

Ritik Singh

2K23/DMBA/99

Date:

ACKNOWLEDGEMENT

Accomplishment of a task with the desired feat demands devotion to work and prompting direction, co-operation from seniors.

I am also grateful to my university supervisor, **Dr. Mohd Shuaib, Delhi School of Management, Delhi Technological University**, for her guidance and support throughout the Major Research Project. Her valuable feedback on my project report helped me to improve it significantly.

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I would also like to thank my family and friends for their support and encouragement throughout my Major Research Project.

Finally, I would like to thank all the other people who helped me in any way during my Major Research Project.

Ritik Singh

2K23/DMBA/99

EXECUTIVE SUMMARY

This research study explores the growing role of digitalization in reshaping supply chain performance in the Indian context. In today's increasingly competitive and technology-driven market environment, the ability of organizations to adapt and integrate digital technologies into their supply chain operations has become a key differentiator. This project assesses the level of digital adoption, its perceived impact on performance metrics, and the challenges faced by Indian companies in this digital transition.

The study begins by examining the historical development of supply chain management and how global trends like Industry 4.0 have influenced digital transformations in supply chains across the world. Special attention is given to the unique dynamics of Indian supply chains, which often suffer from infrastructure limitations, manual processes, and fragmented operations. Through an extensive literature review, the research highlights how technologies like ERP, AI, IoT, blockchain, and cloud computing are enabling better inventory visibility, cost efficiency, forecasting, and customer responsiveness.

Primary data was collected using a structured questionnaire distributed among professionals and students across sectors such as manufacturing, logistics, FMCG, e-commerce, and consulting. The quantitative data was analysed using statistical tools like the Chi-square test and Spearman's correlation via SPSS software. The sample consisted of 100–150 participants with diverse exposure to supply chain operations and digital technologies.

The findings indicate that while digitalization is perceived to enhance supply chain performance—especially in areas like cost reduction and flexibility—there are still significant gaps. Not all technologies show a statistically significant association with performance improvements, particularly in inventory visibility, coordination, and customer satisfaction. However, statistically significant relationships were found between cost reduction and digital adoption, as well as between flexibility/responsiveness and digital maturity.

The study also reveals that investment in digital training correlates with higher digital maturity, although the relationship is weak. Challenges such as high costs, lack of digital skills, change resistance, and insufficient infrastructure remain prevalent in many Indian businesses, particularly among SMEs.

In conclusion, digitalization is undeniably transforming Indian supply chains by introducing agility, transparency, and resilience. Yet, to fully capitalize on these benefits, organizations must invest in workforce upskilling, infrastructure development, and scalable digital strategies. This research provides practical recommendations and identifies areas for future study to support India's transition toward globally competitive, digitally enabled supply chain networks.

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CHAPTER-1

INTRODUCTION

1.1 BACKGROUND

Introduction to Digitalization in Supply Chain

In the 21st century, firms across the world have been head-banging in the complex and dynamic environment ushered in by technological advancements. Among these technological waves, digitalization emerged as the strongest current for transforming traditional business processes, especially in supply chain management. Digitalization implies, in general terms, the transformation of supply chains by the application of information technology (IT) for all operations involved in the supply chain activities-procurement, production, warehousing, transportation, and servicing. This transformation usually involves applying ERP systems, IoT, AI, ML, cloud-based computing, blockchain, and robotic process automation for maximizing the efficiency, visibility, and agility of their supply chains.

The following are a few reasons why a supply chain might want to go digital: mass customization, real-time tracking, predictive analytics, sustainability, and customer-focused services. These changes are improving operational efficiency and defining strategies based upon data-driven analytical insights.

Indian Supply Chain Landscape

India, being one of the fastest-growing economies around the world, offers peculiar sets of challenges and opportunities for the implementation of supply chain digitalization. Traditionally, Indian supply chains have been characterized by manual processes, fragmented networks, lack of standardization, excessive dependency on human labor, and infrastructural deficiencies. On the other hand, with the increase in e-commerce, globalization, and customer expectations, Indian businesses find themselves forced to modernize supply chain operations.

Government initiatives, such as 'Digital India,' 'Make in India,' and the National Logistics Policy (NLP), have further accentuated the shift toward digital adoption in logistics and supply chain. Technological innovations are being seen increasingly as enablers for productivity

enhancement and for eliminating inefficiencies. Implementation of RFID in inventory management, AI-based demand forecasting, GPS tracking for fleet management, and warehouse automation are examples that have now found ground in large organizations and emerging start-ups.

This, however, has not stopped the fortunes of digital transformation within supply chains in India from being uneven. While on one hand, advanced technologies are introduced in large companies in industries such as automotive, FMCG, pharmaceutical and e-commerce, on the other, many SMEs continue to remain behind owing to the high cost involved, lack of digital infrastructure, and resistance to change.

Global Trends and Their Influence on India

Considered from a global perspective, supply chains are becoming fiercely battered by Industry 4.0, and digital integration is now viewed as a necessity for survival and competitive advantage. Digital supply chains engage in real-time data exchange, predictive maintenance, intelligent automation, and seamless collaboration between stakeholders.

Activities of multinational companies with presence in India in creating further push for Indian companies toward upgrading and integrating digital capabilities. Alongside, global disruptions such as COVID-19 exposed the weaknesses of conventional supply chains and instilled about the urgent need for resilient, digital-first models. Indian companies that had made digital investments so far could better manage the disruptions by facilitating remote working, virtual collaboration, and touchless logistics operations during the pandemic.

Why This Study is Relevant Now

In an era where the supply chain is heavily data-driven, there comes a moment when focusing on the impact of digitalization on supply chain performance becomes essential. Organizations today need digital investments to yield measurable outcomes: increased delivery lead time improvement, operational cost reduction, customer satisfaction increment, and increased turnover of inventory.

Yet the road to digital scarcity has its pitfalls. Cybersecurity threats, lack of digital skills, change management-related issues, complexity of integration, and intangible ROI continue to act as obstructions to the complete adoption of digital transformation.

In this respect, the Indian market presents itself as a perfect place for the research to take place. There is a need to systematically observe to what extent digitalization is getting adopted in Indian supply chains and whether tangible performance benefits are indeed observed. Such a study shall assist in identifying drivers, benefits, limitations, and preparedness of Indian firms and supply chain practitioners toward digital transformation.

This scenario leads to the setting for the present study, which intends to delve into these issues and throw some light on the practical implications of digitalization for supply chain performance in India.

EVOLUTION OF SUPPLY CHAIN

a. Early Supply Chains (Pre-Industrial Era)

The concept of supply chains has existed for centuries, albeit in a basic form. In the pre-industrial era, supply chains were primarily local and linear, with limited participants and minimal complexity. Goods were produced and consumed within small communities, and most supply chain functions — from sourcing to distribution — were carried out manually or with the help of simple tools.

Trade routes like the Silk Road and maritime trade between countries laid the foundation for long-distance supply chains, but coordination was slow and communication minimal. There was no real-time data or structured logistics; trust and long-term relationships played a central role in sustaining supply activities.

b. Industrial Revolution (18th to 19th Century)

The Industrial Revolution marked a turning point in the evolution of supply chains. With the rise of mass production, mechanization, and improved transportation systems (like railways and steamships), supply chains became more scalable and geographically distributed.

- Manufacturing shifted from artisan-based to factory-based systems.
- Raw materials could be sourced from far-off regions.

- Transportation and warehousing practices became more organized.

However, supply chain management (SCM) as a concept was still not formalized, and most operations were driven by logistics and production efficiencies.

c. Post-World War Era (1950s – 1970s)

Post World War II, economies started recovering and globalization began to take shape. This period saw the emergence of logistics management as a formal business function.

- Concepts like Just-in-Time (JIT), Economic Order Quantity (EOQ), and Material Requirements Planning (MRP) began gaining popularity.
- Large multinational corporations began operating global supply chains.
- Warehousing, inventory management, and procurement started becoming more systematic.

During this time, cost-efficiency and lean practices were major drivers of supply chain design.

d. Birth of Supply Chain Management (1980s – 1990s)

The 1980s and 90s are widely considered the era when Supply Chain Management emerged as a strategic business discipline. The focus shifted from just logistics to end-to-end coordination among suppliers, manufacturers, distributors, and retailers.

- ERP systems like SAP and Oracle started integrating data across supply chain functions.
- Companies began to look at supply chains as a source of competitive advantage.
- Outsourcing and offshoring became common to reduce costs and focus on core capabilities.

Terms like SCM, value chain, and demand planning became mainstream. Technology started playing a role, although still limited to basic automation and systems integration.

e. Digital Era (2000s – Present)

The 21st century witnessed the rapid digitalization of supply chains. With advancements in IT infrastructure, the internet, and data analytics, supply chains evolved into real-time, interconnected ecosystems.

- Cloud-based platforms enabled centralized data access and global collaboration.
- IoT devices allowed real-time tracking of goods and assets.
- AI and ML algorithms enabled predictive analytics and smarter decision-making.
- Blockchain introduced trust and transparency in transactional data.
- Robotics and automation improved warehouse efficiency and reduced manual errors.

The emergence of e-commerce giants like Amazon, Flipkart, and Alibaba completely redefined customer expectations around delivery speed, inventory availability, and reverse logistics.

f. Post-COVID-19 & Industry 4.0 Era (2020 onwards)

The COVID-19 pandemic exposed vulnerabilities in global supply chains and accelerated the need for resilience and digital maturity. Organizations began to invest more in technologies that ensured visibility, flexibility, and risk mitigation.

The current wave—Industry 4.0—focuses on:

- Smart factories
- Digital twins
- Autonomous logistics
- Cognitive automation
- Sustainability and ESG compliance

Supply chains are now seen not just as a backend function but as central to value creation, innovation, and customer experience.

Conclusion

With supply chains evolving, from simple, localized networks to highly complex, highly technical ones, there arises a need for constant adaptation. Globally and locally, this evolution in India is shaped concerning local constraints. As India looks forward to becoming a manufacturing hub of the world, this perspective on evolution is somewhat essential for organizations in order to stay at par and become future-ready.

Historical Challenges in Supply Chain Management

Supply chain management (SCM) evolved through a number of stages, and every stage had a distinctive set of challenges that shaped its development. Historically, supply chains were far less integrated and responsive than today. Before the days of digital operations, supply chains were battling operational, technological, and strategic problems, about many of which global inefficiencies and disruptions were passed onto companies and especially emerging economies like India.

a. Fragmentation and Lack of Integration

Perhaps one of the earliest and most impeding factors acting against supply chains was fragmentation among departments and stakeholders. Procurement, production, warehousing, transportation, and sales all existed within their own little silos-from very limited coordination or visibility across functions. This usually resulted in duplicate efforts, conflicting priorities, and misaligned goals. For example, procurement could opt to purchase the materials at a lower price, and production could have a problem with respect to quality or lead time. The lack of coordination placed hurdles on the alignment of supply with demand, thereby creating occasions for either over-stock or stock-outs.

b. Limited Information Flow

In times before the launch of ERP and all things digital, manual systems dominated record-keeping. Information flow was slow, erroneous, and predominantly manual consisting of paper documents, phone calls, or fax communications. Consequently, it created serious issues in forecasting, planning, and coordination since companies could hardly track anything in real time. They were basically in the dark regarding the status of their shipments, inventory levels, and production schedules until shipping or production issues were already exacerbated. The inability to receive timely data led to poor decision-making and slow-down of agility in seizing time-on-market opportunities.

c. Inventory Management Issues

Inventory management has been considered a critical aspect of SCM and ever has continued posing challenges throughout periods. Instead of underestimating demand, the inability to forecast demand accurately led to excessive holding of long-inventory, storage charges, and wastage in perishable goods sectors like food and pharmaceuticals. On the contrary, underestimation of demand would be causing frequent stock-outs and loss of sales chances.

Without inventory management systems and data analysis, companies were acting on guesswork with static historical data, which is often unreasonably valid in a dynamic market environment.

d. Poor Infrastructure and Transportation Bottlenecks

In many emerging countries, including India, a variety of infrastructural inadequacies were responsible for logistics headaches; these included poor road conditions, limited rail connectivity, outdated ports, and congestion in urban centres. Frequent were delays in transportation, damages in transit, and unpredictable delivery schedules. To compound matters, customs clearance was far from efficient, bureaucratic hurdles abounded, and there was a lack of a standardized logistics practice—more so in cross-border or inter-state movements.

e. Supplier and Vendor Reliability

Historically, supplier relationship management and ensuring quality and timely delivery were challenging because there were no systems for measuring supplier performance and enforcing contracts. In the absence of proper evaluation of suppliers, companies often depended on oral agreements or informal assessments. This gave rise to delivery delays, inferior materials, and mediocre service levels, all of which impaired production schedules and customer satisfaction.

35 **f. Bullwhip Effect**

The bullwhip effect is a classical supply chain challenge in which small shifts in customer demand are converted into much larger fluctuations upstream. The phenomenon was most perilous in the old, pre-digital days because of poor visibility of demand, long lead times, and absence of real-time communication among supply chain stakeholders. Distributors and manufacturers would overreact to small demand changes, resulting in overproduction, stock imbalances, and increased costs across the supply chain.

g. Inflexibility and Lack of Agility

Traditional supply chains would somehow render rigidity in their processes and could not readily adapt to changes. These supply chains could not readily change their plans to meet the challenges arising from a shift in demand, supply disruption, or an external calamity encompassing strikes and natural disasters. The main factors behind this inflexibility were the absence of state-of-the-art prediction tools, standardized processes, and flexible systems.

Companies resorted to ad hoc solutions that mainly proved inefficient and disgruntled customers.

h. Limited Technological Support

Before the age of computerization, most companies could not avail themselves of automation, tracking, and analytics tools. The entire supply chain procedure was manual, prone to human error, time-consuming, and the net effect from such things was a lowering of productivity. Investment in technology was seen as a luxury rather than a necessity, especially among small and medium enterprises (SMEs).

i. Compliance and Regulatory Challenges

Adhering to regulatory requirements and documentation in supply chain operations—especially in international trade—was a cumbersome task. Companies faced frequent audits, non-compliance penalties, and operational disruptions due to inconsistent regulations, inadequate documentation, and changing legal frameworks. The absence of digital document management systems only worsened the situation.

j. Labor Dependency and Workforce Limitations

Historically, supply chains used to rely finely on manual labor-for instance, packaging, loading and unloading, and warehouse operations. Skill shortages, labor unrest, and seasonal availability posed major challenges especially in the manufacturing and logistics-heavy fronts. Beyond these, limited training and awareness among workers also contributed to reduced efficiencies and increased errors.

Conclusion

These historical challenges highlight how traditional supply chains were constrained by fragmented systems, poor visibility, infrastructural limitations, and lack of technological support. While many of these issues still persist to varying degrees, the advent of digital technologies has significantly alleviated several pain points, paving the way for smarter, more resilient, and customer-centric supply chains. Understanding these past challenges is critical to appreciating the full impact that digitalization has made—and continues to make—on supply chain performance in modern-day India.

How Digitalization is Addressing Historical Supply Chain Challenges

The era of supply chain management has now reached an important defining point with the advent of digital technologies. Traditional supply chains are plagued with inefficiencies, low levels of visibility, and a slow response. The rapid transformation of the previously slow-paced supply chains has now begun. Digitalization is now on its way to becoming a strategic enabler, allowing companies to overcome age-old challenges and create agile, transparent, and customer-friendly supply chains.

a. Enhancing Visibility and Real-Time Tracking

Previously, one of the major hurdles in classic supply chains was the scarceness of visibility across the supply network. Organizations were in the dark about goods being in transit, where bottlenecks were developing, or sometimes even if disruptions had occurred. Today, digital technologies have come to the rescue with real-time monitoring possibilities: monitoring of goods, assets, and processes, facilitated by IoT, RFID, GPS tracking, and cloud platforms, among others. Sensors installed on vehicles and in inventories provide live stream data concerning the location, temperature, and handling of particular goods. Such a high level of visibility allows traceability, reduction of losses, and provision of state updates to customers and stakeholders. This builds trust and operational control into the system.

b. Improving Forecasting and Inventory Management

Previously, inaccurate demand forecast and poor inventory management were frequent causes of stockouts, overstocking, and carrying costs. Now with digitalization, some forecasting tools based on AI analyze historical sales data, seasonal trends, and market behavior to meet demands with optimal accuracy. Machine learning algorithms keep enhancing these forecasts with new data flow. Automated inventory systems will track stock levels in real-time and intervate triggering the replenishment process as soon as a certain threshold is met. This brings the benefit of less holding costs, higher levels of service, and better utilization of warehouse space.

c. Streamlining Logistics and Transportation

Traditionally, transportation delays, inefficient route planning, and disorganized logistics operations have constituted the major bottlenecks in the supply chain. Digital solutions like TMS and WMS are being administered to plan delivery routes, assign loads, track shipments, and manage vehicle performances. For instance, logistics startups in India are combining AI

and GPS-based digital platforms to build more efficient freight matching and route optimization solutions. Automation in logistics warehouses, including robotics and conveyor systems, enhances the order fulfilment speed, accuracy, and safety.

d. Fostering Supplier Collaboration and Integration

Old supply chains largely worked in silo mode with very limited communication between suppliers and manufacturers. This lack of integration created delays in the supply chain and a lack of coordination in their production schedules, with costly duplication of efforts. Today, these collaborative digital platforms, such as SRM systems, bring suppliers and manufacturers together into real-time data sharing environments with joint planning, forecasting, and replenishment operations, thus ensuring supplies are aligned with demand. Since then, implementation of blockchain technology is also being tested across sectors to provide an unchangeable and secure transaction record between buyer and supplier, thereby improving trust and traceability.

e. Enabling Agile and Responsive Decision-Making

Previously, supply chains were largely reactive, responding to disruptions after the fact. Digitalization is transforming this model by providing predictive and prescriptive analytics to identify potential problems and build solutions into the process. Building on that, tools such as digital twins simulate virtual representations of supply chains whereby businesses can model various real-world scenarios such as demand spikes or supplier delays, and plan accordingly. Through this change, supply chains will transform from reactive to proactive decision-making, thereby enabling organizations to develop resilient and flexible supply chains that can adapt to quick variations in the environment.

f. Reducing Operational Costs and Increasing Efficiency

Digital technology assists largely in cost savings, and increasing efficiency. Automation reduces manual labor and human mistakes. AI-based optimization algorithms maximize efficient utilization of resources in procurement, warehouse management, and transportation, among others. Pricing negotiation tools in procurement maximize supplier contract efficiency; on the other hand, digital freight platforms provide a better match of loads and available transports, thus minimizing empty miles and fuel costs. Reduction in lead times, operating costs, and waste are reported by companies using such technology.

g. Supporting Sustainability and Compliance

Emphasis on environmental and social governance (ESG) creates increasing pressure on companies to comply with sustainable supply chain practices. Such digitalization indeed promotes sustainability by allowing carbon tracking, energy monitoring, and waste reduction analytics. Now, using data, inefficiencies can also be identified by the firms, and those inefficiencies are mitigated to reduce emissions and comply with environmental regulations. Digital tools also facilitate automated compliance checks, documentation, and audits, thereby diminishing the calibration of incurring non-compliance penalties.

h. Overcoming Geographic and Infrastructure Barriers in India

In an Indian context where infrastructure challenges endure, digitalization acts as a bridge. Cloud systems and mobile applications allow SMEs, even those located in remote areas, to get into organized supply chains. It is said that e-invoicing, digital payment systems, and integrating GST have made logistics paperwork a matter of history. Startups and 3PL providers are exploiting digital platforms for value-added services such as reverse logistics, demand aggregation, and real-time delivery tracking that help in the formalization and modernization of India's supply chain ecosystem.

Conclusion

Digitalization in supply chain management has enhanced traditional issues of visibility, forecasting, logistics, collaboration, and decision-making. These technologies, enabled by digitalization, render supply chains more efficient operationally, resilient, less costly, eco-friendly, and customer-friendly. In a diverse, emerging market like India, this digital transformation becomes even more crucial to fill the infrastructure gaps and empower SMEs as a stepping stone to building global competitiveness in supply chains. Digitalization would pave the way for Indian supply chains toward becoming an intelligent, responsive, and integrated network in an increasingly uncertain and dynamic global environment.

1.2 Problem Statement

Despite the increasing awareness and adoption of digital technologies in India, many supply chain networks still operate in silos with limited integration and automation. While some companies have successfully implemented ERP systems and warehouse automation, others struggle due to cost constraints, lack of digital infrastructure, and workforce readiness.

Moreover, there is a lack of comprehensive studies focusing specifically on the Indian market, examining how digitalization is actually impacting supply chain performance metrics like cost efficiency, delivery speed, inventory accuracy, and customer satisfaction. Thus, this study aims **to fill that gap by evaluating the real-world impact of digitalization on supply chain performance in Indian organizations**.

1.3 Objectives of the study

The primary objectives of this research are:

- To identify the level of digitalization in supply chain processes across Indian industries.
- To assess the impact of digital tools and technologies on key performance indicators of supply chains (e.g., efficiency, cost, flexibility, transparency).
- To explore the challenges and barriers to digital adoption in the Indian supply chain ecosystem.
- To analyse perceptions and readiness of supply chain professionals and students regarding digital transformation.
- To provide recommendations for better adoption and integration of digital technologies in Indian supply chains.

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1.4 Scope of Study

This study focuses on:

- Indian organizations across sectors such as manufacturing, logistics, e-commerce, FMCG, and retail.
- Both students (with academic/internship exposure) and working professionals involved in supply chain roles.
- Key digital technologies including ERP, IoT, blockchain, automation, AI/ML, and cloud-based systems.
- Measuring impact across supply chain performance areas such as cost, speed, flexibility, customer service, and inventory management.
- Geographical scope is limited to India, but findings may have relevance for other emerging economies with similar supply chain dynamics.

CHAPTER-2

LITERATURE REVIEW

Digitalization in Supply Chain Management

Digitalization in SCM encompasses the adoption of technologies such as the Internet of Things (IoT), Artificial Intelligence (AI), blockchain, and advanced analytics to optimize supply chain processes. These technologies facilitate real-time data sharing, predictive analytics, and enhanced decision-making capabilities. For instance, the implementation of **Enterprise Resource Planning (ERP) systems has been shown to streamline operations, reduce lead times, and improve customer satisfaction by enabling centralized data management and efficient communication across the supply chain (Source: ResearchGate, 2022).**

In India, government initiatives like "Digital India" and the widespread penetration of mobile and internet services have created a fertile ground for digital adoption across industries, including supply chains. Digital technologies enable Indian firms to overcome traditional barriers such as poor infrastructure, lack of standardization, and fragmented logistics networks.

a. Operational Efficiency and Agility

Digital tools have been instrumental in enhancing operational efficiency and supply chain agility. Studies indicate that digitalization leads to improved demand forecasting, inventory management, and responsiveness to market changes. The adoption of Industry 4.0 technologies in the agricultural food supply chain has been associated with increased efficiency and responsiveness (Source: iieta.org, 2023). **Similarly, the integration of digital technologies has been linked to enhanced supply chain visibility, enabling firms to anticipate disruptions and adapt accordingly (Source: SAGE Journals, 2024).**

Real-time data provided by IoT and cloud platforms allows managers to monitor inventory, supplier performance, and logistics operations, thereby reducing lead times and minimizing waste. This is particularly beneficial for Indian businesses facing fluctuating demand and seasonal variations.

b. Resilience and Risk Management

The COVID-19 pandemic underscored the importance of supply chain resilience. Research highlights that digitalization contributes to resilience by enabling better risk assessment, real-time monitoring, and adaptive capabilities. **A study examining the impact of supply chain digitalization on resilience and performance found that digital tools enhance absorptive, response, and recovery capabilities, thereby improving overall supply chain performance (Source: ScienceDirect, 2023).**

In India, where supply chains are vulnerable to natural disasters, political disruptions, and infrastructure bottlenecks, digitalization allows companies to build contingency plans, track disruptions in real-time, and react swiftly to unforeseen events.

c. Integration and Collaboration

Effective supply chain integration and collaboration are critical for performance enhancement. Digitalization facilitates seamless information flow and coordination among supply chain partners. **The implementation of digital procurement systems, for instance, has been shown to improve collaboration and operational performance (Source: Emerald, 2023).**

Digital platforms enable real-time sharing of forecasts, inventory levels, and order statuses across the supply chain network. Blockchain technology, though still emerging, promises secure and tamper-proof transaction records that can enhance trust and collaboration among stakeholders.

d. Cost Reduction and Customer Satisfaction

Digitalization leads to cost efficiencies by reducing manual processes, optimizing logistics routes, and minimizing inventory holding costs. AI-driven chatbots and CRM systems enhance customer engagement and satisfaction by providing timely updates and support. Studies show that companies investing in digital supply chain technologies report improved delivery performance and higher customer loyalty.

Theoretical Frameworks

Several theoretical models underpin the study of digitalization in SCM:

- Resource-Based View (RBV): **Suggests that digital capabilities are strategic resources that can provide competitive advantage (Source: Emerald, 2023).**
- Dynamic Capability Theory: **Emphasizes the role of digitalization in enabling firms to adapt to changing environments by enhancing their dynamic capabilities (Source: ScienceDirect, 2023).**
- Systems Theory: **Highlights the interconnectedness of supply chain components and the role of digitalization in facilitating system-wide integration and performance (Source: Wiley, 2023).**

These frameworks provide a robust foundation for understanding how digital transformation impacts supply chain outcomes.

Research Gaps

Despite the growing body of literature, several gaps remain:

- Contextual Studies in India: Limited research focuses specifically on the Indian context, considering its unique market dynamics and infrastructural challenges.
- Empirical Evidence: There is a need for more empirical studies examining the direct and indirect effects of digitalization on supply chain performance metrics.
- SME Focus: **Small and medium-sized enterprises (SMEs) often face distinct challenges in digital adoption, yet they are underrepresented in current research (Source: SEMS Journal, 2023).**
- Integration of Emerging Technologies: The impact of emerging technologies like blockchain and AI on supply chain performance requires further exploration, particularly in Indian sectors such as agriculture, retail, and pharmaceuticals.

Historical Supply Chain Challenge	Digital Solution Introduced	Impact of Digitalization
Lack of real-time visibility	IoT, GPS tracking, RFID	Real-time tracking of goods in transit; enhanced visibility across supply chain nodes.
Inefficient demand forecasting	Artificial Intelligence (AI), Machine Learning (ML)	More accurate demand prediction based on historical data and real-time inputs; reduced stockouts and overstocking.
Poor inventory management	ERP systems, Automated Inventory Management	Real-time stock level updates; better reorder planning and reduced inventory carrying costs.
Disjointed communication among supply chain partners	Cloud computing, Supplier Relationship Management (SRM) platforms	Seamless data sharing across partners; improved collaboration and coordination.
Manual and error-prone logistics	Transportation Management Systems (TMS), Automation, Route Optimization	Efficient logistics planning; reduced delivery delays and lower transportation costs.
Limited traceability and trust	Blockchain technology	Transparent, tamper-proof record of transactions; enhanced trust between stakeholders.
Slow decision-making and reactive responses	Predictive analytics, Digital Twins	Proactive decision-making through simulation and forecasting; faster response to disruptions.
High operational costs	AI-powered optimization, Automation tools	Reduced labor dependency; minimized waste and optimized resource utilization.
Lack of standardization and compliance	Digital documentation, E-invoicing, GST integration	Simplified compliance processes; reduced human error and audit-ready systems.
Inaccessibility for remote/small-scale participants	Mobile apps, Cloud-based platforms	Inclusion of SMEs and rural suppliers into formal, tech-enabled supply chains.

CHAPTER-3

RESEARCH METHODOLOGY

3.1 Research Design

The research design is the plan for executing the research in a structured, methodical, and logical way. It defines the setting in which one collects, analyses, or interprets data to formulate meaningful conclusions. Given the nature of the topic, which involves examining relationships between variables and obtaining opinion data from a large and heterogeneous base of respondents, a descriptive and quantitative research design has been chosen.

Type: Descriptive and Quantitative

This study employs the descriptive research design that is suitable for studying phenomena, notions, or trends in a systematic way. Descriptive research attempts to portray with accuracy the characteristics of a particular individual, situation, or group. In this particular situation, it aims to describe the current level of digitalization in Indian supply chains, cross-industrial adoption, and the perceived impact on performance indicators such as efficiency, cost, flexibility, visibility, and customer satisfaction.

The research is, on the other hand, quantitative because numerical data is being used, collected through a well-structured questionnaire. Responses measured by both Likert scales and multiple-choice questions would then be statistically analysed to test hypotheses and draw relationships between the adoption of digital technologies and supply chain performance metrics. Quantitative analysis allows for objectivity, comparability, and generalizability across a wider sample.

Approach: Survey-Based Primary Data Collection

The whole investigation follows a survey-centric approach suitable for the collection of data from a large and diverse sample of respondents, including supply chain professionals, managers, and MBAs/PG students having exposure to digital tools and operations.

The research instrument employed was a structured questionnaire on Google Form. It contains:

- Demographic questions (age, gender, industry, experience)
- Technology adoption (ERP, IoT, AI, blockchain, etc.)
- Perceived impacts statements, rated on a 5-point Likert scale

- Questions regarding benefits, challenges, and future outlook

The questionnaire was distributed digitally through e-mail, LinkedIn, WhatsApp, and academic networks to achieve wider coverage and offer convenience in response collection. This method allows for efficient data collection from geographically dispersed respondents while offering uniformity in the questioning format.

Purpose of the Research Design

The chosen research design aims to evaluate the relationship between digitalization and supply chain performance in the Indian context. Specifically, it seeks to:

- Understand how widely digital tools are being adopted in Indian supply chains
- Measure the extent to which these tools affect key performance areas (cost, time, visibility, customer satisfaction, flexibility, decision-making)
- Identify major drivers and barriers to digital adoption
- Support hypothesis testing using statistical tools like the Chi-square test and t-test

By using a descriptive and quantitative framework, the research ensures that the findings are not only statistically sound but also practically relevant for business leaders, policymakers, and academicians studying supply chain innovation in India.

3.2 Data Collection

- Primary Data: Online questionnaire shared with professionals and students.
- Secondary Data: Journals, reports (FICCI, NASSCOM), case studies, industry publications.

3.3 Sampling Method

Sampling Technique: Convenience Sampling

For this study, the type of non-probability sampling chosen has been convenience sampling. This sampling technique requires selecting respondents that are easily to access and are willing to administer their cooperation in the study and who may be relevant to the research topic. While operating in academic research, time- and resource-related constraints were always present, which made this approach the most practical and efficient way of collecting responses from a diverse set of individuals involved in or at least familiar with supply chain operations.

Convenience sampling enabled the researcher to get hold of working professionals, MBA/PG students, and supply chain practitioners via online means of communication such as LinkedIn, WhatsApp groups, institutional mailing lists, and personal-and-professional contacts. Moreover, they could maintain a reasonably well-balanced mix of respondents from various industry sectors like manufacturing, logistics, e-commerce, FMCG, and retail.

Target Population

The target population for this research includes:

- Supply chain professionals with experience in procurement, logistics, warehousing, distribution, operations, or planning.
- MBA/PG students who have undergone internships or academic projects in the area of supply chain management or digital transformation.
- Individuals working in digitalization or IT functions within supply chain-driven organizations.

These groups were selected because they possess practical or academic exposure to both traditional and digital supply chain environments and can offer valuable insights on the transition and its impact.

Sample Size

A total of 77 responses were targeted and collected for this research. This sample size is considered sufficient for descriptive and inferential analysis, including hypothesis testing using statistical methods like Chi-square tests and t-tests.

The sample is heterogeneous, covering different:

- Age groups
- Experience levels
- Industries
- Roles in the supply chain ecosystem

This diversity enhances the reliability of the findings by capturing multiple perspectives on how digitalization is influencing supply chain performance in India.

Sampling Justification

Convenience sampling is justified due to:

- The exploratory and descriptive nature of the study
- Limited access to a full sampling frame of Indian supply chain professionals
- The ability to gather meaningful insights in a time-bound academic setting

Although this method has limitations in terms of generalizability, the responses are adequate to draw indicative conclusions and test the formulated hypotheses.

3.4 Research Instrument

- Structured Google Form questionnaire
- Questions include demographic details, Likert-scale ratings, and multiple-choice questions.

3.5 Variables

- Independent Variables: Use of digital tools (ERP, IoT, AI, etc.), digital maturity, training frequency
- Dependent Variables: Supply chain performance indicators (cost, speed, flexibility, visibility, customer satisfaction)

3.6 Tools used for preparation and Analysis

The following tools were employed for data collection and preparation:

- Google Forms – For creating and collecting responses
- Microsoft Excel – For organizing raw data, performing basic analysis, and creating visuals
- IBM SPSS – For conducting inferential statistics like Chi-square tests and t-tests

3.7 Limitations

Though relevant and practical, a number of limitations of this study on "Impact of Digitalization on Supply Chain Performance in Indian Context" restrict the generality and extent of the research findings. The limitations acknowledged are presented below:

a. Perception-Based Data (Subjectivity)

The research mainly utilizes self-reported survey-style data from a Likert scale. While this method remains an effective way of relating respondents' opinions and perceptions, the slight degree of subjectivity remains intrinsic to it. Every participant's perception and experience of digitalization and its influence on supply chain performance are different based on:

- Professional background and exposure
- Level of involvement with any digital transformation projects
- Personal biases or expectations

Hence, the information collected was on the perceived impact of digitalization instead of an empirically measured impact. For example, one of the respondents may claim to have achieved high efficiency improvement owing to digitalization, yet operational data (such as lead time reduction or cost saving) was not cross-verified. Thus, any conclusion derived from such data should be viewed with perception in mind.

b. Limited Sample Size

The study was conducted with a sample size of about 100-150 respondents, which is deemed sufficient for an academic research exercise but which may not account for the entire landscape of supply chain professionals and businesses in India. Time, access, and resource constraints led the researcher to employ a convenience sampling technique, with the majority of responses coming from known contacts, students, alumni, and LinkedIn connections.

While this method enabled swift and efficient data collection, it does impart a sampling bias:

- Respondents may be somewhat more digitally aware and educated than the general workforce.
- This method may overrepresent certain sectors such as IT-enabled services or e-commerce, whereas other sectors like agriculture and traditional retail might be underrepresented.

Consequently, the findings are to be taken as indicative rather than universally generalizable; one should exercise caution when extending the results to larger populations or industries.

c. Cross-Sectional Analysis-Lack of Longitudinal Perspective

30 The approach used was that of a cross-sectional study, with data collected at one point in time. It looks at the current snapshot of prevailing trends, practices, and perceptions, but it cannot capture the dynamics of change, such as:

- Development of Digital Maturity within Organizations
- Improvement in Performance Indicators as Digital Systems Mature
- Slow Absorption of Technologies like Blockchain or AI

Since digitalization happens gradually, by uploading data at intervals of months or years-one would satisfactorily measure the continued effects on the supply chain metrics-and longitudinal studies could be a better alternative for it. This limitation restrains the study from following any long-term virtues, adverse effects, or equity value of digital transformation projects.

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CHAPTER-4

DATA ANALYSIS AND INTERPRETATION

Hypothesis -1

Null Hypothesis: Digital tools do not improve inventory visibility.

Alternate Hypothesis: Digital tools significantly improve inventory visibility.

Question 1(Independent Variable): Types of digital tools used (ERP, IoT, WMS, etc.)

Question 2(Dependent Variable): Inventory visibility has improved due to digital tools

Crosstabs

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
What kind of digital tools/technologies are currently being used? (Select all that apply) * Please rate the following statements on a scale of 1 to 5 (1 = Strongly Disagree, 5 = Strongly Agree) [Inventory visibility has improved due to digital tools.]	76	100.0%	0	0.0%	76	100.0%

What kind of digital tools/technologies are currently being used? (Select all that apply) * Please rate the following statements on a scale of 1 to 5 (1 = Strongly Disagree, 5 = Strongly Agree) [Inventory visibility has improved due to digital tools.] Crosstabulation

Count

		Please rate the following statements on a scale of 1 to 5 (1 = Strongly Disagree, 5 = Strongly Agree) ...		
		Strongly Diasgree	Disagree	Neutral
What kind of digital tools/technologies are currently being used? (Select all that apply)	Artificial Intelligence / Machine Learning	0	1	2
	ERP Systems (SAP, Oracle, etc.)	0	2	1
	ERP Systems (SAP, Oracle, etc.), RFID / Barcode Scanning	1	0	0
	ERP Systems (SAP, Oracle, etc.), RFID / Barcode Scanning, Warehouse Management System (WMS)	0	0	2
	ERP Systems, RFID / Barcode Scanning, Warehouse Management System (WMS), Transportation Management System (TMS)	0	0	1
	ERP Systems (SAP, Oracle, etc.), Warehouse Management System (WMS)	0	0	4
	IoT Devices	0	2	2
	Warehouse Management System (WMS)	1	1	1
	RFID / Barcode Scanning, Artificial Intelligence / Machine Learning	2	0	0
	RFID / Barcode Scanning, Warehouse Management System (WMS), Transportation Management System (TMS)	0	1	0
Total		4	7	13

What kind of digital tools/technologies are currently being used? (Select all that apply) * Please rate the following statements on a scale of 1 to 5 (1 = Strongly Disagree, 5 = Strongly Agree) [Inventory visibility has improved due to digital tools.] Crosstabulation

Count

		Please rate the following statements on a scale of 1 to 5 (1 = Strongly Disagree, 5 = ...		
		Agree	Strongly Agree	Total
What kind of digital tools/technologies are currently being used? (Select all that apply)	Artificial Intelligence / Machine Learning	4	2	9
	ERP Systems (SAP, Oracle, etc.)	4	5	12
	ERP Systems (SAP, Oracle, etc.), RFID / Barcode Scanning	3	1	5
	ERP Systems (SAP, Oracle, etc.), RFID / Barcode Scanning, Warehouse Management System (WMS)	3	0	5
	ERP Systems, RFID / Barcode Scanning, Warehouse Management System (WMS), Transportation Management System (TMS)	3	4	8
	ERP Systems (SAP, Oracle, etc.), Warehouse Management System (WMS)	1	4	9
	IoT Devices	0	5	9
	Warehouse Management System (WMS)	3	2	8
	RFID / Barcode Scanning, Artificial Intelligence / Machine Learning	3	2	7
	RFID / Barcode Scanning, Warehouse Management System (WMS), Transportation Management System (TMS)	1	2	4
Total		25	27	76

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	41.179[a]	36	.254
Likelihood Ratio	47.304	36	.098
Linear-by-Linear Association	.242	1	.623
N of Valid Cases	76		

a. 50 cells (100.0%) have expected count less than 5. The minimum expected count is .21.

Symmetric Measures

		Value	Asymptotic Standard Error[a]	Approximate T[b]	Approximate Significance
Interval by Interval	Pearson's R	-.057	.120	-.489	.626[c]
Ordinal by Ordinal	Spearman Correlation	-.007	.118	-.058	.954[c]
N of Valid Cases		76			

a. Not assuming the null hypothesis.

b. Using the asymptotic standard error assuming the null hypothesis.

c. Based on normal approximation.

Analysis

Variables Tested:

- Independent Variable: Use of digital tools (ERP, RFID, WMS)
- Dependent Variable: Inventory visibility has improved due to digital tools

Chi-Square Result:

- Chi-Square Value: 41.179
- p-value: 0.254

Interpretation: The p-value is greater than 0.05, indicating that there is no statistically significant association between the type of digital tools used and the perception of improved inventory visibility. This may be due to varying effectiveness of tools across industries or different implementation levels.

Conclusion: Null hypothesis is retained.

Hypothesis-2

Null Hypothesis: Digitalization does not reduce order fulfilment times.

Alternate Hypothesis: Digitalization significantly reduces order fulfilment times.

Question 1(Independent Variable): Digital maturity level in organization

Question 2(Dependent Variable): It has reduced order fulfilment times

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
How would you rate the level of digital maturity in your organization's supply chain? * Please rate the following statements on a scale of 1 to 5 (1 = Strongly Disagree, 5 = Strongly Agree) [It has reduced order fulfillment times.]	76	100.0%	0	0.0%	76	100.0%

How would you rate the level of digital maturity in your organization's supply chain? * Please rate the following statements on a scale of 1 to 5 (1 = Strongly Disagree, 5 = Strongly Agree) [It has reduced order fulfillment times.] Crosstabulation

Count

		Please rate the following statements on a scale of 1 to 5 (1 = Strongly Disagree, 5 = Strongly Agree) [It has reduced order ...			
		Strongly Diasgree	Disagree	Neutral	Agree
How would you rate the level of digital maturity in your organization's supply chain?	Very High	0	0	2	2
	Low	0	2	2	1
	Moderate	2	5	9	11
	High	2	3	4	9
	Very High	1	0	1	3
Total		5	10	18	26

How would you rate the level of digital maturity in your organization's supply chain? * Please rate the following statements on a scale of 1 to 5 (1 = Strongly Disagree, 5 = Strongly Agree) [It has reduced order fulfillment times.] Crosstabulation

Count

		Please rate the following ...	
		Strongly Agree	Total
How would you rate the level of digital maturity in your organization's supply chain?	Very High	2	6
	Low	0	5
	Moderate	5	32
	High	9	27
	Very High	1	6
Total		17	76

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	12.692[a]	16	.695
Likelihood Ratio	14.717	16	.545
Linear-by-Linear Association	.116	1	.734
N of Valid Cases	76		

a. 19 cells (76.0%) have expected count less than 5. The minimum expected count is .33.

Symmetric Measures

		Value	Asymptotic Standard Error[a]	Approximate T[b]	Approximate Significance
Interval by Interval	Pearson's R	.039	.110	.338	.736[c]
Ordinal by Ordinal	Spearman Correlation	.127	.114	1.098	.276[c]
N of Valid Cases		76			

a. Not assuming the null hypothesis.

b. Using the asymptotic standard error assuming the null hypothesis.

c. Based on normal approximation.

Analysis

Variables Tested:

- Digital maturity (Low to Very High)
- Digitalization has reduced order fulfilment times

Chi-Square Result:

- Chi-Square Value: 12.692
- p-value: 0.695

Interpretation: A high p-value indicates no significant relationship between perceived digital maturity and reduced order fulfilment times. This could imply that other factors such as logistics infrastructure, supplier reliability, or human efficiency also influence delivery speed.

Conclusion: Null hypothesis is retained.

Hypothesis-3

Null Hypothesis: Real-time data does not enhance decision-making in supply chains.

Alternate Hypothesis: Real-time data significantly enhances decision-making.

Question 1(Independent Variable): Use of real-time data tools (IoT, AI, etc.)

Question 2(Dependent Variable): Real-time data helps in better decision-making

Crosstabs

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
What kind of digital tools/technologies are currently being used? (Select all that apply) * Please rate the following statements on a scale of 1 to 5 (1 = Strongly Disagree, 5 = Strongly Agree) [Real-time data helps in better decision-making]	76	100.0%	0	0.0%	76	100.0%

What kind of digital tools/technologies are currently being used? (Select all that apply) * Please rate the following statements on a scale of 1 to 5 (1 = Strongly Disagree, 5 = Strongly Agree) [Real-time data helps in better decision-making.] Crosstabulation

Count

		Please rate the following statements on a scale of 1 to 5 (1 = Strongly Disagree, 5 = Strongly Agree) [Real-...		
		Strongly Diasgree	Disagree	Neutral
What kind of digital tools/technologies are currently being used? (Select all that apply)	Artificial Intelligence / Machine Learning	1	1	2
	ERP Systems (SAP, Oracle, etc.)	0	1	3
	ERP Systems (SAP, Oracle, etc.), RFID / Barcode Scanning	1	0	1
	ERP Systems (SAP, Oracle, etc.), RFID / Barcode Scanning, Warehouse Management System (WMS)	0	0	1
	ERP Systems, RFID / Barcode Scanning, Warehouse Management System (WMS), Transportation Management System (TMS)	0	0	0
	ERP Systems (SAP, Oracle, etc.), Warehouse Management System (WMS)	0	0	2
	IoT Devices	0	1	1
	Warehouse Management System (WMS)	0	1	5
	RFID / Barcode Scanning, Artificial Intelligence / Machine Learning	0	1	2
	RFID / Barcode Scanning, Warehouse Management System (WMS), Transportation Management System (TMS)	0	1	0
Total		2	6	17

What kind of digital tools/technologies are currently being used? (Select all that apply) * Please rate the following statements on a scale of 1 to 5 (1 = Strongly Disagree, 5 = Strongly Agree) [Real-time data helps in better decision-making.] Crosstabulation

Count

		Please rate the following statements on a scale of 1 to 5 (1 = Strongly Disagree, 5 = ...		
		Agree	Strongly Agree	Total
What kind of digital tools/technologies are currently being used? (Select all that apply)	Artificial Intelligence / Machine Learning	2	3	9
	ERP Systems (SAP, Oracle, etc.)	2	6	12
	ERP Systems (SAP, Oracle, etc.), RFID / Barcode Scanning	2	1	5
	ERP Systems (SAP, Oracle, etc.), RFID / Barcode Scanning, Warehouse Management System (WMS)	4	0	5
	ERP Systems, RFID / Barcode Scanning, Warehouse Management System (WMS), Transportation Management System (TMS)	4	4	8
	ERP Systems (SAP, Oracle, etc.), Warehouse Management System (WMS)	3	4	9
	IoT Devices	1	6	9
	Warehouse Management System (WMS)	1	1	8
	RFID / Barcode Scanning, Artificial Intelligence / Machine Learning	1	3	7
	RFID / Barcode Scanning, Warehouse Management System (WMS), Transportation Management System (TMS)	1	2	4
Total		21	30	76

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	39.264[a]	36	.326
Likelihood Ratio	39.608	36	.312
Linear-by-Linear Association	.065	1	.799
N of Valid Cases	76		

a. 50 cells (100.0%) have expected count less than 5. The minimum expected count is .11.

Symmetric Measures

		Value	Asymptotic Standard Error[a]	Approximate T[b]	Approximate Significance
Interval by Interval	Pearson's R	.029	.127	.252	.801[c]
Ordinal by Ordinal	Spearman Correlation	.006	.126	.049	.961[c]
N of Valid Cases		76			

a. Not assuming the null hypothesis.

b. Using the asymptotic standard error assuming the null hypothesis.

c. Based on normal approximation.

Analysis

Variables Tested:

- Use of IoT, AI, real-time tools
- Real-time data helps in better decision-making

Chi-Square Result:

- Chi-Square Value: 39.264
- p-value: 0.326

Interpretation: The result shows no statistically significant relationship. While real-time tools are assumed to improve decision-making, not all respondents may use them effectively, or other systems (ERP, human judgment) may play a more prominent role. **Conclusion:** Null hypothesis is retained.

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Hypothesis -4

Null Hypothesis: Digitalization does not reduce operational costs.

Alternate Hypothesis: Digitalization significantly reduces operational costs.

Question 1(Independent Variable): Key driver – "Cost Reduction" selected or not

Question 2(Dependent Variable): Digitalization has helped in reducing cost

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Which of the following IS key drivers for digital adoption in the supply chain?(Select all that apply) * Please rate the following statements on a scale of 1 to 5 (1 = Strongly Disagree, 5 = Strongly Agree) [Digitalization has helped in reducing costs.]	76	100.0%	0	0.0%	76	100.0%

Which of the following IS key drivers for digital adoption in the supply chain?(Select all that apply) * Please rate the following statements on a scale of 1 to 5 (1 = Strongly Disagree, 5 = Strongly Agree) [Digitalization has helped in reducing costs.] Crosstabulation

Count

		Please rate the following statements on a scale of 1 to 5 (1 = Strongly Disagree, 5 = Strongly Agree) ...		
		Strongly Diasgree	Disagree	Neutral
Which of the following IS key drivers for digital adoption in the supply chain?(Select all that apply)	Competitive pressure	3	4	1
	Compliance/regulatory requirements	0	1	1
	Cost reduction	0	2	10
	Customer expectation	0	3	4
	Operational efficiency	1	2	1
Total		4	12	17

Which of the following IS key drivers for digital adoption in the supply chain?(Select all that apply) * Please rate the following statements on a scale of 1 to 5 (1 = Strongly Disagree, 5 = Strongly Agree) [Digitalization has helped in reducing costs.] Crosstabulation

Count

		Please rate the following statements on a scale of 1 to 5 (1 = Strongly Disagree, 5 = ...		
		Agree	Strongly Agree	Total
Which of the following IS key drivers for digital adoption in the supply chain?(Select all that apply)	Competitive pressure	1	1	10
	Compliance/regulatory requirements	1	0	3
	Cost reduction	15	18	45
	Customer expectation	1	1	9
	Operational efficiency	2	3	9
Total		20	23	76

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	36.034[a]	16	.003
Likelihood Ratio	34.429	16	.005
Linear-by-Linear Association	2.920	1	.087
N of Valid Cases	76		

a. 21 cells (84.0%) have expected count less than 5. The minimum expected count is .16.

Symmetric Measures

		Value	Asymptotic Standard Error[a]	Approximate T[b]	Approximate Significance
Interval by Interval	Pearson's R	.197	.141	1.731	.088[c]
Ordinal by Ordinal	Spearman Correlation	.114	.139	.988	.327[c]
N of Valid Cases		76			

a. Not assuming the null hypothesis.

b. Using the asymptotic standard error assuming the null hypothesis.

c. Based on normal approximation.

Analysis

Variables Tested:

- Whether "cost reduction" was selected as a key driver
- Perceived impact on cost reduction

Chi-Square Result:

- Chi-Square Value: 36.034
- p-value: 0.003

Interpretation: The p-value is below 0.05, indicating a strong association. Respondents who selected cost reduction as a reason for digitalization were also more likely to perceive that digitalization helped reduce costs.

Conclusion: Null hypothesis is rejected; alternate hypothesis accepted.

Hypothesis-5

Null Hypothesis: Digitalization does not improve coordination among departments.

Alternate Hypothesis: Digitalization significantly improves inter-departmental coordination.

Question 1(Independent Variable): Digital maturity level

Question 2(Dependent Variable): There is better coordination between departments

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
How would you rate the level of digital maturity in your organization's supply chain? * Please rate the following statements on a scale of 1 to 5 (1 = Strongly Disagree, 5 = Strongly Agree) [There is better coordination between departments (procurement, production, distribution).]	76	100.0%	0	0.0%	76	100.0%

How would you rate the level of digital maturity in your organization's supply chain? * Please rate the following statements on a scale of 1 to 5 (1 = Strongly Disagree, 5 = Strongly Agree) [There is better coordination between departments (procurement, production, distribution).] Crosstabulation

Count

		Please rate the following statements on a scale of 1 to 5 (1 = Strongly Disagree, 5 = Strongly Agree) [There is better coordination between departments (procurement, production, ...			
		Strongly Diasgree	Disagree	Neutral	Agree
How would you rate the level of digital maturity in your organization's supply chain?	Very High	0	0	4	0
	Low	0	0	4	1
	Moderate	2	3	11	7
	High	0	2	7	8
	Very High	0	1	1	1
Total		2	6	27	17

How would you rate the level of digital maturity in your organization's supply chain? * Please rate the following statements on a scale of 1 to 5 (1 = Strongly Disagree, 5 = Strongly Agree) [There is better coordination between departments (procurement, production, distribution).] Crosstabulation

Count

		Please rate the following statements on a ...	
		Strongly Agree	Total
How would you rate the level of digital maturity in your organization's supply chain?	Very High	2	6
	Low	0	5
	Moderate	9	32
	High	10	27
	Very High	3	6
Total		24	76

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	14.722[a]	16	.545
Likelihood Ratio	18.062	16	.320
Linear-by-Linear Association	1.998	1	.157
N of Valid Cases	76		

a. 19 cells (76.0%) have expected count less than 5. The minimum expected count is .13.

Symmetric Measures

		Value	Asymptotic Standard Error[a]	Approximate T[b]	Approximate Significance
Interval by Interval	Pearson's R	.163	.106	1.423	.159[c]
Ordinal by Ordinal	Spearman Correlation	.202	.111	1.779	.079[c]
N of Valid Cases		76			

a. Not assuming the null hypothesis.

b. Using the asymptotic standard error assuming the null hypothesis.

c. Based on normal approximation.

Analysis

Variables Tested:

- Digital maturity level
- Perception of better coordination

Chi-Square Result:

- Chi-Square Value: 14.722
- p-value: 0.545

Interpretation: The relationship is not statistically significant. It suggests that increased digital maturity alone does not guarantee smoother coordination, possibly due to organizational silos or resistance to process change.

Conclusion: Null hypothesis is retained.

Hypothesis-6

Null Hypothesis: Digitalization has no effect on customer satisfaction.

Alternate Hypothesis: Digitalization significantly improves customer satisfaction.

Question 1(Independent Variable): Adoption of automation or delivery tools

Question 2(Dependent Variable): Customer satisfaction has improved

Crosstabs

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
What kind of digital tools/technologies are currently being used? (Select all that apply) * Please rate the following statements on a scale of 1 to 5 (1 = Strongly Disagree, 5 = Strongly Agree) [Customer satisfaction has improved due to faster and accurate delivery.]	76	100.0%	0	0.0%	76	100.0%

What kind of digital tools/technologies are currently being used? (Select all that apply) * Please rate the following statements on a scale of 1 to 5 (1 = Strongly Disagree, 5 = Strongly Agree) [Customer satisfaction has improved due to faster and accurate delivery.] Crosstabulation

Count

		Please rate the following statements on a scale of 1 to 5 (1 = Strongly Disagree, 5 = Strongly Agree) ...		
		Strongly Diasgree	Disagree	Neutral
What kind of digital tools/technologies are currently being used? (Select all that apply)	Artificial Intelligence / Machine Learning	1	0	2
	ERP Systems (SAP, Oracle, etc.)	0	2	2
	ERP Systems (SAP, Oracle, etc.), RFID / Barcode Scanning	1	0	1
	ERP Systems (SAP, Oracle, etc.), RFID / Barcode Scanning, Warehouse Management System (WMS)	0	0	2
	ERP Systems, RFID / Barcode Scanning, Warehouse Management System (WMS), Transportation Management System (TMS)	0	0	1
	ERP Systems (SAP, Oracle, etc.), Warehouse Management System (WMS)	0	1	2
	IoT Devices	0	0	1
	Warehouse Management System (WMS)	1	2	3
	RFID / Barcode Scanning, Artificial Intelligence / Machine Learning	0	1	1
	RFID / Barcode Scanning, Warehouse Management System (WMS), Transportation Management System (TMS)	0	1	0
Total		3	7	15

What kind of digital tools/technologies are currently being used? (Select all that apply) * Please rate the following statements on a scale of 1 to 5 (1 = Strongly Disagree, 5 = Strongly Agree) [Customer satisfaction has improved due to faster and accurate delivery.] Crosstabulation

Count

		Please rate the following statements on a scale of 1 to 5 (1 = Strongly Disagree, 5 = ...		
		Agree	Strongly Agree	Total
What kind of digital tools/technologies are currently being used? (Select all that apply)	Artificial Intelligence / Machine Learning	5	1	9
	ERP Systems (SAP, Oracle, etc.)	3	5	12
	ERP Systems (SAP, Oracle, etc.), RFID / Barcode Scanning	1	2	5
	ERP Systems (SAP, Oracle, etc.), RFID / Barcode Scanning, Warehouse Management System (WMS)	3	0	5
	ERP Systems, RFID / Barcode Scanning, Warehouse Management System (WMS), Transportation Management System (TMS)	3	4	8
	ERP Systems (SAP, Oracle, etc.), Warehouse Management System (WMS)	3	3	9
	IoT Devices	1	7	9
	Warehouse Management System (WMS)	1	1	8
	RFID / Barcode Scanning, Artificial Intelligence / Machine Learning	4	1	7
	RFID / Barcode Scanning, Warehouse Management System (WMS), Transportation Management System (TMS)	2	1	4
Total		26	25	76

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	37.460[a]	36	.402
Likelihood Ratio	40.822	36	.267
Linear-by-Linear Association	.005	1	.943
N of Valid Cases	76		

a. 50 cells (100.0%) have expected count less than 5. The minimum expected count is .16.

Symmetric Measures

		Value	Asymptotic Standard Error[a]	Approximate T[b]	Approximate Significance
Interval by Interval	Pearson's R	-.008	.118	-.071	.944[c]
Ordinal by Ordinal	Spearman Correlation	-.011	.114	-.098	.923[c]
N of Valid Cases		76			

a. Not assuming the null hypothesis.

b. Using the asymptotic standard error assuming the null hypothesis.

c. Based on normal approximation.

Analysis

Variables Tested:

- Use of tools like automation, AI
- Perception of customer satisfaction

Chi-Square Result:

- Chi-Square Value: 37.460
- p-value: 0.402

Interpretation: This result is not statistically significant. While digital tools may contribute to customer satisfaction, other variables like last-mile delivery, customer service, and responsiveness may play a larger role.
Conclusion: Null hypothesis is retained.

Hypothesis-7

Null Hypothesis: Digitalization does not enhance supply chain flexibility and responsiveness.

Alternate Hypothesis: Digitalization significantly enhances flexibility and responsiveness.

Question 1(Independent Variable): Digital maturity level

Question 2(Dependent Variable): How has digitalization affected supply chain flexibility

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
How would you rate the level of digital maturity in your organization's supply chain? * How has digitalization affected supply chain flexibility and responsiveness?	76	100.0%	0	0.0%	76	100.0%

How would you rate the level of digital maturity in your organization's supply chain? * How has digitalization affected supply chain flexibility and responsiveness? Crosstabulation

Count

		How has digitalization affected supply chain flexibility and responsiveness?			
		Negative impact	No impact	Moderately improved	Highly improved
How would you rate the level of digital maturity in your organization's supply chain?	Very High	0	2	2	2
	Low	0	0	5	0
	Moderate	0	2	19	11
	High	2	0	13	12
	Very High	0	3	1	2
Total		2	7	40	27

How would you rate the level of digital maturity in your organization's supply chain? * How has digitalization affected supply chain flexibility and responsiveness? Crosstabulation

Count

		Total
How would you rate the level of digital maturity in your organization's supply chain?	Very High	6
	Low	5
	Moderate	32
	High	27
	Very High	6
Total		76

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	28.330[a]	12	.005
Likelihood Ratio	26.582	12	.009
Linear-by-Linear Association	.049	1	.824
N of Valid Cases	76		

a. 16 cells (80.0%) have expected count less than 5. The minimum expected count is .13.

Symmetric Measures

		Value	Asymptotic Standard Error[a]	Approximate T[b]	Approximate Significance
Interval by Interval	Pearson's R	.026	.132	.221	.826[c]
Ordinal by Ordinal	Spearman Correlation	.066	.128	.571	.570[c]
N of Valid Cases		76			

a. Not assuming the null hypothesis.

b. Using the asymptotic standard error assuming the null hypothesis.

c. Based on normal approximation.

Analysis

Variables Tested:

- Digital maturity
- Perception of responsiveness and agility

Chi-Square Result:

- Chi-Square Value: 28.330
- p-value: 0.005

Interpretation: This result is statistically significant. Companies with higher digital maturity reported better flexibility and responsiveness. This supports the idea that technologies like predictive analytics and real-time tracking help firms adapt quickly to changes.

Conclusion: Null hypothesis is rejected; alternate hypothesis accepted.

Hypothesis-8

Null Hypothesis: Digitalization does not improve risk management or disruption response.

Alternate Hypothesis: Digitalization significantly improves risk management in supply chains.

Question 1(Independent Variable): Digital maturity level

Question 2(Dependent Variable): Has digitalization helped in better disruption/risk management

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
How would you rate the level of digital maturity in your organization's supply chain? * Has digitalization helped in better disruption or risk management?	76	100.0%	0	0.0%	76	100.0%

How would you rate the level of digital maturity in your organization's supply chain? * Has digitalization helped in better disruption or risk management? Crosstabulation

Count

		Has digitalization helped in better disruption or risk management?			
		Yes	No	Not Sure	Total
How would you rate the level of digital maturity in your organization's supply chain?	Very High	6	0	0	6
	Low	1	2	2	5
	Moderate	24	4	4	32
	High	19	4	4	27
	Very High	4	2	0	6
Total		54	12	10	76

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	11.222[a]	8	.189
Likelihood Ratio	12.599	8	.126
Linear-by-Linear Association	.014	1	.905
N of Valid Cases	76		

a. 12 cells (80.0%) have expected count less than 5. The minimum expected count is .66.

Symmetric Measures

		Value	Asymptotic Standard Error[a]	Approximate T[b]	Approximate Significance
Interval by Interval	Pearson's R	.014	.099	.119	.906[c]
Ordinal by Ordinal	Spearman Correlation	.003	.114	.024	.981[c]
N of Valid Cases		76			

a. Not assuming the null hypothesis.

b. Using the asymptotic standard error assuming the null hypothesis.

c. Based on normal approximation.

Analysis

Variables Tested:

- Digital maturity
- Digitalization helped in disruption management

Chi-Square Result:

- Chi-Square Value: 11.222
- p-value: 0.189

Interpretation: No significant relationship was found. While digital tools may offer potential, their effectiveness during disruptions like COVID-19 or geopolitical shifts may vary by industry.

Conclusion: Null hypothesis is retained.

Hypothesis-9

Null Hypothesis: Investing in digital training has no impact on digital maturity.

Alternate Hypothesis: Regular digital training significantly enhances digital maturity.

Question 1(Independent Variable): Frequency of digital training

Question 2(Dependent Variable): Digital maturity level

Crosstabs

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
How often does your organization invest in digital training for employees? * How would you rate the level of digital maturity in your organization's supply chain?	76	100.0%	0	0.0%	76	100.0%

How often does your organization invest in digital training for employees? * How would you rate the level of digital maturity in your organization's supply chain? Crosstabulation

Count

		How would you rate the level of digital maturity in ..		
		Very High	Low	Moderate
How often does your organization invest in digital training for employees?	Never	0	0	1
	Rarely	3	2	6
	Occasionally (once a year)	1	3	17
	Regularly (every 6 months or more)	2	0	8
Total		6	5	32

How often does your organization invest in digital training for employees? * How would you rate the level of digital maturity in your organization's supply chain? Crosstabulation

Count

		How would you rate the level of ...		
		High	Very High	Total
How often does your organization invest in digital training for employees?	Never	3	0	4
	Rarely	3	1	15
	Occasionally (once a year)	8	1	30
	Regularly (every 6 months or more)	13	4	27
Total		27	6	76

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	17.733[a]	12	.124
Likelihood Ratio	19.077	12	.087
Linear-by-Linear Association	2.907	1	.088
N of Valid Cases	76		

a. 14 cells (70.0%) have expected count less than 5. The minimum expected count is .26.

Symmetric Measures

		Value	Asymptotic Standard Error[a]	Approximate T[b]	Approximate Significance
Interval by Interval	Pearson's R	.197	.117	1.727	.088[c]
Ordinal by Ordinal	Spearman Correlation	.250	.116	2.217	.030[c]
N of Valid Cases		76			

a. Not assuming the null hypothesis.

b. Using the asymptotic standard error assuming the null hypothesis.

c. Based on normal approximation.

Analysis

Variables Tested:

- Frequency of digital training
- Digital maturity rating

Chi-Square Result:

- Chi-Square Value: 17.733
- p-value: 0.124

Additional Test: Spearman's Correlation

$\rho = 0.250$, $p = 0.030$

Interpretation: While the chi-square test wasn't significant, Spearman's correlation indicates a weak but statistically significant positive relationship between training frequency and maturity. Regular training supports better digital capability. **Conclusion:** Weak support for alternate hypothesis.

CHAPTER-5

CONCLUSIONS

5.1 Summary of Findings

This research explored the impact of digitalization on supply chain performance in the Indian context through primary survey data and statistical analysis. The study focused on understanding how digital tools—such as ERP, AI, IoT, automation, and cloud-based systems—are being adopted in Indian supply chains and how they affect key performance indicators like cost efficiency, delivery speed, customer satisfaction, inventory visibility, and flexibility.

From the analysis of 100+ responses collected via a structured questionnaire, the following major findings emerged:

- **Cost Reduction**: There is a significant relationship between digitalization and reduction in operational costs. Respondents who selected cost-saving as a driver of digitalization confirmed its effectiveness through improved performance metrics.
- **Flexibility & Responsiveness**: Firms with higher digital maturity levels were more likely to report improvements in supply chain flexibility and responsiveness, particularly in adapting to market demands or disruptions.
- **Digital Training & Maturity**: A weak but statistically significant correlation was found between regular investment in digital training and a higher level of digital maturity within organizations.
- **Inventory Visibility, Order Fulfilment & Coordination**: Surprisingly, no statistically significant association was found between tool adoption and perceived improvements in inventory visibility, order fulfilment time, and departmental coordination—suggesting a possible gap between implementation and execution or differences across industries.

5.2 Practical Implications

- **Strategic Investments**: Indian companies need to shift from selective digitalization to a strategic, organization-wide approach. Technologies must be integrated not just as isolated solutions but across the supply chain to realize full benefits.
- **SME Inclusion**: Special attention must be given to small and medium enterprises (SMEs) that lag in digital adoption due to budgetary or infrastructure constraints. Government incentives and public-private partnerships could drive digital penetration at the grassroots level.
- **Training & Change Management**: Digital tools are only as effective as their users. Companies should invest in continuous training, upskilling, and change management programs to maximize ROI from digital investments.
- **Custom Solutions**: Due to the diversity of supply chain models in India—from organized e-commerce players to unorganized traditional networks—one-size-fits-all digital solutions will not work. Customized tech strategies must be developed.

5.3 Academic and Research Contributions

This study adds empirical value to the limited body of academic research focusing specifically on Indian digital supply chains. While there is ample global literature on supply chain digitalization, Indian studies are often limited to case-specific or conceptual analyses. By using primary data, hypothesis testing, and statistical tools like Chi-square and Spearman correlation, this research provides quantitative backing to claims about digitalization's impact.

5.4 Limitations

- The data is perception-based, relying on self-assessed improvements rather than objective operational data.
- The sample size is limited and uses convenience sampling, which restricts generalizability.
- The cross-sectional nature of the study does not allow measurement of long-term digital impacts.

These limitations point toward opportunities for more robust studies using actual company performance data, industry segmentation, and longitudinal analysis.

5.5 Recommendations for Future Research

- **Longitudinal Studies**: Track digital transformation over 2–3 years to measure sustained performance impact.
- **Industry-Specific Deep Dives**: Examine digital adoption in specific industries like agriculture, pharma, and retail.
- **Comparative Studies**: Compare Indian digital supply chains with global counterparts to identify best practices.
- **ROI-Focused Research**: More studies are needed on how businesses can measure the financial return on digitalization efforts.

5.6 Concluding Remarks

Digitalization has undoubtedly emerged as a game-changer in modern supply chains. In India, where logistical challenges, infrastructural gaps, and workforce readiness still vary widely, digital tools offer a bridge toward smarter, faster, and more resilient supply networks.

However, successful digital transformation demands more than technology—it requires visionary leadership, skilled talent, cultural readiness, and continuous improvement. With the right mix of investment, education, and policy support, India can build globally competitive, digitally enabled supply chains that drive inclusive growth and innovation.

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ANNEXURE

Survey to understand the Impact of Digitalization on Supply Chain Performance in Indian centric

* Indicates required question

1. Name

2. Email

3. Age

Mark only one oval.

- ◯ Under 25
- ◯ 25-35
- ◯ 36-45
- ◯ 46-55
- ◯ Above 55

4. Gender

Mark only one oval.

- ◯ Male
- ◯ Female
- ◯ Others
- ◯ Prefer not to say

5. Are you a: *

Mark only one oval.

- ◯ Working professionals
- ◯ Student (MBA/PG/UG)
- ◯ Business
- ◯ Other: _____

6. Years of Experience in Supply Chain/Operations: *

Mark only one oval.

- ◯ 0-2 years
- ◯ 2–5 years
- ◯ 6–10 years
- ◯ More than 10 years

7. Industry Sector: *

Mark only one oval.

- ◯ Manufacturing
- ◯ Logistics
- ◯ Retail
- ◯ FMCG
- ◯ E-commerce
- ◯ Others(e.g., pharma, automotive, etc.)

Section B: Current State of Supply Chain

8. What kind of digital tools/technologies are currently being used? (Select all that apply) *

Check all that apply.

- [ ] ERP Systems (SAP, Oracle, etc.)
- [ ] RFID / Barcode Scanning
- [ ] Warehouse Management System (WMS)
- [ ] Transportation Management System (TMS)
- [ ] IoT Devices
- [ ] Artificial Intelligence / Machine Learning
- [ ] Blockchain
- [ ] Other: _____

9. How would you rate the **level of digital maturity** in your organization's supply chain? *

Mark only one oval.

- ◯ Very Low
- ◯ Low
- ◯ Moderate
- ◯ High
- ◯ Very High

10. How often does your organization invest in digital training for employees? *

Mark only one oval.

- ◯ Regularly (every 6 months or more)
- ◯ Occasionally (once a year)
- ◯ Rarely
- ◯ Never

11. Which of the following are key drivers for digital adoption in the supply chain? * (Select all that apply)

Check all that apply.

- [ ] Cost reduction
- [ ] Customer expectation
- [ ] Competitive pressure
- [ ] Operational efficiency
- [ ] Compliance/regulatory requirements
- [ ] Sustainability goals

Section C: Perceived Impact of Digitalization

12. Please rate the following statements on a **scale of 1 to 5** *
(1 = Strongly Disagree, 5 = Strongly Agree)

Mark only one oval per row.

	1	2	3	4	5
Digitalization has improved the overall efficiency of our supply chain.	◯	◯	◯	◯	◯
It has reduced order fulfillment times.	◯	◯	◯	◯	◯
Inventory visibility has improved due to digital tools.	◯	◯	◯	◯	◯
There is better coordination between departments (procurement, production, distribution).	◯	◯	◯	◯	◯
Digitalization has helped in reducing costs.	◯	◯	◯	◯	◯
Real-time data helps in better decision-making.	◯	◯	◯	◯	◯
Customer satisfaction has improved due to faster and accurate delivery.	◯	◯	◯	◯	◯

13. How has digitalization affected supply chain flexibility and responsiveness? *

Mark only one oval.

- ◯ Highly improved
- ◯ Moderately improved
- ◯ No impact
- ◯ Negative impact

14. Has digitalization helped in better disruption or risk management? *

Mark only one oval.

- ◯ Yes
- ◯ No
- ◯ Not sure

15. What are the **main challenges** faced during digital adoption in the supply chain? (Select top 3) *

Check all that apply.

- ☐ High Implementation Cost
- ☐ Lack of Skilled Workforce
- ☐ Data Privacy Concerns
- ☐ Resistance to Change
- ☐ Infrastructure Issues
- ☐ Other: _____

16. What major benefits have you observed from digitalization? *(Select top 3)* *

Check all that apply.

- [ ] Improved supply chain visibility
- [ ] Reduced operational costs
- [ ] Faster decision-making
- [ ] Better demand forecasting
- [ ] Enhanced customer satisfaction
- [ ] Improved supplier performance

17. In your opinion, what is the main reason digital transformation initiatives fail in supply chains? *

Check all that apply.

- [ ] Poor planning
- [ ] Lack of leadership support
- [ ] Insufficient employee training
- [ ] High cost
- [ ] Low adoption across functions

18. Do you believe digital transformation in supply chain will be a **key differentiator** in the next 5 years? *

Mark only one oval.

- ◯ Strongly Agree
- ◯ Agree
- ◯ Neutral
- ◯ Disagree
- ◯ Strongly Disagree

19. Which digital technology do you believe will have the **biggest impact** on supply chain in the future? *

Mark only one oval.

- ◯ AI & Machine Learning
- ◯ Blockchain
- ◯ IoT
- ◯ Big Data & Analytics
- ◯ Robotics/Automation
- ◯ Other: _____

20. Do you believe digitalization will reduce the need for human interventions in supply chains? *

Mark only one oval.

- ◯ Yes, significantly
- ◯ No, human input will remain essentials
- ◯ To some extent
- ◯ Not sure

21. In your opinion, how has digitalization impacted the overall performance of the supply chain?

_____

_____

_____

_____

_____